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Expression of Transformer in Cholinergic Neurons of Male *Drosophila melanogaster* Enhances Aggression

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Aggression is a universal trait that is especially important for the survival of a species when resources are limited. In *Drosophila melanogaster*, male aggression has been characterized in detail and recently it was demonstrated that females fight differently from males. These results and the detailed knowledge of the sex determination pathway at hand, the group around Edward Kravitz set out to study the effects of "masculinizations" and "feminizations" of groups of neurons by the suppression or expression of transformer (*tra)*, a gene of the sex determination pathway. In 2006, members of his lab could show that the feminization of the entire brain of a male fly leads to a change of the fighting pattern from male to female. Here, the effects of feminization by the expression of *tra* in subgroups of neurons were studied.
In an initial screen using the GAL4-UAS system, *tra* was expressed in 60 different GAL4-lines, and accordingly feminizing 60 different groups of neurons. In addition to several lines that showed changes in the fighting pattern, one line with increased intensity of aggression was observed. In this line *tra* was expressed in the cholinergic neurons. It was further characterized using our standard fighting chamber and a new assay with Multiwell^{TM} plates that was used to accelerate analysis. The line showed significantly increased aggression in all examined parameters including a newly defined parameter, the "Latency" which showed a higher discriminatory power than the other parameters. It was found that the expression time for *tra*, that was necessary to elicit the enhanced aggression phenotype, is the late larval/early pupal stage. The increased aggression of the characterized line was not due to any changes in phototaxis, geotaxis, olfaction and locomotor activity nor was it caused by effects of the genetic background. A co-localization study of cholinergic neurons and fruitless (*fru*) neurons was conducted because *fru*, a gene of the sex determination pathway downstream of *tra*, is the most likely effector of *tra* expression. It was demonstrated that only a small part of the *fru*-neurons were cholinergic, potentially narrowing down the number of neurons that are involved in the generation of the enhanced aggression phenotype. Especially the mAL-, SG- and P1-clusters showed only a few number of neurons with co-localization of cholinergic and

fruitless neurons. These clusters are particularly interesting as they have been shown to regulate important parts of sexually dimorphic behaviors, namely courtship and aggression. The results of this thesis show that the feminization of cholinergic neurons leads to enhanced aggression in male *Drosophila melanogaster*. Future studies will have to examine the mechanisms by which *tra* acts in the cholinergic neurons and thus narrow down the number of neurons that are involved.