



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2019 PROJECT SUMMARY**

<b>Name(s)</b> <b>Danna Bundogji</b>	<b>Project Number</b> <b>J2201</b>
<b>Project Title</b> <b>Is Biotin the Answer? Planaria and Nervous Tissue Regeneration</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of my study is to see whether Planarian flatworms can demonstrate nervous tissue regeneration under the influence of the natural supplements: Biotin, Vitamin D, Vitamin E, and Aloe Vera following a physical injury.</p> <p><b>Methods</b> 50 Planarian flatworms, 100 Petri Dishes, 10mg Biotin liquid, 10mg Vitamin D liquid, 10mg Vitamin E liquid, 10mg Aloe Vera, and digital microscope. I tested each natural supplement on the planarian flatworms that I gave a physical injury to. Then, I measured and recorded their growth each week.</p> <p><b>Results</b> The average growth for planarians living in water grew at an average growth percentage of 29.73%. Planaria living in Biotin grew at 9.51%, Vitamin D at 44%, and Vitamin E at 30.19%. Lastly, planarians that lived in the Aloe Vera environment 69.41% growth rate.</p> <p><b>Conclusions</b> Injured planarian placed in all solutions completely regenerated after 3-4 weeks. Aloe vera ended up doing the best and helped the planarians grow the fastest when compared to the other natural supplements tested in this experiment. When ranking all the other supplements, Vitamin D did the second best followed by Vitamin E, and lastly Biotin.</p>	
<b>Summary Statement</b> In an effort to find a cure to neurodegenerative diseases, I tested to see whether planarian flatworms can demonstrate nervous tissue regeneration under the influence of various natural supplements.	
<b>Help Received</b> I received approval from my mentor on the natural supplements that I chose to work on during this experiment. After learning the protocol from my mentor, I conducted the experiment and statistical analysis independently.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Angad Gill; John Anthony Santiago</b>	<b>Project Number</b> <b>J2202</b>
<b>Project Title</b> <b>The Effect of Blue Light on Planaria Regeneration</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of our study is to determine the effect of close distance and prolong exposure of blue light on head regeneration of planaria.</p> <p><b>Methods</b> The Planaria was cut into head and tail. The tail was placed into numbered petri dishes and separated into 3 set up. -Set up 1 was exposed to 4 hours and 8 hours of blue bulb light everyday for 14 days -Set up 2 was exposed to 4 hours and 8 hours of blue grow light for 4 hours and 8 hours for 14 days. -Set up 3 was control and was not exposed to close distance blue light. Everyday the Planaria were checked using digital microscope attached to laptop for signs of head regeneration. The first day there is a sign of head regeneration was recorded and analyzed.</p> <p><b>Results</b> Close distance blue light exposure made the head of the planaria regenerate faster. The planaria exposed to longer (8 hours) blue light using blue grow light grew faster than the 4 hours. The planaria that were not exposed to close blue light regenerated their head slower.</p> <p><b>Conclusions</b> The close distance exposure to blue light made the planaria head regeneration faster. This means that the effect of close distance exposure to blue light on Planaria might have similar effect on humans. It might mean that close distance blue light exposure may help humans in wound healing. However, it might also mean that blue light exposure to humans might cause abnormal cells to regenerate faster that could lead to tumor or cancer cells.</p>	
<b>Summary Statement</b> Exposure to close distance and prolonged blue light made the head of the planaria regenerate faster.	
<b>Help Received</b> Consulted a teacher on statistical analysis of our result	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Sarai Golden-Krasner; Maya Lurvey</b>	<b>Project Number</b> <b>J2203</b>
<b>Project Title</b> <b>Testing the <i>Oncopeltus fasciatus</i>' Neuromotor Responses to Olfactory and Visual Stimuli</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Because we are constantly bombarded by sensory stimuli, we rely on our senses to identify critical information in a particular situation and environment. Humans and animals alike must integrate multitudes of stimuli, so we decided to investigate on insects (<i>Oncopeltus fasciatus</i>, also known as a milkweed bug), an organism that displays an optomotor response (stabilizing response to visual stimuli). We hypothesized that the milkweed bug would display a greater response to the visual stimulus as it increased in strength (due to the optomotor response) while keeping the negative olfactory stimulus unchanged. The objective of our study was to test if the <i>Oncopeltus fasciatus</i> optomotor response to positive visual stimuli would affect its response to negative olfactory stimuli.</p> <p><b>Methods</b> 4 <i>Oncopeltus fasciatus</i> insects, 4 oz. bees &amp; paraffin wax, 4 twist ties, 1 helping hand device, 1 y-maze globe, 1 optical stimulus video screen, (coded in the programming language Python with the help of Dr. Hinterworth), 4 sticks of rosemary, and 1 dark enclosure. To test the bug's behavior, we created a Y-maze globe for the insect to turn in response to a visual stimulus (perceived motion on a video screen) and a negative olfactory stimulus (rosemary). We tracked the direction in which the insect decided to turn on the y-maze globe while the visual and olfactory stimuli were present.</p> <p><b>Results</b> When the insects were exposed to increasingly higher levels of visual stimuli, while simultaneously being exposed to negative olfactory stimuli, they frequently responded to the visual stimuli choosing to neglect their previous distaste for the odor and move towards the negative olfactory stimulus (statistically significant).</p> <p><b>Conclusions</b> These results show that the insect's optomotor response will eventually overpower their initial instinct to turn away from the odor. It is concluded that if the <i>Oncopeltus fasciatus</i> is prompted towards a specific direction with a positive optical stimulus, while concurrently exposing it to a negative olfactory stimulus, the strength of the optical stimulus will determine whether the insect continues to move in that direction. This could help in predicting insect migration patterns and could lead to further experiments involving humans or different stimuli.</p>	
<b>Summary Statement</b> Measured by how often it turned toward or away from visual and olfactory stimuli, the <i>Oncopeltus fasciatus</i> increasingly followed the visual stimuli and turned toward the negative olfactory stimuli as the visual stimulus strength increased.	
<b>Help Received</b> We received assistance from Dr. Hinterworth in creating our visual stimulus video. Our parents also supported us by buying all necessary materials for this experiment to be conducted.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Hercules Gonsalves</b>	<b>Project Number</b> <b>J2204</b>
<b>Project Title</b> <b>What Are the Effects of High Audio Frequencies on Pogonomyrmex barbatus?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The purpose of this project is to investigate whether or not different audio frequencies will repel Pogonomyrmex barbatus (also known as Red Carpenter ants). This is a second year project, the reason I am doing this research is because I want a better understanding of why ants are repelled or effected by sound. While I was researching my first year project, I found a video. While watching the video, a bunch of ants were walking around a phone. When the phone rang, the ants walked around the phone clockwise in perfect unison.</p> <p>In my experiment, I will use two connected ant farms, a phone, a speaker, a sugar block, and ants. I will use the connected ant farms to keep my ants in a secure area so they don t wander off. I will use the phone to play different frequencies. I will use the speaker to project the sound. Finally, I will use the ants as the test subject.</p> <p>First, I will put the ants in the ant farm. Second, I will put the sugar cube to one side of the ant farms so the ants will rotate in a solid motion. Third, I will play an audio frequency too high for me to hear. Fourth,I will watch the ants for one minute and see how many ants stopped rotating to the attractant. Fifth, I will record my data. My control for the project will be no sound.</p> <p>My experimental test variable is the different audio frequencies. I will play 5 different frequencies on the phone. After one minute I will change the sound. I will do this five times.</p> <p>From my investigation, I hope to prove that ants will be repelled away from the noise. Ants communicate through a series of vibrations, and frequencies too high to hear produce more vibrations than low frequencies, therefore it will repel the ants.</p> <p><b>Methods</b> Materials: Ants Double ant farm Speaker Phone Water feeder Tunneling sand Tunnel starter tool Procedures:</p>	
<b>Summary Statement</b> As measured by the time it took to effect all ants completely, I found that ants show neutral signs of being effected in any way by audio frequencies.	
<b>Help Received</b> I bought the ant farms myself and my science teacher assisted me on all my testing and observing.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Richard Hoffmann</b>	<b>Project Number</b> <b>J2205</b>
<b>Project Title</b> <b>Pheromone-Based Ant Navigation</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Ant pheromones are the chemical scents that ants release from glands all over their bodies to communicate with other ants. With the use of pheromones, ants can give directions to a location, signal if there is danger towards the colony, mark their territory, recognize nestmates, or attract mates. The question being answered is how ants use pheromones to navigate trails, if the amount of pheromones affect the frequency of ants crossing a certain trail, and if there is any directional information in the pheromones. My hypothesis was that ants would be more likely to follow the path with more pheromones and that there is some directional information in the pheromones.</p> <p><b>Methods</b> A Y-shaped trail was built with swappable sections on it. 3 different kinds of swappable sections were placed on trail. One with lots of pheromone, one with little pheromones, one with no pheromones. 5 trials where different sections of the trails were swapped around and switched with other kinds of trails. A camera recorded the ants behavior.</p> <p><b>Results</b> On the trail with the strongest amount of pheromones, there were about 9.5 ants crossing the trail each minute. On the trail with the weakest amount of pheromones, there were about 0.3 ants crossing the trail per minute. This shows that the more pheromones there are on a trail, the higher the number of ants crossing the trail. Additionally, there was no significant dependence on the direction of the pheromone trail.</p> <p><b>Conclusions</b> The goal of this experiment was to find out if ants would be more likely to follow a trail with more pheromones and if the direction of a trail affects the ants decisions. The more pheromones on a trail, the higher the frequency was of ants crossing the trail per minute. Moreover, the direction of the pheromone trail did not have a significant influence on the frequency of ants crossing trails per minute. The differences in frequency between the trail directions was small compared to the change in frequency between the strong and weak pheromone trail condition. In the experiment, the independent variable was the amount of pheromones on a trail and the dependent variable was the frequency of ants crossing a trail in a minute. Two new questions arose from the experiment: does terrain affect ant behavior? How does an ant behave when the trail it is on turns while its walking on it? All in all, this experiment demonstrates that ants are more likely to follow a path with more pheromones and there is no directional information in the pheromone trails.</p>	
<b>Summary Statement</b> I discovered that pheromones on trails do not provide ants with any directional information, but ants follow the path with the most pheromones.	
<b>Help Received</b> I came with the idea of my experiment. I also designed and built the system in which the ants traveled across and analyzed the results. I received some advice from my dad, Heiko Hoffmann.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Suraj Jayaraman; David Ouk</b>	<b>Project Number</b> <b>J2206</b>
<b>Project Title</b> <b>Project Planaria</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Our experiment was to determine if the strength of Neodymium magnets would affect the regeneration of Planaria (flatworms with regenerative abilities). If the presence of the magnets accelerates the healing process of body tissue, then it being implemented would benefit all medical procedures. It would be much cheaper to implement magnets to heal wounds (cuts and bruises specifically) than to go through surgery.</p> <p><b>Methods</b> We first measured the original sizes of the 40 Planaria, then we cut them in half and measured them, then we put them into eight petri dishes with one magnet strength group under every two, and after two weeks, we measured it again to find out the growth. Afterward, we compiled all the data into charts and tables, and we calculated the averages of each magnet strength.</p> <p><b>Results</b> The results of the experiment showed that the Planaria that were exposed to no magnets had the most growth, with high strength in second, medium in third, and low in last. The no magnet Planaria had an average growth of 1.29 millimeters, the 60 pound pull force (high strength) Planaria had an average growth of 0.919 mm, the 36 pound pull force (medium) Planaria had an average growth of 0.769 mm, and the 11 pound pull force (low) Planaria had an average growth of 0.576 mm. Our results showed that the Planaria regeneration actually decreases when exposed to the Neodymium magnets.</p> <p><b>Conclusions</b> This data helped us find out that magnetism affecting the body tissue within Planaria decreases the healing rate. We conclude that magnetic healing is not beneficial, as it actually slows the healing process of body tissue, making the idea of magnet usage to heal cuts and bruises impractical.</p>	
<b>Summary Statement</b> We tested whether Neodymium magnets affect the regeneration of bisected Planaria, and learnt that magnets decrease tissue growth.	
<b>Help Received</b> We performed and documented the experiment ourselves and our science teacher reviewed our documents.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Christopher Kwok; Nicholas Kwok</b>	<b>Project Number</b> <b>J2207</b>
<b>Project Title</b> <b>Tannins from Indian Almond Leaves that Alters Pregnancy Behaviors, Gestation Period, and Fertility Structure of Guppies</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> We are studying the tannins from the Indian almond leaves that alters the pregnancy behaviors, gestation period, and fertility structure of <i>Poecilia reticulata</i>; guppies. The purpose of this study is to potentially produce cheaper fish at a faster rate, being applied to large guppy farms/ breeders and the aquarium hobby. In our economy today, we suffer from limiting food sources including large proteins like steak. We are making these food harder to obtain for other species like reptiles. Once stabilizing guppy breeding, it has the potential to become a primary, nutritious protein source for many animals. We hypothesize that the tannins from the Indian almond leaves will overall be beneficial to the guppies reproduction, as it contains a richness of chemicals and tannins, as well as antioxidants and antibacterial properties.</p> <p><b>Methods</b> Through research we specifically chose ten properties to collect data during our experiments such as: Gestation, Pregnant Belly Size, Swimming Patterns, Eating Frequency, Pregnancy Rate, Number of Fry, Time for the Fry to Mature, Fry Size, Fry Coloration, &amp; Time for Females to Recover from Delivery. For our experiment, we first set up 3 identical 29 gallon tubs with identical filtration, heaters, etc. Then we added 10 grams of Indian almond leaves in 2 of the 3 habitats. After we released 5 female and 3 male fancy yellow guppies into each habitat. Lastly, we began to collect data as breeding stimulated. We did two trials in total, each trial was 6 weeks along with maintenance throughout accomplishing 6 experiments.</p> <p><b>Results</b> In result, the Indian almond leaves were beneficial to the guppies reproduction. The leaves shortened the gestation period by about a week and doubled the pregnancy rate. The number of fry also dramatically increased as the average fry per litter doubled. Lastly, the time that the females took to recover from delivery shortened significantly about half the time. Our data also indicated that the leaves didn't affect the fry's health.</p> <p><b>Conclusions</b> Our data supported our hypothesis and we can apply our discoveries to guppy farms/breeders, producing fish at a faster rate using these biodegradable, organic leaves. In the future, we would like to test these leaves on market fish, like tilapia, salmon, and bass. If we are able to increase the reproduction of these fish, it can revolutionize our economy, as well as benefiting our environment.</p>	
<b>Summary Statement</b> We were able to successfully increase the reproduction of guppies dramatically by introducing organic and biodegradable Indian almond leaves, releasing tannins, that alters the pregnancy behaviors, gestation period, and fertility structure.	
<b>Help Received</b> We didn't receive any assistance for this project and the experiments. However, we wouldn't have completed the project financially without the help of our parents.	



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<b>Name(s)</b> <b>Julia Melgoza</b>	<b>Project Number</b> <b>J2208</b>
<b>Project Title</b> <b>Water Temperature and Mosquito Pupae</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective of this study is to determine how fast mosquito pupae will emerge as adult mosquitoes in different water temperatures.</p> <p><b>Methods</b> Three mosquito breeding jars were filled with tap water. Ten mosquito pupae were placed in each mosquito breeding jar and were kept at different water temperatures for 7 days. The container with warm water was kept at 27 degrees Celsius with a heating pad. The container with room temperature water was kept at 20 degrees Celsius on the kitchen counter. The last container with cold water was kept at 10 degrees Celsius in the refrigerator. The jars were checked daily or hourly for the emergence of adult mosquitoes.</p> <p><b>Results</b> All ten adult mosquitoes emerged out of the warm water in 2 days. All ten mosquitoes emerged out of the room temperature water in 5 days. No adult mosquitoes emerged out of the cold water after 7 days.</p> <p><b>Conclusions</b> Mosquito pupae were kept in warm, room temperature, and cold water for 7 days. It only took 2 days for adult mosquitoes to emerge in warm water. It is concluded that mosquito pupae emerge into the adult stage faster with increased water temperature.</p>	
<b>Summary Statement</b> I placed mosquito pupae in three different water temperatures and showed that the pupae in warm water emerged faster into the adult stage.	
<b>Help Received</b> I got help in understanding the mosquito life cycle from Dr. Steven Su and Alfonso Melgoza from the West Valley Mosquito and Vector Control District. They let me use mosquito breeding jars and mosquito pupae for the experiment done at home.	





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<b>Name(s)</b> <b>Christian Mueller</b>	<b>Project Number</b> <b>J2209</b>
<b>Project Title</b> <b>Effects of Dietary Supplements on Brown Planaria</b>	
<b>Abstract</b> <b>Objectives</b> Measuring the regeneration rate of planaria after being introduced to several different dietary supplements. <b>Methods</b> One hundred and five brown planaria, seven petri dishes, two milliliters or milligrams of zinc, protein, sugar, vitamin E, vitamin A, and vitamin D3, and a metric tape measure. Tested the difference in planaria's regeneration rate when introduced with different dietary supplements. <b>Results</b> After being introduced with different dietary supplements, every planarian shrunk in size, all except the control group. Some vitamins did more or less harm than others. <b>Conclusions</b> As shown from my results, all of the supplements decreased the planarians' length, which was not what I expected in my hypothesis. In conclusion, the dietary supplements that I tested harm planaria and their regeneration rate.	
<b>Summary Statement</b> I tested to see whether dietary supplements boost planaria's regeneration rate or not and by how much.	
<b>Help Received</b> I received some advice from my science teacher, who also ordered the planaria.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
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<b>Name(s)</b> <b>Zaighum Nagra</b>	<b>Project Number</b> <b>J2210</b>
<b>Project Title</b> <b>The Effect of Corn Silk Extract on Neuronal Regeneration</b>	
<b>Abstract</b> <b>Objectives</b> This study examines effective dosage of corn silk ( <i>Zea mays</i> Linnaeus) aqueous extract on neuronal regeneration. <b>Methods</b> Using planaria ( <i>Girardia tigrina</i> ) as a model for neuronal regeneration, 250 mg/mL corn silk aqueous extract (CS) is tested for its effect on neuronal regeneration. Same concentration of <i>Astragalus membranaceus</i> extract is used as positive; and water as normal controls. Three doses of 1, 2 and 3 mL CS extract are tested in triplicate in three separate trials. <b>Results</b> Dissected planaria heads in 2 mL CS grew 4.9% faster than 1 mL extract and water. The locomotive velocity of 2 mL CS was also significantly (15.3%) higher than 1 mL, using paired t test at $P=0.01$ . The differences between 2 and 3 mL were not significant. <b>Conclusions</b> Faster growth rate and higher locomotive velocity of regenerating 2 mL planaria, combined with microscopic evidence of faster progressing development of neoblasts show that 2 mL dose is most effective for neuronal regeneration. The hypothesis proved to be supported by the results. CS contains proteins, vitamins, minerals, flavonoids, terpenoids and other antioxidants. The bio-active constituents confer neuroprotection and promote memory, learning, cognition and regeneration by inhibiting neuronal apoptosis.	
<b>Summary Statement</b> Effective dose of CS determined in this study may be used for neuroprotection and neuroregeneration in neurodegenerative diseases such as Alzheimer's and Parkinson's	
<b>Help Received</b> Initiated, discussed and completed the project at the UCLA-CURE Digestive Diseases Research Center laboratory under the supervision of Lixin Wang, MD, PhD	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Neelan Patel; David Samy</b>	<b>Project Number</b> <b>J2211</b>
<b>Project Title</b> <b>Effects of Infrared and Visible Light Wavelengths on Planaria Regeneration</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> Planaria can regenerate into 270 different separate organisms. Our goal is to further understand this type of regeneration and in the future possibly apply this to humans. We will test whether different wavelengths of light affect the regeneration of planaria. We became interested in Planaria in school when we were studying invertebrates and learned about the phylum, Platyhelminthes. The regenerative qualities interested us. We wondered if the regeneration rate could affect the mortality rate as well. We decided to test the effects of infrared light, red light, green light, blue light and white light on Planaria regeneration rates.</p> <p><b>Methods</b> We tested a total of 240 Planaria in two tests. Each test included 120 Planaria in twelve Petri dishes; each dish containing 10 planaria. We exposed each experimental group to a certain wavelength of light. We used red, green, blue, infrared and white light. For the control we used dark conditions. We cut the Planaria using a scalpel and recorded the rate of regeneration over a period of two weeks, and then we repeated the entire test. We used a dissecting scope to document regeneration of the eye spots.</p> <p><b>Materials</b> Brown Planaria from KLM Scientific, Artec LED (Blue light 470nm, Green light 510nm, Red light 725nm, White LED, UltraFire A100-IR Infrared 850nm, Petri dishes, Microscope, Thermometer, Hydrometer</p> <p><b>Results</b> The Planaria under infrared light had the fastest rate of regeneration, and on average fully regenerated their eye spots in 8.7 days. The second fastest rate of regeneration was with white light, taking on average 9.2 days to regenerate. Close behind, was the control condition with an average speed of 9.4 days. The green light and the blue light both had a speed of 9.8 days. Lastly, we have red light, with a speed of 10.2 days to regenerate, making it the slowest.</p> <p><b>Conclusions</b> Our hypothesis that the Infrared light would have a beneficial effect on Planarian regeneration, was supported by the findings that Planarian exposed to infrared light had by far the fastest rate of regeneration amongst the wavelengths of light that we tested. We were surprised to find that white light had not been as detrimental as we had thought, since our hypothesis stated that it would have resulted in the slowest rate of regeneration. Our prediction that the effect of red, green, and blue light would be similar was supported by the results, although green and blue were a little faster than red, the differences were within the margins of error.</p>	
<b>Summary Statement</b> We tested the effects of near infrared, red, green, blue and white light on Planaria regeneration rate.	
<b>Help Received</b> We designed and performed the experiments, and also did the analysis ourselves.	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Sarah Stutsman</b>	<b>Project Number</b>  <b>J2212</b>
<b>Project Title</b>  <b>Color: An Attractant to Egg-laying Aedes Mosquitoes or Not?</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> To determine whether mosquitoes prefer to lay their eggs in a specific colored oviposition trap.</p> <p><b>Methods</b> Method: Set up and fill traps 2/3 of the way with water. Every day record your observations. After 4 days, take out paper towels from traps and count the number of Aedes mosquito eggs collected. Repeat eight times, rotating the traps positions each time. Materials: 2 graduated cylinders (250ml and 10ml); red, orange, yellow, green, blue, purple, black, and white cups; notebook; paper towels; magnifying glass</p> <p><b>Results</b> After performing eight trials (one trial took four days), I found that the white oviposition trap collected a statistically significant average number of Aedes mosquito eggs when compared to the control (the black oviposition trap). The differences between the average number of Aedes mosquito eggs collected by the other traps were not major. To determine if mosquitoes actually prefer white, more data would need to be collected. After each of the trials, I rotated the oviposition traps positions to eliminate the position variable. A graph was made of the number of Aedes mosquito eggs laid in each of the different positions on average. However, there was no major difference between this data.</p> <p><b>Conclusions</b> It can be concluded from this experiment s data that, unlike stated in my hypothesis, Aedes mosquitoes, when laying their eggs, prefer the color white as the white oviposition trap collected a statistically significant number of eggs when compared to the control (the black oviposition trap). Each trial, the oviposition traps rotated spots to eliminate the variable of mosquitoes preferring a specific location. However, after examining the data further, it could be concluded that mosquitoes don t prefer a specific spot when laying their eggs as there was no major difference between the average number of eggs collected in each spot. This experiment of mosquito vision could be continued with a malaria net, seeing if mosquitoes could see a hole in it, or if they would have to rely on randomly checking the net. It could also be continued by testing to see whether mosquitoes prefer a certain shade of white, or by testing whether they are attracted to an oviposition trap with a certain color paper towel. The results from this experiment could improve the world by allowing scientists to more mosquitoes track and the diseases they carry easier, preventing their spread.</p>	
<b>Summary Statement</b>  After collecting and counting eggs that Aedes mosquitoes laid in eight different colored oviposition traps, it was found that the number of eggs collected in the white oviposition trap was statistically significant; leading to the conclusio	
<b>Help Received</b>  Ms. Julie Tsecauras from the UCR entomology department gave me suggestions, ideas, and helped answer any questions I had; Mr. Andrew Garcia from the UCR entomology department clarified what Aedes mosquito eggs look like	



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b> <b>Malo Vanier</b>	<b>Project Number</b> <b>J2213</b>
<b>Project Title</b> <b>Natural Ant Repellents</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> The objective and goal of this study was conducted to find out the most effective natural repellent around the house. I wanted to know the best way of finding a repellent for ants without harming the environment.</p> <p><b>Methods</b> I conducted the experiment in about 2 weeks. I did 5 trials for each repellent, 6 in total, including the control. I worked on observations and recorded the behaviour of Argentine ants searching for food. Then, I added natural repellents to determine which of the natural barrier worked better than others to repel or delay the ants from finding a food. I got my own ant farm (called Small Ant Tower) on a website called AntsCanada. I caught ants in my backyard and then set them up with water, food and other necessities. I then used the tube to make a experimental box where I would put the ring barrier of natural repellents and the cheese inside (used for the bait).</p> <p><b>Results</b> My experience has shown the ant colony responded differently to each natural repellent. The Peppermint repelled the ants the most in both ways, keeping them away from the ring of natural repellents (distance) and delaying them in finding the food (time). The least efficient repellents were the Lemon and Cayenne Pepper. They did work better than the control but did not dissuade well the ants.</p> <p><b>Conclusions</b> This data that I have obtained will spread the knowledge on ants and the natural repellents. This data shows that Peppermint has the best repellent barrier so this will inform us on how to keep ants away with the best non harmful repellent. This will also help people use other methods to repel ants than harmful environmental ways.</p>	
<b>Summary Statement</b> I have found and proven that the best natural repellent for keeping ants away is peppermint.	
<b>Help Received</b> An Apeel Scientist helped me investigate and learn more about this project with giving me ways on what ants to choose, what ant farm, etc. My mom and my science teacher helped me persevere through this project, helping me choose what project topic I wanted to do and how I would create it.	