New thinking on regulation of sex chromosomes in fruit flies

September 19 2011

Fruit flies have been indispensible to our understanding of genetics and biological processes in all animals, including humans. Yet, despite being one of the most studied of animals, scientists are still finding the fruit fly to be capable of surprises, as evidenced by new research at the University of Rochester.

The latest revelation has to do with the activity of the X chromosome in male fruit flies. It was widely accepted that all X chromosomes in male fruit flies showed an increased level of activity. It was also believed that, in the absence of increased activity, the cell would die. But biologists at the University got some unexpected results when they studied chromosomal behavior in fruit flies.

The findings, by the lab of Associate Professor Daven Presgraves, have been published in the journal PLoS Biology.

While chromosomes in most animals come in pairs, that is not the case with all sex chromosomes. Males, typically being the ones to determine the gender of offspring, carry both the X and Y chromosomes, compared to the female, which carries two X chromosomes. Since the sex chromosomes carry genetic instructions for traits that go beyond gender determination, a process—called dosage compensation—evolved to ensure that the X chromosomes in males and females are expressed at the same level.

Dosage compensation occurs differently from one species to the next. In

male fruit flies (*Drosophila*), the expression—or activity—of genes on most of the single X chromosomes is doubled to match the expression of the two X chromosomes in female cells. Scientists have believed that the process of dosage compensation occurs in all cells of the male fruit fly. But University biologists have discovered that is not the case with the germ (reproductive) cells in the testes.

A complex of proteins called the dosage compensation complex is responsible for upregulating gene expression in somatic (non-reproductive) cells. "That complex doesn't exist in germ cells, so it was assumed that dosage compensation occurred in those cells by some other mechanism," said lead author Colin Meiklejohn, "We showed there is no upregulation of X chromosomes in the testes of flies."

Scientists have assumed that dosage compensation is needed for any male cell to survive, said Meiklejohn. It's not clear why there are no negative effects in the male sex cells, but Meiklejohn said that's a question University researchers will look at next.

Provided by University of Rochester