

The Summer Undergraduate Research Fellowship (SURF) Symposium
25 July 2014
Purdue University, West Lafayette, Indiana, USA

Spatiotemporal Changes in Nuclear Strain Measured by Traction Force Microscopy

Ryan Watts , Jonathan T. Henderson, Corey P. Neu

Weldon School of Biomedical Engineering, Purdue University

The knowledge of how cells interact with and sense their surroundings is missing the key components of time dependency and how substrate stiffness affects amount and rate of strain. This new knowledge of cell-substrate interaction can be applied further to research regarding chromatin spatiotemporal dynamics to better understand gene accessibility for transcription. Studying how the cell functions on a deeper level will provide understanding of cellular morphological changes and proliferation. This study uses the methods of optical microscopy and traction force microscopy (TFM) to image substrate deformation as well as analyze its strain profile to find where forces are interacting with the substrate the most. A 60X objective on a confocal microscope was used to image the cell membrane, nucleus, and fluorescent beads in PDMS gels of varying stiffness on which the cells were placed. Based on how the nucleus deforms as well as how the beads move due to cell-substrate interaction, a strain profile of the gel along with traction force analysis can be determined to quantify how the cell is interacting with its substrate. The results are that as the cell is trypsinized after spreading along the substrate, the focal adhesions made by the cell will disconnect, causing the beads to spread out locally around the cell. It was also found that as substrate stiffness increases, the rate of cell spreading increases. From these findings, it can be concluded that the cell responds more positively in environments of higher stiffness and spreads at a faster rate.