Cell size, polyploidy, and sex determination in *Nasonia*

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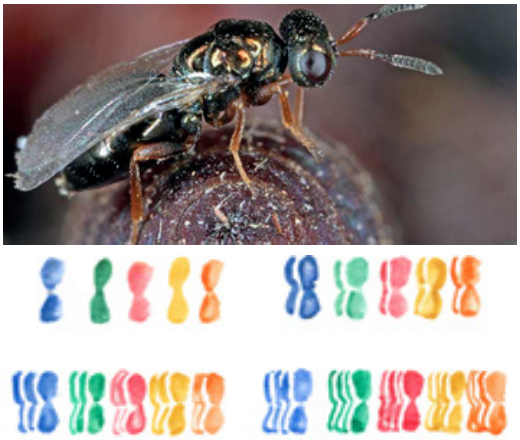

Polyploidy is the condition of having more than the usual number of chromosome sets. In many ways polyploidy is detrimental because of problems of infertility and abnormal cell biology. However, polyploidization has happened many times via whole genome duplication in the evolutionary tree (including for humans!). It may have provided benefits such as additional gene copies and increased hardiness. This begs the question, how do polyploids overcome disadvantages to derive benefits?

One possible adaptation that has allowed polyploids to persist is cell reduction mechanisms. Polyploid cells are larger than normal cells. In vertebrate polyploids, cell reduction mechanisms are used to retain fairly normal overall body size and physiology. However, it is unknown if this also holds for invertebrate polyploids, including insects. We will use the parasitoid wasp system *Nasonia vitripennis* to investigate whether there are cell reduction mechanisms in insect polyploids. Like all hymenopterans, *N. vitripennis* has a haplodiploid sex determination system: normally, unfertilized eggs become haploid (1n) males and fertilized eggs become diploid (2n) females. However, there are many ways that ploidy levels change. Some are naturally occurring. Others can be created by using RNAi knockdown to obtain null mutants of various sex determination genes. These lines produce haploid (1n) females, diploid males (2n) and triploid females (3n). In this project we will examine whether cell size and number change across ploidy levels for these lines with divergent ploidy.

The student will learn 1) insect (*Nasonia*) culture 2) various molecular techniques such as RNAi injection to create different polyploid lines; flow cytometry to track the ploidy of individuals; and cell staining of wings to assess cell size and number 3) morphological measurements such as cell count via wing hairs (setae) and rhabdomeres (eye cells) , head and wing size 4) microscopy imaging and 5) statistical data analysis.

Methods: insect (*Nasonia*) culture, RNAi injection, flow cytometry, cell staining of wings; morphological measurements; microscopy imaging; statistical data analysis.

Starting date: open