The Molecular Mechanisms of Ethanol Neuroadaptation

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Alcohol consumption is known to induce cognitive impairments mainly affecting executive functions, episodic memory, and other capacities related to brain function. Nevertheless, the cellular and molecular mechanisms underlying such interactions is still unknown. Recent evidence has uncovered a similar interaction between ethanol exposure and cognitive function in the fruit fly, Drosophila melanogaster, which opens the way for molecular studies in a genetically tractable model system. Using an olfactory conditioning assays where an odorant is used as a conditioned stimulus (CS) and is paired with a heat shock used as an unconditioned stimulus (US), it was shown that Drosophila larvae can learn to avoid the odor in future exposures. However, when the animals are exposed to a short acute dose of alcohol, they are no longer able to learn this association. Interestingly, larvae that have undergone prolonged chronic ethanol exposure seem to successfully avoid the odorant paired with the heat shock just as well as control ethanol-naive larvae, which is suggestive of ethanol-induced neuroadaptations. Our aim is to understand the genetic and cellular components responsible for this adaptation. For this, we employ RNA Sequencing technology to evaluate differences in gene expression in the brain of larvae chronically exposed to ethanol and in control larvae. Results from RNA sequencing suggest neuroadaptations are modulated by a diverse array of synaptic proteins within the larvae brain. With the knowledge obtained from this study, we could be able to understand ethanol's effect on learning and memory and gain an insight into how addiction may be contributing to damages in this behavior.