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Pictured Left to Right: Mario Cabodi, PhD Research Assistant, Professor; Joyce Wong, PhD, Associate Professor; Denise Safko, JMNMF Secretary, RSA Committee; Chentian Zhang, JMNMF RSA Recipient; and, Greg Safko, JMNMF President.

SUMMARY: A Hydrogel Based Microfluidic System for Cancer Competitive Metastasis

Skin cancer is the most common type of cancer in the United States, of which the most aggressive form is melanoma: one person dies of melanoma every 62 minutes. If melanoma is detected early, the survival rate is about 99 percent, but for metastasized melanoma, the survival rate drops precipitously to 15 percent. Despite the fatal consequences of metastasis, its mechanism of action has not yet been elucidated. Researchers have been studying the mechanism of cancer metastasis for decades, and one of the most prevalent hypotheses is based on the mesenchymal transition. Briefly, most primary cancers start out as immobile. The mesenchymal transition transforms immobile cells into more mobile mesenchymal cells and shuts down production of adhesive proteins that glue cancer cells together. This could potentially explain how cancer cells detach from their neighbors and migrate to a new site via the bloodstream. However, to date, no one has provided direct evidence supporting this hypothesis.

Most studies investigating cancer metastasis have focused on using rodent models. While traditional rodent models provide an environment that is physiologically relevant for studying cancer, the cost to generate and maintain immunocompromised rodents (required for any study involving human cells) is high, and the results obtained from those studies are always affected by numerous factors that are difficult to deconvolute. Recent advancements in biomaterials science and microfabrication technology have enabled the study of cancer biology in physiologically relevant and cost effective ways. Biomaterials such as hydrogels provide cells with a microenvironment that is more similar to the native tissue when compared against the standard petri dish substrate. The microfabrication technology also has the capability to create complex environments for cells, and by virtue of the resulting miniaturization, the cost of experiment can be substantially reduced.

Here I propose a hydrogel based model system to study melanoma metastasis to address the following questions: 1) Do melanoma cells undergo a mesenchymal transition to trigger metastasis? 2) Do melanoma cells preferentially migrate to a particular type of tissue compared to other tissues? More specifically, this system creates a hydrogel based metastatic microenvironment for melanoma cells by encapsulating melanoma cells together with healthy tissue cells with precise spatial control, with the goal of recreating the *in vivo* environment *in vitro*. The outcome of the proposed model system will shed light on the mechanism of melanoma metastasis and provide a platform to discover new drugs to block melanoma metastasis.