CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

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Project Number

S1002

Project Title

Phase 3: Enhancement of Spatial-Temporal Reasoning in Mus musculus domesticus via Generalized Mozart Effect

Abstract

Objectives/Goals

Mozart affects the firing patterns in the mammalian columnar cortex, used in spatial-temporal (ST) reasoning. An animal model of the #generalized Mozart effect#--enhanced higher brain function in response to exposure to music--was established by Phase I. Phase II determined that the generalized Mozart effect lasted at least 6 hours after exposure to music; this long-term causal enhancement suggested clinical relevance in potential use of this effect treating epilepsy. After receiving a positive response from the research community, Phase III tests the longevity of the effect through implementation of increasing time-lapses of auditory stimuli, suggesting permanent enhancement of brain function.

Methods/Materials

40 mice were exposed to music for 10 weeks before testing. Music was edited to have a properly timed music dosage, bringing the stimuli exposure into clinical relevance with limited human exposure. To assess the effects of a time lapse, this protocol was used: Day 1, music was stopped 6 hours before testing. Day 2, a longer time lapse of 8 hours was used. Music was stopped 8 hours before the maze runs for the day. Day 3, 10 hours, Day 4, 12 hours. Day 5, the music was stopped entirely for the full day before the maze run is done. Each subject performed 3 trials daily.

Results

Our hypothesis was correct. The ST reasoning abilities of mice exposed to Mozart were consistent despite an increasing time-lapse. This indicates that the exposure to the music made neuropsychological changes to the mice, likely due to the neuroplasticity of the mammalian brain.

Conclusions/Discussion

These studies link neurophysiology with behavior by using control music demonstrated to not preferentially activate specific spatial-temporal cortical regions in fMRI studies; based on the regions activated it is predicted whether a piece will enhance ST ability in a behavioral study. Beethoven#s Fur Elise is a suitable control on the basis of its differential cortical activation patterns observed in fMRI studies compared to the Mozart Sonata, consisting of reduced or absent activation of areas associated with ST reasoning--particularly prefrontal cortex, occipital cortex, and the cerebellum. If precise exposure to the complexities of Mozart excites the cortical columns in the brain sufficiently to result in a normalizing effect, there is clinical significance in the non-invasive treatment of epilepsy.

Summary Statement

Laboratory mice were exposed to Mozart and their spatial-temporal learning tested throughout the implementation of increasing time-lapses of auditory stimuli.

Help Received

None.