

Speaker: Dr. Emily Gehrels

Time: 11:00am-12:00pm

Location: Whitaker Biomedical Engineering 1103

Title: How to create form and function in biological and synthetic systems

Abstract: Biological organisms are able to develop from simple eggs to adults with complex forms and functions through the process of morphogenesis, or structure formation. What can we learn about the rules and possibilities of self-organization by studying their development? I will present one such study where we uncover how *Drosophila* embryos use symmetric forces to create a polarized flow of cells needed to achieve their final form.

Cell flows in the early *Drosophila* embryo are driven by an interplay between biological signaling and tissue mechanics. Using live imaging, we observe how changes in the expression of force-generating proteins, and the geometry of the tissue relate to tissue dynamics at the onset of morphogenesis. We use theoretical and computational methods to model the behavior of the tissue and challenge our findings using select genetic perturbations of the embryos. With this combination of experimental and modeling approaches, we have uncovered how organized multicellular dynamics emerge from genetic, mechanical, and geometric "information" during early *Drosophila* development.

This type of biological process relies heavily on the consumption of energy, which keeps the system from relaxing to an equilibrium (or dead) state. I will briefly introduce how, in combination with biophysical studies, synthetic model systems allow us to perform highly-controlled tests on the impact of energy input on the self-organization of form and function in different systems.

Bio: Emily Gehrels is a postdoctoral researcher at the Marseille Developmental Biology Institute working to understand the physical mechanisms at play during *Drosophila* embryo development. Previously, she completed her doctoral work at Harvard University where she created responsive and dynamic systems using colloids. In her future work, she plans to bring together the perspectives of soft-matter physics and developmental biology to uncover the fundamental principles underlying the creation of form in both living and synthetic systems.