



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Caroline Ba Doe Lwin; Annette Lopez	Project Number S2201
Project Title Effects of Wavelengths on Brine Shrimp Behavior and Adaptations	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Our objective was to observe and record the behavior of brine shrimp after exposing them to various wavelengths over different intervals of time.</p> <p>Methods/Materials We used six different light sources: red light, yellow light, green light, blue light, black light, and sunlight. First, we hatched the brine shrimp and tested the lights on their adolescent stage. We focused a certain light on them for five minutes, observed, five minutes, and repeated until we got to five trials. We repeated this process for the other lights as well, using different brine shrimp. In each exposed cup, there were two brine shrimp. We looked for changes in their color, speed, and swimming direction.</p> <p>Results After testing each of the different lights, we observed that in yellow light, green light, blue light, and black light, the brine shrimp ended up moving faster than the control. The control was no light, and the brine shrimp in the control barely moved. Moreover, the brine shrimp exposed to red light and sunlight ended up moving slower in the last trial than the first. We found that brine shrimp was more active and excited in warmer, lighter water, than darker, cooler water. The brine shrimp adapted to their environment by changing into the color of the light exposed to them. They went from white and translucent to darker to match their environment.</p> <p>Conclusions/Discussion Waves do not transfer matter, but they transfer energy, which is key to understanding that wave interaction does not compromise the matter it comes into contact with, which ultimately allows us to freely observe the matter at hand. The energy transferred from the luminous sources we used came in the form of heat and light which permitted us to explore the effects of that energy on the brine shrimp. The use of refraction and diffraction ultimately affected the behavior of the shrimp when the time it takes for the lights to reach the organisms affects the time they have to adapt and how they will adapt to the intensity of the light as it passes through the various barriers.</p>	
Summary Statement Brine shrimp under the visible spectrum and under UV and infrared rays have displayed natural adaptations as observed through their behavior changes.	
Help Received Chemistry and Biology teachers provided us with lamps and light bulbs; Friend provided us with microscope.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Edith Chavez	Project Number S2202
Project Title Planarians: Handedness after Regeneration	
Abstract Objectives/Goals I want to know if a planarian that regenerated from the piece of another will have the same handedness as that original. Methods/Materials 20 planarians were flipped onto their back using a clean plastic spoon and then observed to see whether they rolled to the left or right to get back onto their underbelly. After each was tested at least 10 times and the results were recorded they were assigned "right-handed" or "left-handed" based off what happened at least 70% of the time. Any less and they were "ambidextrous" instead. After being labeled, each got a number assigned that was written on the lid of their petri dish. After all were tested, they were cut in half using a surgical knife and a microscope slide on ice to put the worm on, and the two halves were placed into separate petri dishes with the worm#s designated number, handedness, and the letter "h" or "t" for if the piece was a head or tail written on the lid, each with 30 ml of water, 1/3rd changed daily using a syringe starting 2 days after being cut. In some cases the mouths fell out as well but being much smaller, were easy to identify. They also weren#t identified as separate pieces until later. Besides having their water changed, they were fed a pea-sized piece of hard-boiled egg yolk once a week. After two weeks-time given for complete regeneration, each new worm was tested 10 times and the results for each individual recorded. #20 brown planarians #surgical knife #spring water #microscope slide #40 petri dishes #hard-boiled egg yolk #permanent marker #ice #plastic spoon Results Of the 20 planarians, 60% were lefties, 20% were ambidextrous, and 20% were righties. Of the ones that regenerated from a piece (64 total), approximately 90% had the same handedness as the original, half of the remaining 10% had been mouths that became unresponsive after a few trials and all the pieces had come from a planarian whose handedness represented 70% of what occurred during the testing. Conclusions/Discussion From the data, it is seen that should the planarian have come from the piece from another, then it will have the same handedness as the one it came from even if it didn#t regenerate from the part with head. This indicates that the attribute is most likely genetic though I don#t have equipment to find out if it is for sure.	
Summary Statement My project is about finding out if handedness is something a planarian retains after asexual reproduction (regeneration).	
Help Received Parents helped with photos, acquiring materials, and cooking eggs.	



**CALIFORNIA STATE SCIENCE FAIR
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Name(s) Rachel E. Choi	Project Number S2203
Project Title Effect of Maternal Wounding on Embryonic Development in <i>Drosophila melanogaster</i>	
Objectives/Goals The objective of this project was to determine whether female fruit flies that are injected with <i>Listeria monocytogenes</i> bacteria produce more successful embryos. This could be part of the immune reaction of the fly to either the <i>L. monocytogenes</i> infection, which establishes a lethal infection for the fly, or the wound required to introduce the bacteria.	
Abstract Methods/Materials For the experiment, wild-type female fruit flies were divided into three groups: flies injected with <i>L. monocytogenes</i> , flies injected with phosphate buffer saline (PBS), a sham saline solution used to test for wounding effects, and uninjected/unwounded flies. These flies were allowed to mate with male flies and lay eggs for 24 hours, at which point eggs were collected. Eggs were then counted the next day to determine the hatching rates for the various groups, to measure how successful the embryonic development was in each group.	
Results On all days of the experiment, there was a significantly higher hatching rate for either the <i>L. monocytogenes</i> group or the PBS group, compared to the uninjected/unwounded group.	
Conclusions/Discussion While there was no significant difference between the hatching rates of the PBS and the <i>Listeria</i> groups, both groups had significantly higher hatching rates compared to the uninjected group. The results show that female fruit flies produce embryos with higher hatching rates in reaction to the wounds required to inject the flies with either the PBS or the bacteria. This may be a way that the female fruit flies react to the wound stress in order to ensure that more of their offspring survive. The results also indicate the possibility of a signaling pathway between the wound and the reproductive system.	
Summary Statement When female fruit flies are wounded, they produce embryos with higher hatching rates, possibly to ensure that more of their offspring survive.	
Help Received Performed research at Stanford Medical Center under the supervision of Dr. David Schneider and Alexander Louie; Alejandra Guzman helped with fly husbandry and egg counting; Brenda Torres helped grow bacterial cultures	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Hunter Cleveland; Joshua Oakes	Project Number S2204
Project Title Feast or Famine: An Observational Study on the Effects of Varying Food Levels on a Drosophila hydei Colony's Success	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective was to determine which food level would result in the most successful <i>Drosophila hydei</i> colony. It was hypothesized that the colony which receives the largest amount of food (Colony A) will produce the most offspring, therefore becoming the most successful.</p> <p>Methods/Materials Five <i>Drosophila hydei</i> colonies were made and observed during each trial. Each colony received a different amount of food. Colony A received 50 mL, B received 40mL, C received 30 mL, D received 20 mL, and E received 10mL. An eighteen day period was allotted for each trial and the colonies were observed for the duration. Success was then measured upon the number of offspring produced in each colony.</p> <p>Results Colony E was the most successful of the five colonies observed. Colony E produced or tied for the most offspring in each of the two trials.</p> <p>Conclusions/Discussion The data did not support the hypothesis. However colony A did produce offspring the fastest in each of the two trials. Colony A was always ahead of all the other colonies in terms of the life cycle of the <i>Drosophila hydei</i>. From these results one may form the theory that more food yields faster reproduction rate, but not necessarily more offspring. One may also form the theory that less food yields a slower reproduction rate but a larger amount of offspring.</p>	
Summary Statement To determine which food level results in the most successful <i>Drosophila hydei</i> colony.	
Help Received Mother advised display board layout	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Christopher Fu; Daniel Pak	Project Number S2205
Project Title Investigating the Relationship between Body Wall Ossicle Composition and Species in Holothuroidea	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals As echinoderms, sea cucumbers share many characteristics with other species in their phylum, including the presence of ossicles. The objective of this experiment was to distinguish between two different sea cucumber species found on the coast of Cabo Blanco using their body wall ossicle composition. They were initially distinguished by their habitats and skin colors, red or white. Our null hypotheses were that there is no association between sea cucumber species and types of ossicles present, and that the mean rod length for red sea cucumbers is equal to that of white ones.</p> <p>Methods/Materials Tissue samples of approximately 1 sq. cm. in area were taken from each of 39 sea cucumbers and placed in vials of bleach to dissolve the soft body tissue, leaving behind only the ossicles. The vials were allowed to settle for a day, and each tissue sample was observed under a light microscope. The types of ossicles and the lengths of rod ossicles present in each sample were then recorded.</p> <p>Results A contingency table was used to record the observed occurrences of each type of ossicle in the two species of sea cucumbers. An expected ossicle distribution was calculated assuming that there is no correlation between ossicle type and species. A G test was performed to compare the observed and expected ossicle distributions, and a Student's t test was performed to compare the distributions of rod lengths in each sea cucumber. Both null hypotheses were rejected.</p> <p>Conclusions/Discussion From the results of the G test, we concluded that there exists a statistically significant association between ossicle type and species. Furthermore, from the results of the Student's t test, we concluded that the rod length distributions in each species of sea cucumber were significantly different. Consultation with A Field Guide to Sea Stars and Other Echinoderms of Galapagos allowed us to identify the species of the sea cucumbers as <i>Holothuria kefersteini</i> and <i>Holothuria arenicola</i>.</p>	
Summary Statement Two sea cucumber species were identified as <i>Holothuria kefersteini</i> and <i>Holothuria arenicola</i> based on body wall ossicles, and there is a relationship between ossicle distribution and species as well as rod length distribution and species.	
Help Received School sponsored trip to Costa Rica; Used University of Georgia lab under supervision of Dr. Diana Lieberman.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Jaclyn Juarez	Project Number S2206
Project Title Skin Regeneration: Aloe Vera vs. Neosporin (Using Planaria)	
Abstract Objectives/Goals For a long time natural substances have been used to cure different types of injuries. With the evolution of medicine, injuries are now being cured with chemically produced substances. The question is, however which substance works faster to cure a minor cut on the skin, aloe vera or Neosporin/Antibacterial ointment? This experiment is designed to answer that very question. Methods/Materials I used planaria as a substitute for skin in order to evaluate skin regeneration according to two different methods. The first method I used to enhance the rate of skin regeneration was a natural substance known to help cure cuts, aloe vera. The second method I used was a chemically produced substance, neosporin. I applied both methods on separate planaria that I cut in half to compare the growth of each planaria. Whichever group of planaria with the specified method grew the most meant that the particular method helped skin regenerate better. All test trials were completed from December 6-December 10 in OHMMHS Biology Laboratory Room Results The results of the experiment showed that the group of planaria that I applied Aloe Vera to grew the most. Before application, December 6th, the planaria averaged at a length of 8.3mm. After application, December 10th, I remeasured the planaria and the length had changed to an average of 13 mm. This average was significantly higher than the control group and the group that I applied Neosporin to. Conclusions/Discussion The planaria that had an application of Aloe Vera had regenerated a new body and new head; the Aloe Vera helped planaria regenerate the most over a period of 5 days. With these results, it is adequate to conclude that Aloe Vera, a natural substance, helps planaria regenerate faster from a minor cut than a chemically produced substance. If Aloe Vera regenerates planaria faster, there is reason to believe that it can also regenerate minor skin cuts better than Neosporin, a chemically produced substance.	
Summary Statement To determine whether a natural or chemically produced substance regenerates planaria the quickest in order to translate the results into human skin regeneration.	
Help Received Physiology teacher helped gather materials; English teacher revised Lab report	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Anastasia N. Kuzovkina	Project Number S2207
Project Title Do Cell Phones Affect Living Organisms? An Experiment Using Planaria	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My goal was to figure out if cell phones can affect living organisms. For my experiment I used planarian and observed their activity and speed.</p> <p>Methods/Materials Materials: 1 metal board with wells, 1 ruler with a centimetric scale, 1 stopwatch, 1 dropping pipette, 1 small plastic cup, spring water, 1 cell phone with 1 charger. Procedure: For group 1: 1. Fill a well on the metal board and the small plastic cup with spring water. 2. Using the dropping pipette, take a planarian from the big plastic cup (where they constantly live) and place it into the well. 3. Wait until the planarian starts moving in a straight direction. 4. Measure the distance that the planarian has travelled in a straight direction with the ruler, measure the time that it took the planarian to do this with a stopwatch. Record the data. 5. Using the dropping pipette, take the planarian out of the well and move it into the small plastic cup. 6. Repeat steps 2-5 with all the planarians. 7. Using the dropping pipette, put all the planarians back to the big plastic cup where they constantly live. For group 2: 1. Place the big plastic cup with the planarians next to a charging cell phone for 2 hours 15 minutes (the amount of water in the cup is approximately 45 ml). 2. Do steps 2-7 from the procedure for group 1. For group 3: 1. Place the big plastic cup with the planarians next to a charging cell phone for 2 hours 15 minutes (the amount of water in the cup is approximately 45 ml), make 10 calls with the length of 1 minute during this time. 2. Do steps 2-7 from the procedure for group 1.</p> <p>Results Planarians that spent 2 hours 15 minutes next to a charging cell phone were slightly more active and faster than the control group. Planarians that spent 2 hours 15 minutes next to a charging cell phone that produced 10 calls during this time (1 minute each) were significantly more active and faster.</p> <p>Conclusions/Discussion Cell phones can affect living organisms.</p>	
Summary Statement My project is about figuring out if cell phones can affect living organisms using planaria - considering their activity and speed.	
Help Received My project's advisor is the only person I received help from.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Lauren J. Lee	Project Number S2208
Project Title The Effects of Pressure on the Spawning and Hatching Processes of Haliotis rufescens	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Haliotis sorenseni, or white abalone, are the first marine invertebrates to be listed as endangered due to overharvesting and reproductive failure. Many breeding techniques have been studied, but have thus far been proven unsuccessful. The objective of this study was to observe changes in the spawning and hatching processes of Haliotis rufescens, commonly known as red abalone. The main purpose of experimentation was to determine if pressure could help induce spawning and hatching of abalone species. If proven successful, because of similarities in their anatomies and reproductive behaviors, the same breeding technique could potentially be used on the white abalone.</p> <p>Methods/Materials Six adult red abalone specimens were divided into three groups of two. Each group was treated with pressure, desiccation, and no prior treatments to induce spawning. Upon spawning, the gametes of the same adult subjects were gathered and fertilized. Pressure was obtained through a pressure chamber in which the adults and fertilized eggs would be placed. Results were recorded the week after fertilization. Larvae were photographed and counted. Additionally, experimental adult test subjects were observed a week later to ensure health and eating habits.</p> <p>Results The results show that the pressure treated adult abalone had a greater spawning success rate in comparison to desiccation and no prior treatment groups. After performing a chi-square analysis for the larvae, however, the results show the larvae treated with pressure hatched at a delayed rate in comparison to the control group.</p> <p>Conclusions/Discussion The study shows pressure treatment can be used as a potential captive breeding technique that would optimize spawning success rates and ultimately could help to restore declining populations of threatened deep-water species including the endangered white abalone.</p>	
Summary Statement My study is to discover a new induction treatment, pressure, to promote spawning and hatching of abalone species and apply the same techniques to restore an endangered species.	
Help Received Project overlooked by Dr. Kiersten Darrow and staff members at Cabrillo Marine Aquarium; mentored by Marissa Velarde; Parents helped with transportation to research facility; Mr. Peter Starodub was the research mentor and teacher	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Saige J. Manier	Project Number S2209
Project Title Jumping Galls: A Novel Mechanism for Motility	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This research aims to discover how and why the Neuroterus saltatorius wasp larvae cause galls jump and how this mechanism of motility can be applied to other areas of science, including the design of a Mars rover.</p> <p>Methods/Materials To discover why the galls jump, the temperature range for jumping was found by measuring jumping rates from 0-45°C using an ice and hot water bath. Gall jumping rates in varying levels of relative humidity were recorded using CaCl₂(s) and various saturated salt solutions to create known relative humidities. Time lapse photographs were taken of the galls to approximate the distance jumped/month. The fuel efficiency of the galls was calculated through completing two lipid extraction procedures, before and after the galls completed their jumping cycle. The proposed mechanism of motility for the galls, momentum transfer, was modeled using mousetraps set off with varying amounts of weight attached.</p> <p>Results Between 20 and 40°C is the temperature range at which galls jump. As relative humidity decreases from 90 to 0%, the jumping rate increases by 780%. While jumping, galls lose 21% of their weight as water. The galls jump 0.57-1.2 cm/min, or 0.13 mi/month. Through lipid extraction, it was found that trial 1 galls 0.06 mg fat/gall, and each 2nd trial gall contained 0.0821 mg fat. Each jump requires 3.1×10^{-8} J. Each gall jumps ~90,000 times before hatching. Each gall must contain 7.3×10^{-8} g fat in order to sustain this jumping rate. Compared to the measurement that a gall contains 6×10^{-5} g fat, a gall has 760x the amount of fat needed to jump for one month. Each gall would get 8 million mpg of gasoline! The mouse trap jumped farthest at two weights.</p> <p>Conclusions/Discussion Galls jump to escape heat and becoming dried out. The larvae are sensitive to changes in humidity. Galls jump to reach cooler areas of higher humidity where survival is more likely. Galls lose water without completely drying out to maintain a consistent internal humidity in an arid environment. The galls use so little fat to jump that there is no noticeable fat loss, leading to an extremely fuel efficient mechanism of motility. The galls contain more than enough fat to jump, allowing for variation in jumping rate and environment. The mousetraps support the concept that momentum transfer can be used as transportation. This leads to the consideration of using momentum transfer to power a Mars rover.</p>	
Summary Statement This project is about how and why the Neuroterus saltatorius galls jump and how their mechanism of motility can be applied to the design of a Mars rover.	
Help Received Dr. David Deamer mentored-allowed me to work in his lab, provided feedback, and provided some materials. Yann Nichols and Larkin Wilson assisted in creating poster. Two fellow students assisted in counting jumps in one of the experiments.	



**CALIFORNIA STATE SCIENCE FAIR
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Name(s) Robin Park	Project Number S2210
Project Title Discrimination in Ants: Effects of Varying Territorial Distribution on Cohabitation of <i>L. humile</i> and <i>P. imparis</i>	
Abstract Objectives/Goals In this research, the effect of varying territorial distribution on the cohabitation of the two species in conflict was tested. Methods/Materials Because the ants previously displayed high levels of aggression when equal numbers of both species were placed into a single habitat, unequal numbers of ants were injected into the environments (based on a pilot study): 20 <i>L. humile</i> and 4 <i>P. imparis</i> . Two separate environments were created using clear plastic jars (diameter: 6 in) topped with a layer of punctured aluminum foil. Territory was distributed using food (2 g of diced pear). In group 1, the food was spread out over the entire bottom of the container. <i>L. humile</i> was placed into the environment first. In group 2, the food was placed into a separate, open plastic container in the habitat (diameter: 1.5 in), and <i>P. imparis</i> was placed outside the container. The frequency of visits and average duration of stay (in the <i>L. humile</i> territory) per <i>P. imparis</i> ant were recorded over four hours and statistically analyzed between groups. Results In group 1, the outnumbered <i>P. imparis</i> traveled up to the ceiling, coming down quickly to eat and ascending again. In group 2, any <i>L. humile</i> ant venturing into the <i>P. imparis</i> territory was targeted. In each group, the frequency of visits and average duration of stay significantly increased over time ($p < 0.05$). While group 1 showed more increase in visits than group 2 ($p < 0.01$), the overall duration of stay between the groups was not significantly different ($p > 0.05$). Conclusions/Discussion The more frequent visits in group 1 can partially be attributed to the larger territory possessed by <i>L. humile</i> ; there is a higher chance that the <i>L. humile</i> chemical cues were spread over a larger area, due to the territorial distribution. Thus, there was probably a higher chance for CHC exchange, eliminating cues for discrimination. Despite the difference in rates of frequencies, statistical analysis demonstrated that the overall duration of stays of <i>P. imparis</i> were not significantly different. This could be attributed to the natural biorhythms of the ants. Results support that when a larger group of <i>L. humile</i> and a smaller group of <i>P. imparis</i> are cohabitating, the likelihood of peaceful cohabitation increases when the <i>L. humile</i> territory is larger.	
Summary Statement This study was conducted to find the optimal cohabitation settings for species in conflict: the non-native <i>L. humile</i> (Argentine) ants and the native <i>P. imparis</i> (winter honey) ants.	
Help Received Dad helped with statistical analysis, mom helped collect ants and take photos.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Angela N. Pogson	Project Number S2211
Project Title The Relationship between Anemone Color and the Abundance and Diversity of Their Endosymbionts	
Abstract Objectives/Goals Anemones and other cnidarians contain microscopic photosynthetic endosymbionts called zooxanthellae, with which they have a symbiotic relationship. Anemones are also incredibly variable in their coloration patterns. I investigated if there was a relationship between the color of anemones (<i>Anthopleura xanthogrammica</i> and <i>A. sola</i>) and the abundance and diversity of their endosymbionts (<i>Symbiodinium muscatinei</i>). Prior to my study, marine biologists assumed that the coloration of anemones was not related to endosymbionts but by the production of their own pigments and green fluorescent proteins. Methods/Materials I sampled tentacles from 42 anemones at Davenport Landing, CA and recorded their size and coloration. I extracted total DNA and constructed PCR primers that amplified regions of the mitochondrial cytochrome b (cytb) gene from both endosymbionts and anemones. PCR products were sequenced, edited using the APE program, and aligned using CLUSTAL. I also used the MEGA5 program to build phylogenetic trees. I also estimated the ratio of anemone to symbiont DNA using quantitative PCR. I tested if the relative abundance of endosymbionts to host differed between five anemone color groups (ranging from pale to dark green) using SYSTAT. Results I found no genetic differences between the <i>S. muscatinei</i> cytb sequences (N = 15), or between the <i>A. xanthogrammica</i> (N = 5) or <i>A. sola</i> (N = 17) sequences. The two anemone species were very similar, differing by only a single mutation at the cytb gene. I was able to quantify the relative concentrations of endosymbiont to host DNA using quantitative PCR in 26 animals. I observed significant differences in the relative concentrations of endosymbionts between five anemone color groups ($F(4, 21) = 5.103, P = 0.005$). This was a result of cream-colored anemones having 23% less endosymbionts than the darkest green/gray anemones. Conclusions/Discussion I found a surprising lack of genetic diversity in both endosymbionts and anemones. This suggests that there is no cryptic diversity within endosymbionts as found, for example, in tropical corals. However, I did find that the abundance of endosymbionts differed between anemones from different color groups. This suggests that the abundance of the endosymbionts is related to color but indirectly through different levels of sun exposure and the production of the anemone's own pigments.	
Summary Statement I investigated if the diversity and abundance of an anemone's endosymbionts was related to the color of the host.	
Help Received I used the Camps lab at UCSC under the supervision of Dave Alexander and the Pogson lab at UCSC under the supervision of Grant Pogson	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Cynthia Rodriguez	Project Number S2212
Project Title Get Squirmy	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective was to test a mealworm's respiration rate in various temperatures and see at which temperatures their respiration rate is the highest. I used the temperature with the highest respiration rate to see if it affects the rate at which the mealworms mature and I compared to mealworms at room temperature.</p> <p>Methods/Materials I used beakers, 3 large beakers, ice, the ISOTEMP 205 water bath, 100 mealworms, a ring stand, thermometers, Vernier LabQuest2, Vernier CO2 gas sensor. For the first part of my experiment, I tested mealworms in a Nalgene bottle. I plugged a CO2 gas sensor to my LabQuest2 and then attached my CO2 sensor to the Nalgene bottle that held the mealworms. Then I submerged the Nalgene bottle with the worms in ice or in a warm bath, depending on the trial. I read and recorded the data.</p> <p>Results At 115F, the mealworm's respiration rate was higher than at 35F. The mealworm's growth rate is faster at 120F temperature than at room temperature.</p> <p>Conclusions/Discussion My project can benefit people around the world. I have proven that keeping mealworms at hotter temperatures will increase their growth rate therefore providing food at a faster pace for the people that depend on these worms to survive.</p>	
Summary Statement Testing what temperatures will increase a mealworm's respiration the most then use that temperature to see if their growth rate is faster than at room temperature	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
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Name(s) Grace S. Gilman	Project Number S2299
Project Title Does Ultrasonic Sound Increase the Activity Level of Insects?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To determine whether or not insects, specifically crickets, red harvester ants, and ladybugs, activity levels will be increased by ultrasonic sound.</p> <p>Methods/Materials I took three different insects with different methods of hearing and placed them in separate habitats. I allowed them to settle into the habitats for a week after which I observed their normal behavior from 11:00am to 12:00pm for a single day. I then turned on an ultrasonic pest repeller that emits ultrasonic sound from 11:00am to 12:00pm after which I turned it off until the next day for three consecutive days to see if the ultrasonic sound would increase the activity levels of the insects. After that I repeated the entire procedure with new insects of the same species but purchased from different stores.</p> <p>Results My data shows that the activity levels of all three insects were increased when I had the ultrasonic pest repeller on. It also showed that the crickets activity level was increased the most by 467% average over when there was no ultrasonic sound. The ants had the second most increased activity levels with 167% more then with no ultrasonic sound. The ladybugs were least affected by the ultrasonic sound with 89% increase over when there was no ultrasonic sound.</p> <p>Conclusions/Discussion Based on my results I can conclude that ultrasonic pest control does increase the normal activity of crickets, red carpenter ants, and ladybugs. I can also conclude that the crickets activity level was increased the most, the red carpenter ants activity level increased less then the crickets but more then the ladybugs, and the ladybugs activity level was increased the least of the three species of insects. This was due to the varying sensitivity of the hearing structures of the insects.</p>	
Summary Statement This project proved that ultrasonic sound increases the activity level of insects.	
Help Received	