What's All the Buzz? Drosophila melanogaster as a Unique Model for Addiction Disorders and Physiology After Traumatic Brain Injury (TBI)

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Traumatic brain injury (TBI) is a leading international cause of morbidity and mortality and can significantly disrupt brain physiology resulting in substance abuse and sleep disorders. Drosophila melanogaster has been validated as a model to explore drug addiction. The goals of this project were to utilize Drosophila melanogaster and determine whether single TBI or concussion and recurrent TBI (rTBI) will: 1) Cause an increased propensity to consume caffeine containing media. 2) Disrupt circadian rhythms, by measuring circadian period (T) and rhythmicity index (RI). 3) Can be mitigated by therapeutic hypothermia. A “high-impact trauma” (HIT) device a was built, which used a spring-based mechanism to propel flies against the wall of a vial, causing mechanical damage to the brain. Caffeine enriched and regular media were presented to flies inside a constructed choice chamber. Hypothermia was induced for 3 minutes in a refrigerator at temperature of 16C, after each hit was performed. Circadian data was obtained by monitoring fly locomotor activity with the Drosophila Activity Monitoring (DAM) system. Significantly more flies preferred the caffeinated medium, after both single and recurrent TBI. Hypothermia showed some mitigation of the effect of TBI causing caffeine addiction. The circadian rhythm appeared more resilient to disruption after TBI, but increased numbers of arrhythmic flies, particularly among the female cohort were observed. Recurrent TBI in flies may predispose them to substance-abuse disorders and disrupted circadian rhythms. Hypothermia offers some protection against such disruptions in brain physiology.

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