Does Transvection Occur During the Embryogenesis of *Drosophila melanogaster*?

Rachel Henderson, 2015

The conventional model of gene regulation involves the regulatory region of one chromosome interacting with the promoter region on the same chromosome causing gene expression, which is called expression in cis. Transvection is another form of nuclear transcriptional regulation during which homologous chromosomes pair and the regulatory region on one homologue interacts with the promoter region on the other homologue causing gene expression in trans. Previously, the Bateman Lab has studied the phenomenon of transvection throughout the development of the *Drosophila melanogaster* life cycle and observed transvection as early as stage 16 of development.

During embryogenesis or the first 24 hours of *D. melanogaster* development, homologue pairing is variable. Therefore, observing transvection during this period gives insight into when homologues begin to pair in certain tissues and when transvection becomes important for gene regulation. Previous research conducted by Beatriz Malibiran ‘14 used a GAL4/UAS FLP reporter system to observe transvection during embryogenesis by directly visualizing GFP fluorescence. Autofluorescence of embryos affected Beatriz’s ability to detect GFP expression in specific embryonic tissue and observe transvection during embryogenesis.

My project this summer involved testing a new method to observe transvection during embryogenesis by utilizing a GAL4/UAS reporter system, in which GFP mRNA was expressed in specific central nervous system tissue and visualized using in situ hybridizations. To observe cis expression, a construct with a UAS enhancer in cis to a GFP gene was in embryos. To observe trans expression in embryos, the UAS enhancer was located on one homologous chromosome, while the other homologue contained the GFP gene, but not an enhancer. In order for GFP to be expressed, the UAS enhancer must act in trans. GFP would only be expressed in certain nervous system tissue where GAL4, a transcriptional activator, was expressed and could bind to the UAS enhancer activating transcription. I utilized two different enhancers that drove expression of the GAL4 gene in either the glial cells or neuronal cells. I conducted in situ hybridizations with a GFP probe, and observed cis or trans expression of GFP mRNA using fluorescent microscopy.

Cis expression of GFP in both glial and neuronal cells was detectable although difficult to observe over the non-specific background staining of the embryos. Observing trans GFP expression in the central nervous system tissue was also difficult for the same reason. After probe optimization, cis expression was easily detectable within the neuronal cells of the brain and ventral nerve chord. Probe optimization, however, did not improve detection of trans GFP expression. Overall, this method of observing transvection has some flaws, and other methods could be explored in order to study transvection during embryogenesis.

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