Effects of Idiopathic Pulmonary Fibrosis on the Mechanics of Murine Lung Tissue

Objectives
To implement bi-axial testing methods in the study of the effects of IPF on the tissue mechanics of decellularized lung tissue and to contribute to a broader understanding of how mechanical and physical phenomena interact to govern the behavior of biological and medical systems.

Background
• Approximately 5 million people worldwide suffer from Idiopathic Pulmonary Fibrosis.
• Idiopathic Pulmonary Fibrosis is an interstitial lung disorder, which causes progressive scarring of lung tissue.
• This progressive scarring is generally irreversible and affects the patient’s ability to get enough oxygen into the bloodstream.

Methods
• 1 Speckle sample that has been cut into a cruciform shape with Vernhoeff Stain, which provides texture for strain mapping.
• 2 Mount sample on biaxial testing apparatus that creates forces similar to those created by lung inflation.
• 3 Stretch the sample steadily over a six minute period and then return to the initial state during the following six minutes.
• 4 Record forces on each of the 4 arms of the biaxial apparatus during stretching.
• 5 Record a movie during stretching via a digital camera mounted above the sample. This allows for strain mapping via the tracking of changes in speckle location.

Results
Strain Maps
• All strain maps shown are for the same sample which had been treated with FITC.
• The Exx strain maps show the component of strain in the X direction.
• Likewise, the Eyy strain maps show the Y component of the strain.
• Take note of variances in color scales.

Force Measurements
• The plot above shows the averages of force measurements over time for fibrotic tissues in purple and normal tissues in blue.
• The average values were higher for fibrotic tissues during the stretching phase, but the difference was not statistically significant.