CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

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S1803

Project Title

The Effects of Caloric Restriction on the Subsequent Stress Resistance and Chemosensation of Caenorhabditis elegans

Abstract

Objectives/Goals

The nematode, C. elegans, displays sensitivity to certain stressors, such as heat, oxidative stress and caloric restriction. The purpose of Part I of the experiment was to demonstrate the effects of controlled nutrient deprivation on the lifespan of C. elegans. In Part II, we developed a chemotaxis assay in order to efficiently and accurately quantify chemosensation (used as a measure of neural function) of the C. elegans by observing the worm's transition to a dauer state (lowered cellular function due to minimal environmental nutrients). In Part III, we tested our chemotaxis assay on worms that were starved initially for 24 hours and 48 hours to observe the effects of nutrient deprivation on chemo-sensation.

Methods/Materials

The worms were cultured in NGM plates and then synchronized. These worms were starved for up to a 48-hour period before they were revived on an NGM+OP50 plate. For Part I, worms were deprived of E. coli for up to 10 more days and the percentage of non-dauer worms was calculated. Part II focused on the development of a chemotaxis assay. In Part III, the worms were starved and then revived, and subsequently their cognitive development was measured using the chemotaxis assay from Part II.

Results

In Part I, we show that C. elegans can have an increased lifespan when exposed to a caloric restriction stressor. Results from Part III conclude that the worms are not able to respond as well to chemical odorants after caloric restriction. This means that despite the fact that they are able to live longer, the worms' cognitive development is harmed by caloric restriction.

Conclusions/Discussion

Part I of our experiment demonstrated that worms exposed to longer periods of starvation subsequently showed a decrease to the susceptibility to becoming dauer. Because butter seemed to be the strongest tested attractant in Part II, we chose to use butter as the primary attractant for testing in Part III. As predicted, Part III showed that longer periods of starvation weaken chemosensation. With the data collected in Part I and Part III, we can conclude that ROS produced through starvation has disrupted the proper function of the neurons responsible for chemosensation.

Summary Statement

Through the research process, we have learned that caloric restriction can actually increase the worms# lifespan, but has subsequent negative impacts on the worms# cognitive development as shown by our studies.

Help Received

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