

Lay abstract

Impact of the neuron-breast cancer cell interactions on the growth and survival of brain metastasis

Cancer occurs when cells lose the ability to control their rate of proliferation and consequently form a mass called the primary tumor. As the tumor grows, certain cells start to detach from each other, move outside their initial position and into the bloodstream. When they exit the blood stream and start to form a new mass in a new location, the full process is called metastasis, and it is the biggest challenge in curing breast cancer. When cancer cells arrive to a new organ, they are exposed to completely new environment, including cell types, and connective tissue that they have never encountered previously. They must adapt to the new niche, learn how to interact with the new cell types, and utilize such interactions in order to keep growing and spreading. My research aims to study the interactions between breast cancer cells that have reached the brain, and host neurons.

From my initial data, I have established that breast cancer cells can directly interact with neurons. Next, from the computational analysis of patient survival using public databases, I discovered that there are nine proteins involved in cell-cell interactions, called adhesion molecules, that appear at higher levels in patients with shorter survival. I hypothesize that some of these nine adhesion molecules are in charge of breast cancer-neuron interactions.

In the first aim, I will test if neuron-breast cancer cell interactions can promote cancer cell growth, or their spreading to another part of the brain. In the second aim, I will study the role that different adhesion molecules play in the interaction between breast cancer cells and neurons. Using nine candidates I have identified, I will test whether the elimination of specific adhesion molecules disrupts breast cancer cell-neuron interactions, thus decreasing brain metastasis. If so, I will deepen the search on the specific adhesion molecule, to identify the specific inhibitor of such interactions.

Understanding the communication between metastatic cancer cells which arrive from the breast, and cells located in the brain, will guide us in developing new therapeutics against breast-to-brain metastasis.