CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

S2210

Project Title

Diagnosing Neurodegenerative Diseases (ALS): Using Infrared Spectroscopy to Test for Neurodegeneration in C. elegans

Abstract

Objectives/Goals

Current methods for diagnosing neurodegenerative diseases like Amyotrophic Lateral Sclerosis are time-consuming and tedious as they require patients to undergo multiple invasive and painful blood and cerebrospinal fluid tests. The purpose of my project was to develop a minimally invasive, one-test diagnostic tool for diagnosing neurodegenerative diseases like ALS. The test uses the concept of infrared spectroscopy as it involves projecting infrared light on healthy and degenerated neurons and comparing the vibrational frequencies they each produce, as a result of being exposed to IR light, to determine the level of neurodegeneration.

Methods/Materials

Experiment involved use of C.elegans as a model organism. Control Group (3 plates of wild type C. elegans exposed to 5min of infrared light), Experimental Group (9 plates of C.elegans infected with Levamisole hydrochloride chemical and exposed to 5min infrared light). Tested for neural vibrational frequencies by observing movements of wild type C.elegans and infected C.elegans with neurodegenerative disease, under IR light LED projection. Used DinoLite microscope to capture the movements of C.elegans, and used WormLab software to analyze them.

Results

An exposure to IR light caused the neurons of control group C.elegans to produce a vibrational frequency that promoted a sinusoidal wave motion with greater mobility and speed(45um/sec-120um/sec). An exposure to IR light caused the neurons of the experimental C.elegans to produce a vibrational frequency that promoted rapid fluctuations in movement(Num of reversals: 2-12) and muscular bends(Center Points(deviation from normal body position): 4 units-15 units).

Conclusions/Discussion

My experiment proves that there is a distinct difference between the vibrational frequencies produced by healthy neurons and degenerated neurons of C.elegans when they are exposed to infrared light. This experiment has a direct relation to diagnosing neurodegenerative diseases(ALS) in humans since the vibrational frequencies of the degenerated corticospinal neurons in ALS patients will differ from the vibrational frequencies of the corticospinal neurons in a healthy individual when both neurons are exposed to IR light. The experiment proves that the vibrational frequencies can be used to determine the shape, structure, and condition of the neurons and can serve as diagnostic markers for diagnosing neurodegenerative diseases like ALS.

Summary Statement

A novel approach towards developing a minimally invasive, one-test diagnostic tool for diagnosing neurodegenerative diseases like ALS using infrared spectroscopy.

Help Received

I conducted the experiment in my school's STEM class, under the supervision of my mentor, Mrs. Renee Fallon, who guided me through methods such as pouring plates and provided me with necessary materials such as Petri dishes, micropipettes, and Nematode Growth Medium.