**Lay Description of Important Outcomes**

We have developed a system that will let us evaluate how mechanical energy is distributed through a tissue. The system will allow us to evaluate how cells interpret the strain in real-time within tissue mimicking environments, as well as within tissues that contain metastatic cells. We have also evaluated how the mechanical energy effects the cells gene expression profile and have identified the unique genes that increase in response to the mechanical loading of a breast cancer cell. Of note, we observed that when cells undergo cyclic mechanical loading, similar to the type of mechanical loading that occurs in the lungs during breathing, we see a significant increase in genes related to cell cycle arrest, matrix protein production, and inflammation. Furthermore, we have observed that static loading is sufficient to induce a dormant phenotype. These data indicate that an increase in physical activity may be beneficial for patients with metastatic disease, and that simple activities such as standing may be sufficient to induce dormancy in load bearing tissues such as the bones.

**Bulleted Summary of Findings**

* Developed a novel platform for evaluating mechanical properties of tissues in real-time within tissue models and ex vivo tissues that contain metastatic cells.
* A provisional patent has been submitted covering the in-plane tissue stretching system (Attorney Docket No. 70351-01).
* Identified the genes that change during mechanical loading, and have demonstrated that both static and cyclic loading can induce growth arrest and dormancy.
* Lifestyle changes such as an increase in physical activity may be beneficial to patients with metastatic disease, as the mechanical loading that occurs during these activities may drive cells into a state of growth arrest.
* Since static loading alone can induce growth arrest, patients may benefit by simple low impact activities such as standing.
* An R01 proposal was prepared for PAR-19-113. The proposal scored in the 15th percentile and has been resubmitted with the suggested revisions.

**Publications/Presentations**

Manuscripts:

1. Libring, S., Enriquez, A., Solorio, L., Lee, H. In Vitro Magnetic Techniques for Investigating Cancer Progression. Cancers. September 2021. PMCID: PMC8430481
2. Howard, M., Enriquez, A., Hsu, C.W., Lee, H., Solorio, L. In-Plane ECM Stretcher with Force Characterization and Optical Capabilities to Evaluate Strain Energy Distribution in Tissues. *In preparation*
3. Libring, S. Enriquez, A., Howard, M., Wendt, M.K., Lee, H., Solorio, L. Role of Applied Strain Energy on Tumor Quiescence and Dormancy. *In preparation*

Podium Presentations:

1. Libring, S., Munoz, J., Enriquez, A., Field, T.C., Jimenez, J., Lee, T., Satoski, D., Wendt, M., Calve, S., Buganza-Tepole, A., Lee, H., Brubaker, D., Solorio, L. Mechanical Force as a Suppressor in the Metastatic Microenvironment. Midwest Tumor Microenvironment Meeting, 5 Minute Blitz. Kansas City, KS. May 2022.
2. Libring, S., Solorio, L. Using Fibronectin-Based Drug Screening Platforms for Precision Medicine of Metastatic Breast Cancer Patients. BME Bytes, 30 Minute Presentation. West Lafayette, IN. February 2022.

Poster Presentations:

1. Libring, S., Munoz, J., Enriquez, A., Field, T.C., Jimenez, J., Lee, T., Satoski, D., Wendt, M., Calve, S., Buganza-Tepole, A., Lee, H., Brubaker, D., Solorio, L. Mechanical Force as a Suppressor in the Metastatic Microenvironment. Midwest Tumor Microenvironment Meeting. Kansas City, KS. May 2022.
2. Libring, S., Munoz, J., Enriquez, A., Field, T.C., Anczukow, O., Lee, H., Brubaker, D., Solorio, L. Effect of Mechanical Force on Triple Negative MDA-MB-231 Breast Cancer Cells in 3D, Fibronectin-Based Biomimetic Lung Model. Office of Interdisciplinary Graduate Programs Spring Reception 2022. West Lafayette, IN. May 2022.
3. Howard, M., Enriquez, A., Hsu, C.W., Lee, H., Solorio, L. In-Plane ECM Stretcher with Force Characterization and Optical Capabilities. Biomedical Engineering Society Annual Meeting. Seattle, WA. October 2023.