CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)	Project Number
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Project Title

Reducing Neuronal Hyper-excitation in Autism: Various Herbs' Ability to Increase Inhibition in the Roots of A. thaliana

Abstract

Objectives/Goals

Several symptoms of autism spectrum disorder are the result of a high excitatory to inhibitory neuron signaling ratio. Currently benzodiazepines are the most popular drug used to normalize an excitable cortex, however it has several adverse effects such as myorelaxation. My goal is to find an herbal extract that can increase signal inhibition at the GABA-A receptor without these effects and to identify which of two groups of chemicals in these extracts, valepotriates and flavonoids, is the more powerful inhibitor.

Methods/Materials

The plant species Arabidopsis thaliana was used as a model organism as it has been experimentally verified that the AtGLR receptor family in A. thaliana has a similar primary sequence and secondary structure to the GABA-A receptor. Arabidopsis seeds were grown in plates with the negative control, the solvent of the extracts, and in plates with each of the extracts. During the 12 day growth period, pictures were taken under a dissecting microscope and primary root length was measured on Adobe Illustrator.

Results

Each of the six extracts elicited root length inhibition as compared to the negative control. By day 12, average primary root length of seeds grown with an extract was 7.59 mm as compared to the control length of 19.74 mm. Delayed germination times among seeds grown with an extract were noticed; by day 5, all seeds grown in the negative control had germinated, however only 34.5% of seeds grown with an extract had germinated. Root metacutinisation (a process in which the exodermis browns and encases the root during periods of inactivity) was noticed for 50% of seeds grown with Valerian extract. Finally in 50% of seeds grown with Passion Flower and 30% of seeds grown with Valerian, the radicle failed to pierce the seed coat while the hypocotyl and the cotyledon emerged.

Conclusions/Discussion

T-tests showed statistically significant root length inhibition as compared to the negative control for 4 out of the 6 extracts. Valepotriates were not shown to be a more powerful inhibitor than flavonoids. These results are promising as they suggest that extracts from Catnip, Valerian, St. John's Wort, and Skullcap do increase neuron signaling inhibition. Further tests would include comparing the results with that of benzodiazepines and testing on the GABA-A receptors in C. Elegans.

Summary Statement

I determined that extracts from Catnip, Valerian, St. John's Wort and Skullcap inhibit root length growth of Arabidopsis thaliana; therefore, these extracts look promising in normalizing neuronal hyper-excitation in autism.

Help Received