Transfer Scholar Position Description

**Mentor name:** Rob Unckless, Molecular Biosciences

**Job/project title:** Genomes in conflict

**Remote or in-person:** This would be an in-person position for the 2022-2023 year.

**Project description:** Organisms are constantly adapting to challenges in their environment. Less appreciated is the fact that organisms also must constantly adapt to intragenomic parasites that bias their own transmission without regard to the fitness of the host. Transposable elements are probably the best studied intragenomic parasites, but meiotic drive elements that break Mendelian laws of segregation are also ubiquitous and have the potential for catastrophic consequences to their hosts. A better understanding of the genetic mechanisms involved in meiotic drive systems would inform how they evolve, what aspects of gametogenesis they target, how the genome fights back, and how they contribute to important evolutionary processes including reproductive isolation, chromosome evolution and even extinction. Furthermore, our understanding of natural meiotic drive systems will inform the use of synthetic gene drives for pest control.

Our goal is to gain an understanding of the genes and mechanisms involved in both sex-ratio meiotic drive and resistance to drive in Drosophila affinis and to understand the genomic consequences of meiotic drive. Meiotic drive is loosely defined as any process that selfishly cheats during gametogenesis to produce a non-Mendelian distribution of gametes. In males, this often occurs after meiosis during spermiogenesis and is particularly striking when the driving machinery resides on a sex chromosome. This sex-ratio meiotic drive usually occurs on the X chromosome and results in males that sire mostly daughters. Sex-ratio meiotic drive is found in plants and animals. We study sex-ratio meiotic drive in D. affinis and previously identified an excellent candidate meiotic drive locus as well as Y chromosomes that are resistant to meiotic drive. An intriguing aspect of the D. affinis system is that males without a Y chromosome are fertile, and in such males, the sex-ratio X chromosome kills itself resulting in all male offspring.

**Potential student tasks and responsibilities:** They will learn to identify Drosophila species morphologically and learn about how distinguishing characteristics have important biological function. Through a series of crosses to in the lab, Scholars will identify deviations from the strongly female-biased sex ratio consistent with resistance. Scholars will then perform several crosses to determine whether resistance is Y-linked or autosomal. The level of sophistication of this project can grow with the Scholar. For example, Scholars could begin to map autosomal resistance genes.
**Student qualifications and characteristics:** Students should be interested in genetics and evolutionary biology, but need not have taken either class. Some ability to get around (drive a car) would be helpful, but not absolutely necessary. This project has the potential to involve field collections from Minnesota down to Texas, but that would be optional and probably in spring/summer 2022.

**Additional comments:** These are transfer scholar positions specifically