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Magnetically Actuated Cell Stretching Platform to Induce Phenotypic Changes in Metastatic Cells

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Although metastasis is responsible for about 90% of cancer deaths, only few *in vitro* models can be used to evaluate dynamic behaviors of metastatic cancer cells. Many studies have shown that mechanical stimuli can trigger various cellular responses such as gene and protein expression, which could lead to changes in cellular phenotype. Similarly, metastasized breast cancer cells in the lung tissue are constantly stretched by cyclic mechanical stress due to breathing, which alters cellular morphology and proliferation state. Such transitions can make the secondary tumors resistant to the chemotherapy used to effectively treat the primary tumors. In this work, we developed an *in vitro* tumor microenvironment that simulates *in vivo* respiration to investigate the mechanism of the phenotypic changes of metastatic breast cancer cells due to mechanical stimulation. We designed and fabricated magnetic microactuators using maskless photolithography technique to stretch tumor cells. Next, we coated fibronectin fibrils over the gaps of microactuators to mimic natural ECM environment and seeded tumor cells on the fibronectin mesh to generate a tumor microenvironment. As a result, the amount of strain that our microdevice could apply on the fibronectin mesh corresponded to the amount of strain experienced during normal respiration. In conclusion, the magnetically actuated *in vitro* cell stretching platform can provide precise strain control over a large actuation range to mimic mechanical stimulation in the lung. In the future, we will evaluate potential changes in metastatic cell phenotype and provide additional insights on the mechanism of secondary tumor drug resistance.

KEYWORDS

Magnetic actuator, cell stretching platform, mechanical stimuli, breast cancer, tumor microenvironment