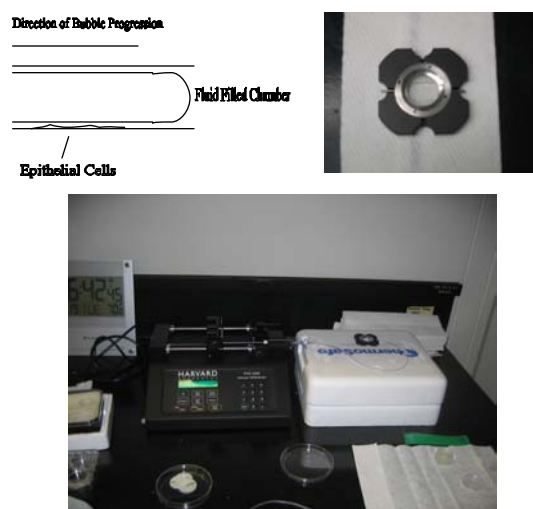


Quantification of Epithelial Cell Injury During Ventilation Treatment

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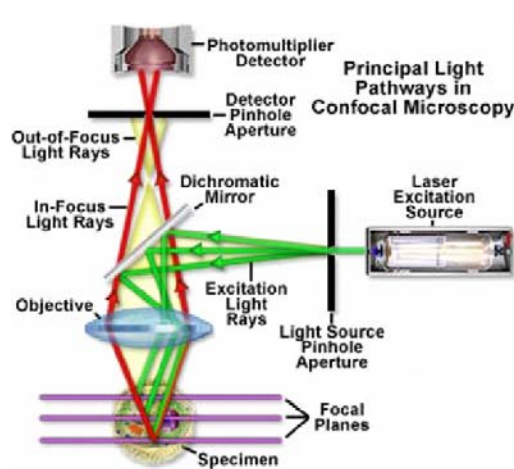
Abstract: For patients with acute respiratory distress syndrome (ARDS), low tidal volume and low pressure ventilation therapy is a common treatment. During ventilation, the fluid-occluded small airways of the deep lungs often experience cyclic opening and closing. We investigated epithelial cell injury during reopening. In our experiments, lung epithelial cells were placed on the glass surface of an *in-vitro* flow chamber. We forced a bubble through the chamber to simulate conditions experienced by lung epithelial cells during reopening events. Cellular injury during reopening was tracked with fluorescent staining of the cells. We used confocal microscopy to investigate the effect of cell topography on injury. We will also investigate mechanical properties of cells during reopening events with Optical Tweezers Technique. Cells used in this study were from the A549 human lung epithelial cell line.

In Vitro Airway Reopening Model

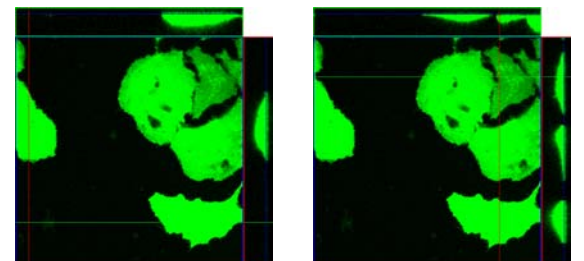


We fill our chamber with occlusion fluid and then pump some air with a syringe pump to create a bubble.

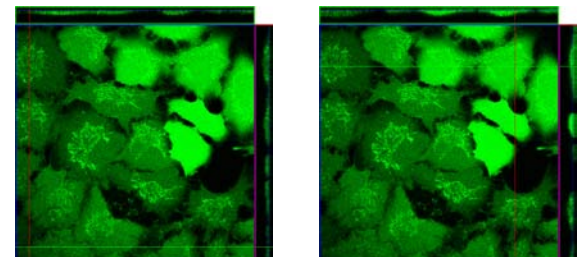
Confocal Setup



Low Confluence Cell Topography

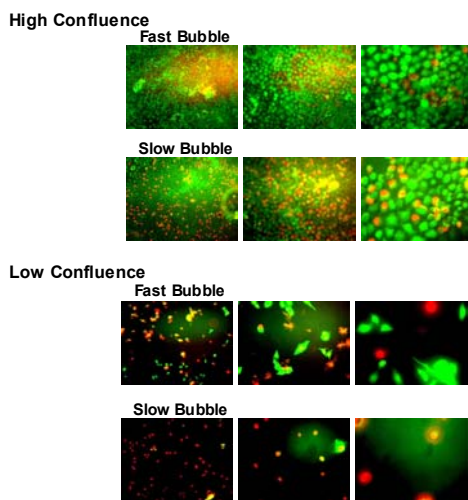


High Confluence Cell Topography



It was shown that, cells in high confluence cell layer have flat shapes whereas cells in low confluence cell layer have rounded shapes.

Effect of Bubble Speed on Cellular Injury



Bubble Speed Effect on Cell Injury

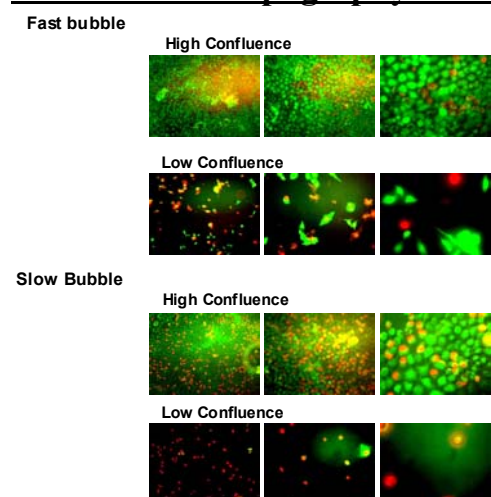
Cell Topography Effect on Cellular Injury

Confirmed Estimations

Future Directions
Micro rheology Based
Optical Tweezers

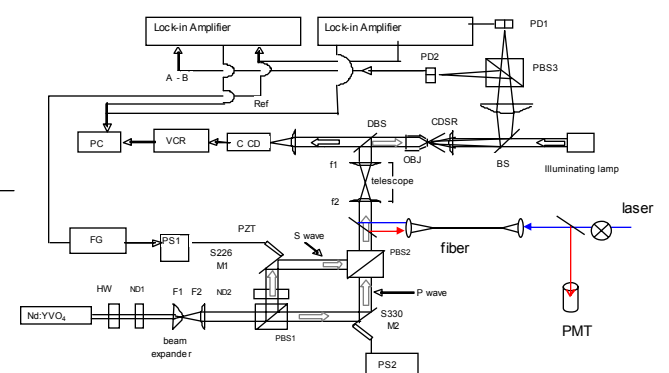
It was previously hypothesized that, slow bubbles would lead to more injury because of the high pressure gradient at low bubble speeds. Calcein AM and Ethidium homodimer are used as live (green) and dead (red) stains. These hypotheses are confirmed.

Effect of Cell Topography on Cellular Injury



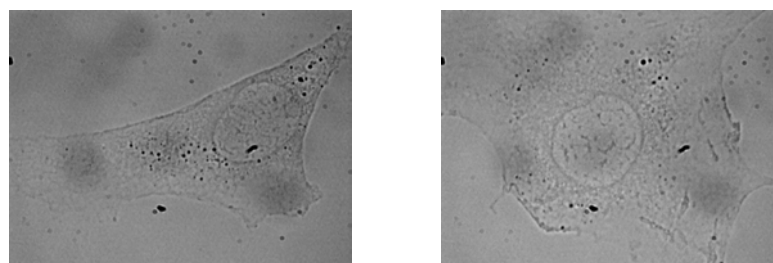
It was previously hypothesized that, nonplanar cell topography on walls would increase stresses and stress gradients on cells. These hypotheses are confirmed.

Optical Tweezers Setup



The mechanical properties of the cells will be analyzed with Optical Tweezers Technique. Either granular structures seen in the below pictures or inserted spherical beads will be trapped.

Phase Contrast Images of Epithelial Cells



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