**Lay Description of Important Outcomes**

As treatments for breast cancer improve and patients survive longer, the prevalence of breast-to-brain metastasis increases, severely affecting patients’ function, quality of life, and overall prognosis. 10-15% of women with metastatic breast cancer develop brain metastases. However, rates as high as 30% (HER2+) and 50% (triple negative) are observed. Patients with breast cancer brain metastases are frequently excluded from clinical trials, and standard treatment options are often ineffective. Thus, there is an urgent need to understand the biology of breast cancer brain metastases for prediction of patient risk and discovery of novel drug targets for improved treatment of the already metastasized patient.

One potential strategy to halt the progression of breast cancer brain metastases is through modulation of the space surrounding the brain tumor (i.e., the tumor microenvironment [TME]). The brain TME is made up of tumor cells, and a diverse array of non-cancerous cells, including normal brain cells such as neurons, astrocytes, and microglia. Microglia, the brain’s immune cells, play an important role in immune surveillance and defense; and we now understand that microglia help regulate brain metastases. However, little is known about the role of microglia in breast cancer brain metastasis progression, and how the dynamics of “tumor associated” microglia (TAMs), which reside in the brain tumor, can be modulated for therapeutic benefit.

Recent key accomplishments include:

1. Development of a method to test new biomarkers in patient cerebrospinal fluid.

2. Identification of patients with matched brain, primary breast cancer, and brain metastatic breast cancer, for investigating cancer and immune cell interactions.

 3. Teaming with an ongoing clinical trial at Stanford for patients with breast cancer brain metastases.

 4. Applying for additional funding to sustainably continue this line of research.