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 world wide 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

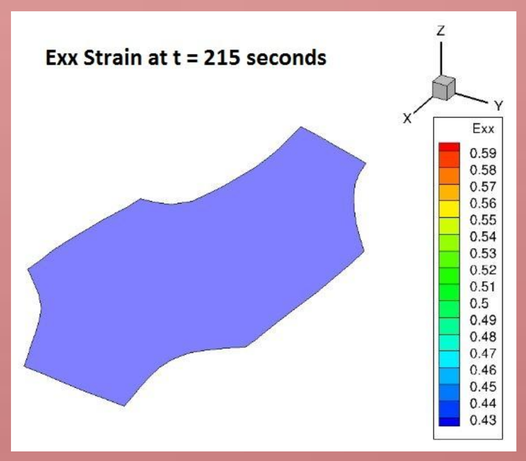
•1 Speckle sample that has been cut into a cruciform shape with Vernhoeff Stain, which provides texture for strain mapping.

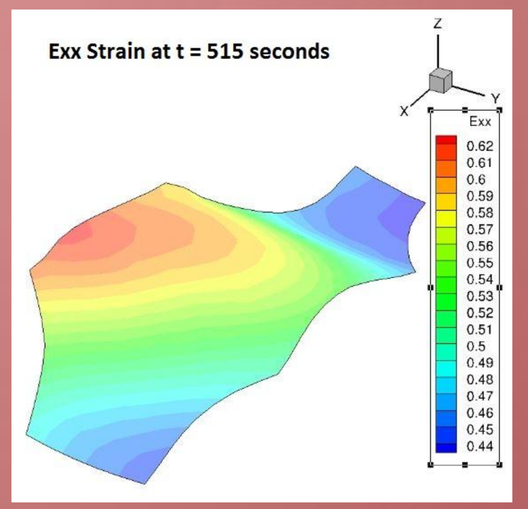
•2 Mount sample on biaxial testing apparatus that creates forces similar to those created by lung inflation.

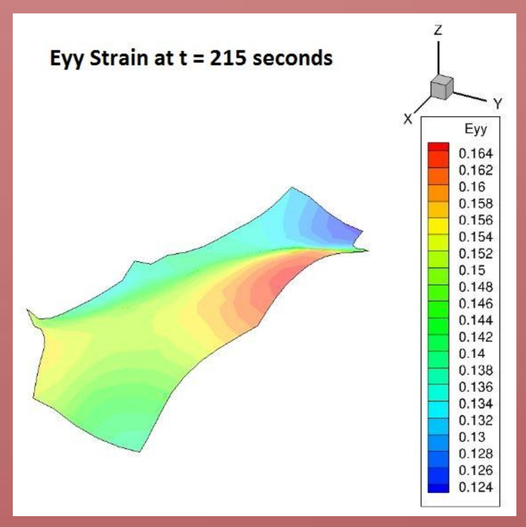
•3 Stretch the sample steadily over a six minute period and then return to the initial state during the following six minutes.

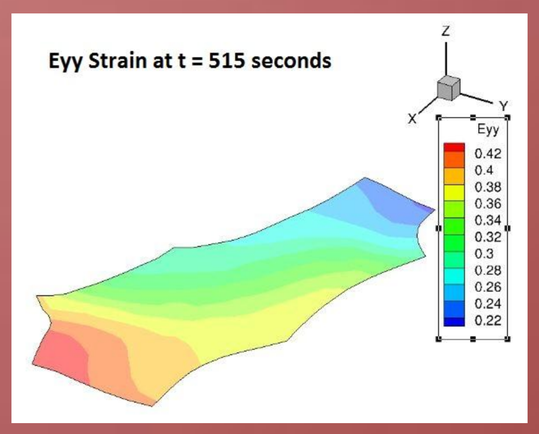
•4 Record forces on each of the 4 arms of the biaxial apparatus during stretching.

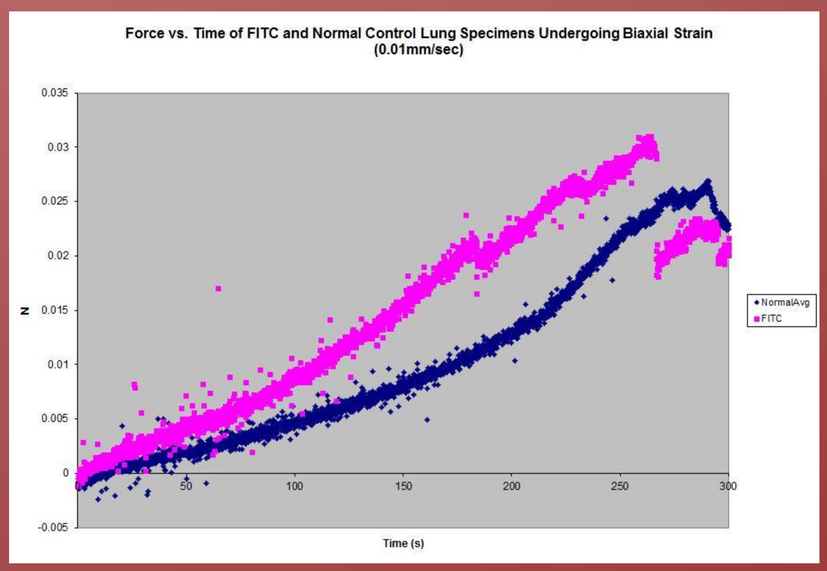
•5 Record a movie during stretching via a digital camera mounted above the sample. This allows for strain mapping via the tracking of changes in speckle location.











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.