Automated, Tablet-Based Microscope for Imaging 3D Culture Models of Breast Epithelial Growth and Behavior

Sarah McFann[1], Benjamin Ricca[2], Mike D'Ambrosio[2], Johnathan Wang[2], and Daniel Fletcher[2]
[1]Department of Chemical and Biological Engineering, The University of Alabama
[2]Department of Bioengineering, The University of California, Berkeley

Mammary epithelial cells within the body reside in a chemically and mechanically complex 3D environment known as the extracellular matrix (ECM). Though the ECM has been shown to play an important role in both the development and maintenance of breast architecture, the role of external forces that deform the matrix surrounding the epithelial cells is still unclear. In this study, we applied a compressive strain that generated a transient force to a 3D malignant breast epithelial culture and found that single malignant cells could be "phenotypically reverted" to develop into growth-arrested, polarized structures. To further characterize the inputs that lead to this type of mechanically induced phenotypic reversion, the effectiveness of mechanically induced phenotypic reversion, and the pathway through which mechanically induced phenotypic reversion occurs, we needed a high-throughput method capable of imaging multiple developing 3D cell cultures in real-time. To address this need, we developed an inexpensive, tablet-based, automated microscope to collect time-lapse images of the growth and behavior of 3D breast epithelial models.