



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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<b>Project Title</b> The Effect of Interrupted Sleep on Cognitive Behavior and Neurophysiology in Drosophila melanogaster	
<b>Abstract</b> <b>Objectives/Goals</b> Our experiment's objective is to determine interrupted sleep's effect on cognition. Common diseases like sleep apnea and generalized anxiety disorder interrupt sleep instead of depriving it, but, taking a closer look, we realized that minimal pre-existing experimentation had been performed on interrupted sleep. We hypothesized interrupted sleep would lower cognitive capabilities compared to normal sleep. <b>Methods/Materials</b> We used Drosophila melanogaster as our animal model for the sleep study. Our experiment regulated Drosophila sleep using blue lights controlled by an Arduino. We divided fruit flies into four test tubes; one tube was a blue light control, one functioned on normal sleep, one's sleep was interrupted, and one tube was deprived of sleep. Interrupted sleep was defined as 5 minute waking periods every two hours of sleep in the night. Deprived sleep was defined as obtaining half the amount of normal sleep in Drosophila, or four hours. Our experiment measured cognition through memory and reaction time, which was tested through attraction to vinegar. <b>Results</b> For reaction time, we measured their reaction time in comparison to each other across the 8 days. Flies with interrupted sleep consistently had the fastest reaction time (5-7 seconds) whereas those with deprived sleep has the slowest (13-16 seconds). In our second experiment, classical conditioning, we took their average reaction time and compared it to the reaction with the fake Q-tip stimulus. We found a similar change of 5 seconds between the two times for all types of sleep. However, that time change meant that interrupted sleep was almost doubling the average reaction time, indicating that another factor that was playing a role. <b>Conclusions/Discussion</b> We concluded that this heightened vigilance occurred due to an increased level of cortisol and adrenaline. We believe the loss in memory is due to the lack of REM sleep obtained each night. Restarting from the beginning of each sleep cycle every time the subject wakes up means that the last stage of the sleep cycle, REM, is never acquired in adequate amounts. In the future, we could use sleep monitors on humans. We could also test for synaptic protein levels to probe the effects of interrupting certain sleep stages on daily activities.	
<b>Summary Statement</b> We discovered that interrupted sleep led to quicker reaction times, but severely decreased memory and learning capabilities.	
<b>Help Received</b> We designed the experiment and Arduino programs ourselves. Our teacher provided vinegar, Arduino wires, outlets, and other common materials to us for our experiment. We bought our fruit flies from Carolina.	