"Stem cell differentiation trajectories in Hydra resolved at single cell resolution"

Abstract: The adult Hydra continually renews all cells using three distinct stem cell populations. We sequenced approximately 25,000 Hydra cells and identified the molecular signatures of cell states, from stem cells to terminally differentiated cells. We constructed differentiation trajectories for each lineage and identified the transcription factors expressed along these trajectories, thus creating a multi-lineage map of an adult organism. Altogether, we have built a comprehensive molecular description of Hydra homeostatic development. We are currently using single cell sequencing to test the effect of manipulating signaling pathways on Hydra stem cell differentiation pathways.

Dr. Juliano joined the faculty at UC Davis in 2015 as an Assistant Professor in the Molecular and Cellular Biology Department. She is a developmental biologist with a long-standing interest in stem cell biology. Her doctoral research, mentored by Dr. Gary Wessel at Brown University, focused on understanding the molecular mechanisms underlying the maintenance of plasticity during sea urchin development. Dr. Juliano completed her post-doctoral work at Yale University in the laboratory of Dr. Haifan Lin with co-mentoring from Dr. Rob Steele at UC Irvine. At Yale, Dr. Juliano began working with Hydra, a small freshwater cnidarian that continually renews all cell types as an adult and has remarkable regenerative abilities. During her post-doctoral work, she discovered a critical role for the PIWI-piRNA pathway in Hydra stem cells. In her own laboratory at UC Davis, Dr. Juliano continues to use Hydra as a model to understand stem cell function, development, and regeneration. In her most recent publication, Juliano and her team subjected the adult Hydra to single cell sequencing, created a molecular map of the entire organism, and built differentiation trajectories to describe each stem cell differentiation pathway. This work now serves as a foundation for her laboratory's current research goals, which include dissecting the molecular mechanisms underlying stem cell differentiation, understanding how the conserved injury program triggers developmental pathways during regeneration, and understanding how the Hydra nervous system is able to continually remove and add neurons into neural circuits.