



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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<b>Project Title</b> <b>Enhanced Alzheimer's Treatment via External Gamma/Brain Wave Stimulation</b>	
<b>Objectives/Goals</b> MIT researchers stimulated gamma waves in mice brains with flashing lights to trigger microglia to clean up beta amyloid plaques (the cause of Alzheimer's Disease). The lights would be uncomfortable for humans and may trigger seizures. We built an EEG with some spare parts and an Arduino and tested whether sounds and vibrations at the same frequency (40 Hz) would cause the same result in humans without the side effects. <b>Abstract</b> <b>Methods/Materials</b> We built an EEG using a MindFlex headset and Arduino. We modified code found on instructables.com to filter out low quality data, look only at gamma waves, and record data to a memory card. We built our own stimulation devices using an Arduino, LEDs, a stepper motor, a function generator, and a cell phone. We are currently working on using a real EEG to compare to ours. We collected baseline rates of gamma wave activity in a quiet room. Then we turned on either a blinking light, sound, or vibration at 40 cycles per second, the frequency of gamma waves and measured the response in the brain. We used these stimuli at other frequencies to use as a control. <b>Results</b> We found a very strong response to the 40 Hz vibrations and little or no response to the light and sound. We hypothesize that this is because our EEG only has one sensor and it is on the forehead. Visual and auditory processing happen near the back of the brain. Sensory processing happens in the top/mid brain which is picked up by our sensor. We cannot prove that this increase in gamma brain waves also reduced amyloid plaques, but Dr. Tsai at MIT proved that relationship. Therefore, we can assume that if we increase gamma activity, it will result in reduced beta-amyloid plaques. <b>Conclusions/Discussion</b> Although we experienced limitations in our self-made equipment, we were able to show a strong relationship between 40 Hz vibrations provided by our vibration vest and gamma waves in the brains of our subjects. We anticipate that as we continue our tests with a real EEG, we will be able to show that the light and sound also produce a strong response that we were unable to measure with our equipment. Combined with the research of Dr. Tsai at MIT, we can conclude that it is possible to reduce beta-amyloid plaques with 40 Hz vibrations and we anticipate that we will soon be able to prove the same with flashing lights and clicking sounds.	
<b>Summary Statement</b> We are trying to treat Alzheimer's by using external stimuli to increase gamma waves in the brain as measured by our home-made EEG machine.	
<b>Help Received</b> n/a	