Investigating the Effect of Traumatic Brain Injury and THIP on Short-Term Memory in Drosophila melanogaster Using Aversive Phototaxic Suppression

Srivastava, Niraj (School: Keystone School)
Montemayor, Abby (School: Keystone School)

This study aimed to determine whether traumatic brain injury (TBI) causes learning and short-term memory (STM) deficits in Drosophila melanogaster, and if THIP, a GABA-A receptor agonist, will reduce such deficits. The researchers hypothesized that TBI severely impairs STM, and that increased sleep caused by THIP will reduce STM deficits from TBI. The researchers divided 1–4-day-old flies into 4 groups with a 4-day treatment: flies with normal food (control), flies with TBI induced by a homemade High Impact Trauma Device with normal food, flies with TBI orally administered THIP (0.1 mg/mL), and flies with a 2-day prophylactic treatment of THIP (P-THIP) prior to TBI and a 4-day THIP treatment. The researchers assessed STM, using Aversive Phototaxic Suppression (APS), and neurodegeneration, using climbing assays and lifespan analysis. For APS, flies were placed in a homemade T-maze 16 times to choose between a light chamber with the aversive stimulus of quinine and a dark chamber without stimulus, with photo-negative choices indicating better STM. In the TBI group, STM was impaired by 21% compared to the control ($p=0.00687$), while P-THIP rescued STM by 18% ($p=0.01244$). However, THIP treatment did not improve STM for flies with TBI ($p=0.348$). While none in the TBI group passed the climbing assay, 28% of flies with P-THIP improved motor function and passed. By Day 4 of treatment, 87% control, 29% TBI, 41% THIP, and 75% of flies with P-THIP survived. Results established flies as a model for memory deficits caused by TBI, and the mechanisms behind P-THIP could be targeted to treat such deficits in humans.

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