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In order to understand the role of fibroblasts and myofibroblasts in the early induction of breast cancer in vitro, we developed a mathematical model to simulate interactions between these fibroblasts and tumor epithelial cells as well as performed experiments to validate the model. The mathematical model describes the dynamics of various concentrations of cells and growth factors present in the tumor microenvironment by a system of differential equations. In the experiments, tumor cells are placed on one side of a membrane and either normal fibroblasts or tumor associated fibroblasts are placed on the other side. This membrane is semi-permeable, allowing growth factors such as EGF and TGF- β to cross over, however restricting cells from being in direct contact with each other. Simulation of our mathematical model and results from our experiments were in good agreement and therefore confirmed the models ability to predict aspects of tumor cell behavior in response to signaling from fibroblasts. (Received September 17, 2008)