Proposal for HHMI Summer Research Scholar Funds for Summer 2013

Laura Sirot

Seminal fluid proteins: Male-derived modulators of male and female reproductive success

Description of Research In most insects, females store sperm for prolonged periods (up to several years in honey bees) and from multiple males. Therefore, even after mating with a male, a female can influence the reproductive success of her mate by modulating the number of sperm she stores, the timing and number of eggs she lays, and/or whether and when she mates a subsequent male. Interestingly, males have evolved their own mechanisms by which to modulate these very same female post-mating behaviors. The best understood example of such male effects involves proteins that males transfer to females during mating in their seminal fluid (seminal fluid proteins or Sfps). In the insects studied so far, males produce more than 100 proteins in their reproductive glands. The functions of most of these proteins are unknown, but, in the pomace fly, *Drosophila melanogaster*, some are known to increase feeding, ovulation rate and egg production; decrease the probability of re-mating; and promote sperm storage.

This summer, the HHMI researcher will participate in the following research project:

Functional analysis of seminal fluid proteins in the mosquito *Aedes albopictus*

Aedes albopictus is an important vector of a number of disease-causing organisms including those that cause dengue fever and Chikungunya. The mosquito was introduced to the United States in the 1800's and is now spread across much of the Southeast. Since dengue has also been detected recently in the United States, control of *Ae. albopictus* is of great concern for human health in this country as well as abroad. We have recently identified over 150 proteins transferred from males to females in the seminal fluid of *Ae. albopictus.* The goal of this study is to investigate the function of the Sfps of *Ae. albopictus* in order to understand the basic biology of this species and to investigate potential new tools and pathways for control of their reproduction and disease transmission.

The student who works with me this summer will be trained and participate in experimental design, animal maintenance, observational and experimental studies of insect behavior, dissections of insect reproductive tissues, lab experiments using biochemical techniques such as 1D gel electrophoresis, and data analysis and presentation. In addition, we will have a weekly journal discussion group in which we will discuss relevant primary scientific literature. The student will also participate in the HHMI-sponsored summer workshops.

For more information about insect seminal fluid proteins, please see:

Sirot, L.K., M.C. Hardstone, M.E.H. Helinski, J.M.C. Ribeiro, M. Kimura, P. Deewatthanawong, M.F. Wolfner, & L.C. Harrington. 2011. Towards a semen proteome of the Dengue vector mosquito: Protein identification and potential functions. *PLoS Neglected Tropical Diseases*, 5:e989.

Avila, F.W., L.K. Sirot, B.A.L. LaFlamme, D.C. Rubinstein, & M.F. Wolfner. 2011. Insect seminal fluid proteins: identification and function. *Annual Review of Entomology*, 56: 21-40.

Sirot, L.K., B.A. LaFlamme, J. Sitnik, C.D. Rubinstein, F.W. Avila, C.Y. Chow, & M.F. Wolfner. 2009. Molecular social interactions: Drosophila seminal fluid proteins as a case study. *Advances in Genetics*, 68:23-56.

Sirot, L.K., R.L. Poulson, M.C. McKenna, H. Girnary, M.F. Wolfner, & L.C. Harrington. 2008. Identity and transfer of male reproductive gland proteins of the yellow fever mosquito (*Aedes aegypti). Insect Biochemistry and Molecular Biology*, 38:176-89.