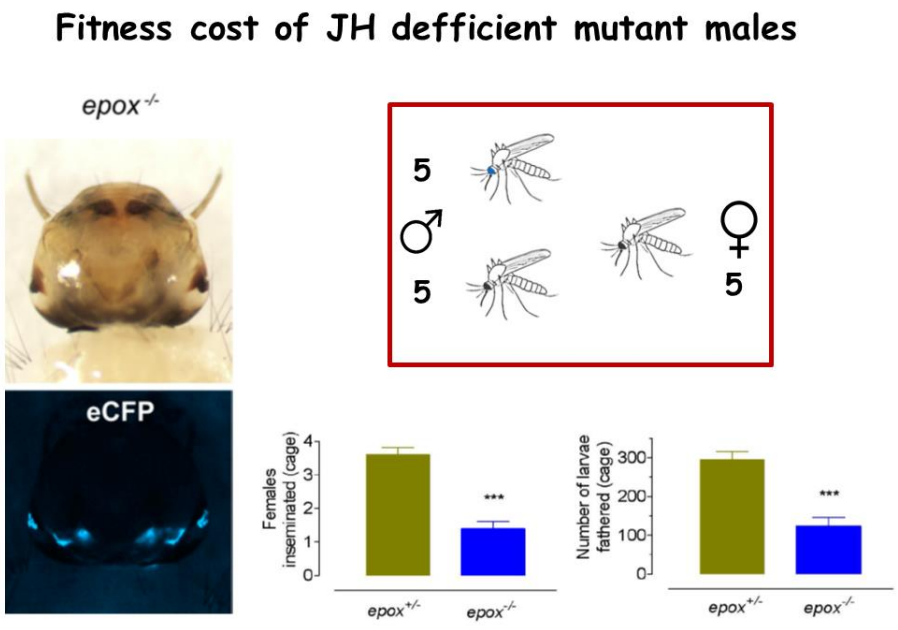
**Laboratory of molecular biology and physiology of mosquitoes** takes an integrative approach that combines experiments at the organismal, cellular, and molecular levels to understand the synthesis, signaling, and role of juvenile hormone in mosquitoes. Juvenile hormone (JH) is an important hormonal regulator in insects. In females of Aedes aegypti, JH signals the completion of ecdysis to the adult stage and initiates reproductive processes. Our research, integrating metabolomics, genomics, and proteomics tools, shows that regulation of JH synthesis in mosquitoes has unique features related to adaptation to blood feeding and cyclic regulation of ovarian development. These unique features provide potential research opportunities to identify targets for new specific chemical and/or genetic strategies to control mosquitoes.

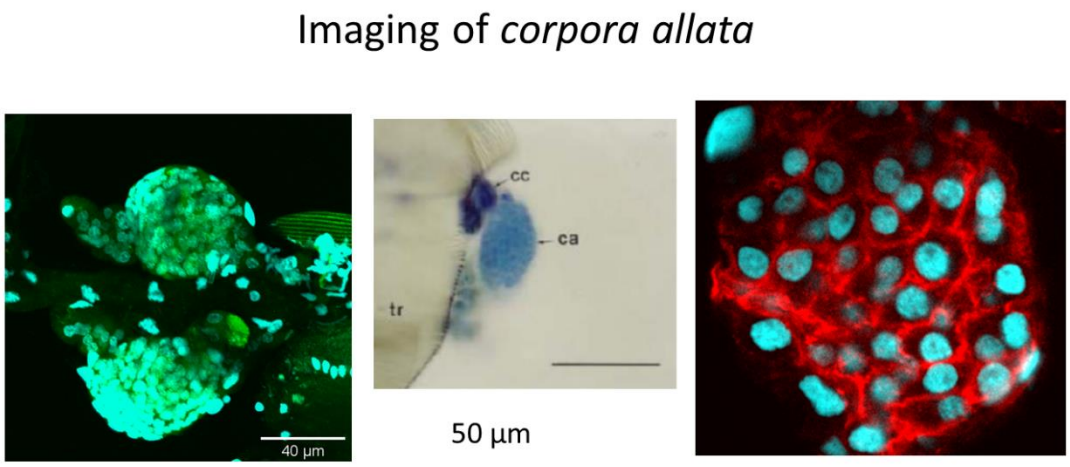
We used CRISPR/Cas9 to generate mosquitoes lacking one of the two enzymes that catalyze the final steps of MF /JH biosynthesis and epoxidation, respectively: the methyltransferase JHAMT and the P450 epoxidase CYP15 (EPOX). jhamt-/- larvae lacking both MF and JH die at the onset of metamorphosis. Strikingly, epox-/- mutants that synthesized MF, but not JH, went through the entire life cycle. While epox-/- adults were fertile, reproductive output of both sexes was drastically reduced.

**As part of this research, we offer the following topics for undergraduate and graduate students.**

A. **Investigate the reproductive fitness cost in epoxidase mutant adult males** outcompeted by wild-type males in mating studies (Nouzova et al, PNAS 2021). The student will conduct mating competition studies with WT and mutant males selected for size or hormonal phenotype. The ability to mate and fertilize females will be analyzed by evaluating offspring using fluorescence microscopy.



B. **To study the reorganization of the endocrine gland complex (EGC) during metamorphosis.** The EGC of the larva contains three endocrine glands, the corpora allata (CA), the corpora cardiaca (CC) and the prothoracic glands (PG). In the pupal stage, processes of apoptosis and organ remodeling change the structure of the EGC into the adult CA-CC complex. The student is going to dissect EGCs and analyze those using different microscopic imaging techniques. This project will be performed in collaboration with faculty from the Laboratory of Microscopy and Histology (Institute of Entomology, BC).




C. **To study the interactions between fat body** (FB), the tissue that synthesizes yolk proteins, **and the ovaries** during oogenesis in wild type (WT) and JH-deficient mutants (JH-). The student will employ microscopic imaging techniques to identify differences in tissues between WT and JH-mutants. The student will also dissect mosquito tissues, extract RNA and generate transcriptomes.