



TREND
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Particle Image Velocimetry of Optically Stretched Cells

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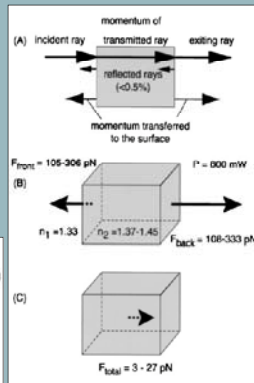
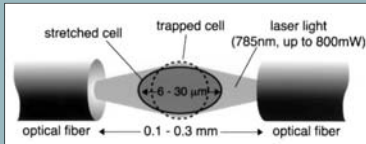
Background

Optical Stretcher

Traps the cells, then stretches them along the axis of the beam.

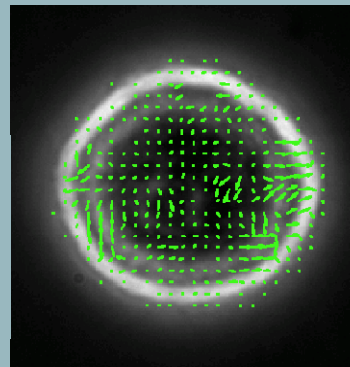
Tells us about cell dynamics and structure.

Specifically, are cancer cells "stretchier?"



Goal: Adapt and Apply PIV to Analyze Cell Interiors

Particle Image Velocimetry (PIV)



PIV tracks boxes of pixels, producing a series of velocity vector fields.

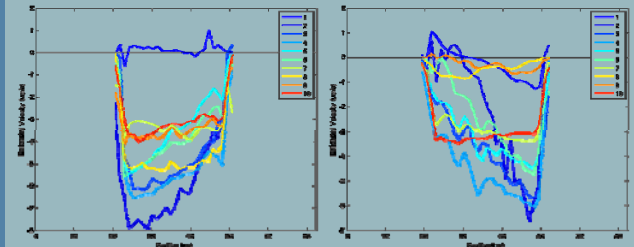
Adjusted PIV Code:

- Threshold to single out the cell
- Accounting for cell movement by subtracting average velocity

Results

ML7 "Shoulder"

Position vs. Horizontal component of velocity for ML7 without the shoulder and ML7 with the shoulder. The former is stretching, while the latter is contracting.



Results only confirmed the observation

The Cells

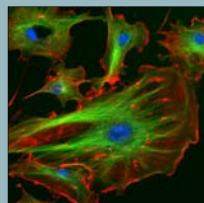
Human Mammary Epithelial Cells (HMECs)

GFP are **less** cancerous. **TWIST** are **more** cancerous

Blebbistatin loosens the cytoskeleton

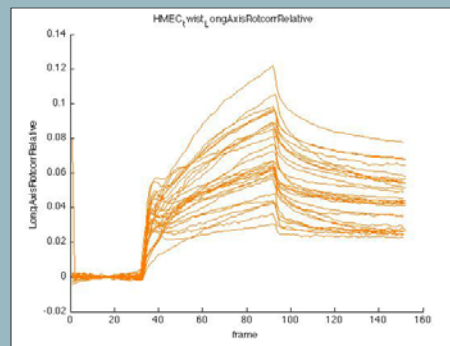
ML7 locks the cytoskeleton

Cytoskeleton of a cell, with actin in red, and microtubules in green. Does not include tubulin (Wikimedia commons).



Applications

Unexplained "Shoulder" of contraction in HMEC-TWIST ML7

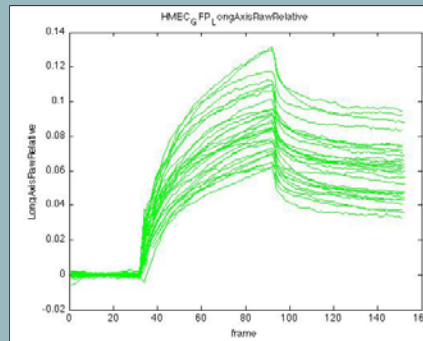
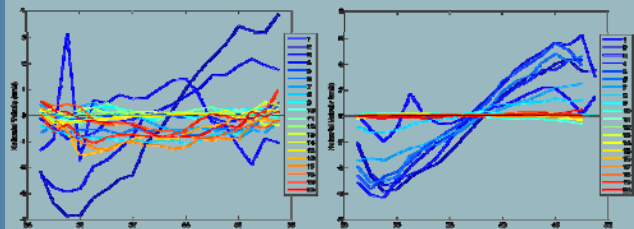


General differences between GFP and TWIST

GFP and TWIST

Position vs. horizontal velocities for a GFP and a TWIST cell.

GFP generally had fewer but stronger stretches. TWIST generally had more but weaker stretches.



Previously done shape analysis of stretcher cells

What about the cell interior?

Conclusions:

GFP and TWIST could correlate to a viscoelastic model of the cytoskeleton where GFP is more elastic and TWIST is more viscous.

PIV on the recoil stages, however, proved inconclusive.

Primary finding is that PIV is, in fact, a viable method of analysis for optical stretcher data.