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Project Name(s):  
Mechanisms driving development and disease of the heart and hematopoietic system

General Topic (Keywords):  
Organ development, fibrosis, tumor, EMT, heart, blood cell system, hematopoiesis, microenvironment, sensory neurons, peripheral nervous system, signal transduction, transcription factor, BMP/Smad, model organism research, Drosophila

Project Description(s):  
The Brückner laboratory at UCSF offers summer projects that investigate mechanisms driving development and disease of (1) the heart and (2) the blood cell system. Both projects use genetics in the fruitfly Drosophila melanogaster, live imaging, qPCR and other techniques.

(1) Nearly one third of congenital heart diseases are caused by defects in heart valves and associated structures. These elements develop during embryogenesis through epithelial-to-mesenchymal transition (EMT), a process in which ordered epithelial cells change their shape and migratory behavior, based on a switch in gene expression. This process is triggered by Bone Morphogenetic Proteins (BMPs), secreted proteins and their downstream Smad signaling pathways, in combination with other signals that remain incompletely understood. Similar mechanisms may underlie adult heart disease, e.g. fibrosis and heart tumors, and tumor metastasis in general. More research is needed to better understand the genetic and regulatory programs that drive heart formation, and cause EMT-related disease. Past research has shown that heart formation in Drosophila is an excellent, simple and fast system that has informed our understanding of vertebrate heart development. In this project, we use Drosophila genetics to understand the role of a newly identified transcription factor, and cooperation of BMP with other signaling pathways, in heart formation and EMT.

(2) The blood cell system is regulated by many factors, and recently has been found to be controlled directly by the nervous system (Brückner Cell Stem Cell 2011; Makhijani et al. Nature Communications 2017). Focusing on the blood cell system in the Drosophila larva, we investigate molecular mechanisms how sensory neurons of the microenvironment, and their activation by sensory inputs, regulate hematopoietic (blood cell forming) sites.

Desired Skills or Experience:  
Previous lab experience required, some experience with Drosophila preferred.

Time Commitment: 2-3 months full time over the summer; part-time during the school year.

Preferred Starting Date: flexible