Over 281,000 new cases of breast cancer are diagnosed annually within the United States. The majority are estrogen receptor-α positive (ER+) and these patients are often treated with adjuvant endocrine-targeted therapies to prevent tumor recurrence. These therapies include aromatase inhibitors (AIs; letrozole) or selective estrogen receptor modulators (SERM; tamoxifen). While initially effective, resistance can develop leading to tumor recurrence and the development of breast cancer metastases. ER+ breast cancer patients are more likely to develop bone metastases than other subtypes. However, the currently available preclinical models to study bone metastases are ER-negative. In collaboration, our group has developed several bone metastatic ER+ breast cancer models to test novel combinatorial strategies to treat metastatic ER+ breast cancer.

The human body contains more bacterial cells than human cells. Therefore, it is unsurprising that the gut microbiome plays a critical role in the development of disease. Menopause and breast cancer was shown to shift the gut microbiome. Literature also indicates that probiotic bacteria (such as Lactobacillus and Bifidobacterium species) often found in over-the-counter supplements, can reduce inflammation and preclinical breast tumor growth. Probiotic bacteria secrete numerous factors that can promote bone health. Therefore, probiotic bacterial supplements and probiotic-secreted metabolites could be a novel treatment factor to enhance current FDA-approved metastatic ER+ breast cancer therapies.

Our goal is to determine whether probiotic supplements in combination with Faslodex and Palbociclib reduce established ER+ breast cancer bone metastatic lesion growth, increases bone health, and improves overall survival. Throughout this project, we hope to impact women with stage IV bone metastatic ER+ breast cancer, uncovering new molecular mechanisms affecting therapy response. We also aim to develop implementable interventions modifying the microbiome to create a metabolically favorable microenvironment to reduce metastatic growth and progression in patients with bone metastatic ER+ breast cancer. Dietary supplements can be easily translated to the clinic; therefore, the transition to a phase I clinical trial in patients could be accomplished quickly, allowing for immediate benefit to women with stage IV metastatic ER+ breast cancer patients with bone lesions.