

Banu Baydil, H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL, USA
Katarzyna A. Rejniak, H. Lee Moffitt Cancer Center and Research Institute, Tampa, FL, USA

Data-Driven Computational Modeling of Breast Tumor Aggressiveness

Normal mammary ducts are composed of two distinct layers of cells, luminal epithelial cells and basal myoepithelial cells, separated from the stroma by a surrounding continuous lining of the basement membrane attached to the myoepithelial outer layer. The homeostasis of the mammary duct, its structure and function are regulated by both the epithelial cells and the myoepithelial cells and their interaction. Myoepithelial cells for instance play a role in the regulation of the polarity of the luminal epithelial cells. Also, during lactation, the contraction of myoepithelial cells along the ducts facilitates milk ejection.

Recent studies suggest that interactions between myoepithelial cells and the neo-plastic epithelial cells play a significant role in the progression of pre-invasive breast cancers to invasive stage. While normal myoepithelial cells act as suppressors of uncontrolled cell growth, tumor myoepithelial cells promote invasion by degrading the basement membrane through production of matrix metalloproteinases.

Motivated by these observations, we developed a computational model of mammary ducts composed of individual myoepithelial and epithelial cells. By bridging this model with histopathological data we study the importance of the interactions between these two cellular layers in the initiation and progression of tumor invasion. We further investigate various biophysical properties of individual epithelial and myoepithelial cells and their relative role in the advancement of breast cancer from pre-invasive to invasive ductal carcinoma.