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A century later another surprise: A non-visual behavioral function of the *white* gene

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Discovery of the *white* mutation in *Drosophila melanogaster* has broadly influenced our understanding of the mechanisms of inheritance. We recently discovered a role of the *white* gene in memory formation. Thus, the *white* gene continues to provide insight into basic biological functions. We use two conditioning methods to routinely measure learning and memory in *D. melanogaster*, the heat-box, and classical olfactory conditioning. In the heat box experiments, *white* mutant flies' learning performance was notably impaired. However, in olfactory conditioning studies the mutant flies performed the same or better than wild-type flies. This differentiates the molecular mechanisms that support these conditioned behaviors. To better understand the regulatory elements that control *white* expression, we have initiated a molecular characterization of the *white* genomic locus. We identified the necessary regulatory elements by defining the deletion in the w1118 null allele. Using PCR methods we found that the deletion is about 7 kb long, and includes 5' regions, exon 1, and part of the first intron. Experiments to determine the sufficient set of regulatory elements for conditioned behavior were initiated. Two results argue that existing genomic transgenes do not contain all regulatory elements. First, mutations that affect eye color have molecular lesions outside a 14 kb genomic transgene. Second, attempted behavioral rescue experiments with this transgene fail. We interpret the failure of the 14 kb transgene to rescue as a consequence of incorrect *white* expression. Thus, we are creating a genomic construct that is 18 kb long that includes genomic DNA up to the next known gene. These approaches should define the regulatory regions necessary and sufficient for behaviorally important *white* expression.