The Effect of Nonassociative Learning on Oxidative Stress in Caenorhabditis elegans: A Potential Application for Alzheimer's Disease Research

Patton, Gillian (School: Spring Valley High School)

Alzheimer's disease results in learning and memory deficits due to toxic changes in the brain caused by amyloid-β plaques and oxidative stress (Alzheimer's, 2011). Oxidative stress is caused by the overproduction of free radicals, which are uncharged molecules containing an unpaired valence electron (Morcos & Hutter, 2009). Nonassociative learning is a type of cognitive processing that only uses one stimulus instead of two related stimuli. Cognitive processing promotes neural growth and learning, while Alzheimer's inhibits it. The purpose of this study was to test how nonassociative learning impacts oxidative stress and thus, if it might be considered as a potential treatment option for Alzheimer's disease. It was hypothesized that the application of nonassociative learning would reduce the effects of oxidative stress on C. elegans, resulting in increased mobility and egg-laying. Mechanosensory, chemosensory, and novel environment habituation were used to increase mobility and egg-laying in C. elegans, in opposition to a hydrogen peroxide treatment that induced oxidative stress. The equation $F(3,236)=44.73$, $p<0.0001$ was used to run the one-way ANOVA for time to paralysis. The Tukey test demonstrated differences between the control group and all of the experimental groups. The equation $F(3,16)=4.72072$, $p=0.021252$ was used to run the one-way repeated measures ANOVA for egg-laying. The Fisher test demonstrated differences between the control group and the mechanosensory and chemosensory groups. It was concluded that the application of nonassociative learning to C. elegans reverses the negative effects of oxidative stress, stimulating mobility and egg-laying.

Awards Won:

Third Award of $1,000