Toward Understanding the Neural Circuitry Regulating Cold Sensitivity in C. elegans, a Two-Year Study

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Acute cold is important to animal survival as temperature plays an important role in metabolism, lifespan, and other physiological phenomena in animals. An experiment is conducted to determine the neurons associated with cold sensation using the nematode C. elegans. The purpose of the project is to find the neural and molecular mechanisms responsible in mediating the sensitivity of cold in C. elegans. Through screening, cat-2 mutants were determined to be defective in their response to cold stimuli. cat-2 is used along with N2 wild type worms as a control to test the other candidates that encode for downstream neurons. Preliminary experiments showed that 13°C was the optimal temperature to test C. elegans, as it is the temperature at the threshold that separates the nematodes' swimming (>13°C) and coiling (<13°C) behavior. Worms were transferred to tubes containing M9 solution and the tubes were then placed inside an insulated testing chamber I built, which serves to keep the temperature constant. Body thrashes were counted when the tube was exposed to both 20°C water (control) and 13°C water because body thrashes indicate the rate of locomotion, an easy and obvious indicator of behavioral changes in C. elegans. The body thrashes are then normalized and plotted. Candidates that showed a significantly higher amount of head swings than the N2 wild type did were determined to be defective in reacting to cold temperatures. It is concluded that dopamine receptors and the CEP/ADE/PDE Dopaminergic neurons are involved in the neneural circuitry regulating cold sensation in C. elegans. A better understanding of cold sensation can lead to mechanisms targeting specific neurons in more complex organisms to manipulate the way they sense or respond to cold stimuli.