



## Optogenetics-assisted reinforcement learning in *Drosophila*

**By Rebecca Yang**

Associate Professor  
Department of Neurobiology  
Duke University



**Abstract:**

While *Drosophila* can be classically conditioned to associate cues with reward, it was unclear whether they can learn more complex reward rules through trials and errors. Here we show that *Drosophila* readily learn a reward rule that requires them to perform a specific action at a specific location. We first identified specific neurons whose optogenetic activation was profoundly attractive to flies. We next developed a high-throughput closed-loop system that automatically delivers rewards optically to flies if their actions and positions conform to the rule we specified. Flies quickly learned the place-action reward rule and adjusted their behavior when the rule changed. Lastly, we showed that this form of learning depended on a specific subset of dopaminergic neurons that are different from the ones that mediate olfaction classical conditioning. Our results suggest that *Drosophila* are able to solve complex reward rules, enabled by a powerful and previously unknown reward system.

**Bio:**

**Ph.D., 1995-2002. Dept. Biological Science, Stanford University.**

**Thesis advisor:** Michael Simon.

**Thesis project:** Genetic analysis of planar polarity development of *Drosophila* eye.

**Post-doc., 2003-2009. Dept. Physiology, UCSF.**

**Advisor:** Yuh-Nung Jan.

**Project:** Genetic analysis of post-mating behavior of *Drosophila* females.

**Assistant professor, 2009-2016. Dept. Neurobiology, Duke University.**

**Associate professor, 2016- . Dept. Neurobiology, Duke University.**

**Date:**

Friday,  
10/21/16

**Time:**

1:30pm

**Location:**

COB 267

For More  
Information  
Contact:

Fred Wolf

[fwolf@ucmerced.edu](mailto:fwolf@ucmerced.edu)