Summer 7-6-2012

Chronic Ethanol Exposure Causes Disinhibited Behavior in Drosophila

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Funding Source:
National Science Foundation

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Ethanol consumption is frequently associated with disinhibited sexual and locomotor behaviors in humans. Dopamine, a major monoamine found in vertebrates and invertebrates, is implicated in these processes since it regulates motivation, reward, motor control, and sexual behaviors. The goal of this study is to elucidate the role of dopamine in ethanol-associated behavioral disinhibition using the genetically tractable model system Drosophila melanogaster. Previous studies have shown a requirement for normal dopamine neurotransmission for ethanol-induced courtship disinhibition. Furthermore, genetic manipulation of the dopamine system revealed that D1 receptor activity is important for disinhibition and D2 for sensitization. The current study focuses on the role of the novel dopamine ecdysone receptor (DopEcR) that binds both dopamine and ecdysone steroid. We exposed thirty-three male flies to 95% ethanol once daily for six consecutive days and recorded their behaviors. Sedation time is measured to monitor the fly’s capacity to tolerate ethanol after repeated exposures. Male flies typically do not court other male flies. However, they show a significant increase in inter-male courtship activity under the influence of ethanol, representing "cognitive behavioral disinhibition". Interestingly, DopEcR mutant flies exhibited a significantly attenuated increase in inter-male courtship suggesting its crucial role in ethanol-induced disinhibition. The studies to test the effect of overexpressed DopEcR in inter-male courtship are in progress. These findings enhance our understanding of the neurobiological basis of ethanol-induced behavioral disinhibition.