Title: The role of biomechanics in the breast cancer cell migration: A mathematical model

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Abstract:

We investigated the role of microenvironment in an early development of Ductal carcinoma in situ (DCIS) and the invasion process in later stages. DCIS is an early stage non-invasive breast cancer that originates in the epithelial lining of the milk ducts, but it can evolve into comedo DCIS and ultimately the most common type of breast cancer, invasive ductal carcinoma. Understanding the progression and how to effectively intervene in it presents a major scientific challenge. The extracellular matrix (ECM) surrounding a DCIS tumor contains several types of cells and several types of growth factors that are known to individually affect tumor growth. However, the complex biochemical and mechanical interactions of stromal cells with tumor cells is poorly understood. The model can predict how perturbations of the local biochemical and mechanical state influence tumor invasion via crosstalk between a tumor and stromal cells such as fibroblasts. We present a hybrid invasion model where stromal cells play a significant role in triggering the invasion process of cancer cells from breast ducts. Our results shed light on the interactions between growth factors, mechanical properties of the ECM, and feedback signaling loops between stromal and tumor cells, and suggest how epigenetic changes in transformed cells affect tumor progression in the early and late stage of breast cancer. *joint work with Hans Othmer (University of Minnesota)