



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Alexandra Aerni; Jessica Jaeckel	Project Number S2201
Project Title The Effect of Different Temperatures on the Cellular Respiration of Crickets	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This research aims to discover if a cricket's cellular respiration rate is effected by varying temperatures in its environment and how this knowledge can be applied to other cold-blooded creatures.</p> <p>Methods/Materials To discover if temperature had an effect on the cellular respiration of crickets, three water baths were set up at the following temperatures: 40 degrees C, 21.8 degrees C (room temperature), and 10 degrees C. Three crickets were placed in each of the baths so an average could be determined. One test tube filled with beads was also put into each of the baths as the control. The amount of oxygen consumed was what was measured. Before the crickets and beads were placed into test tubes, KOH was put onto a cotton ball to absorb the CO₂ produced as a byproduct of aerobic cellular respiration. We waited 5 minutes until equilibrium to place red dye on the end of the pipette, fully submerge the test tubes in the baths, and start the timer.</p> <p>Results The crickets at 40°C were consuming more oxygen than the crickets at room temperature (21.8°C) and the cold temperature (10°C). The readings for the warm crickets show a faster decrease, and drop to lower numbers than the room temperature crickets and cold crickets. For example, take the second cricket from each temperature. The warm water cricket at 2 minutes had a reading of .88mL, and by the 14 minute mark had a reading of .415mL on the pipette. The room temperature cricket had a reading of .88mL at 2 minutes, and ended with a reading of .84mL. The cold temperature cricket had a reading of .83mL at 2 minutes and ended with a reading of .80mL at 14 minutes. As you can see, the warm water crickets consume much more oxygen than the room temperature and cold temperature crickets.</p> <p>Conclusions/Discussion The result of the crickets' change in respiration was due to the fact that crickets are cold blooded creatures, meaning that they take on whatever temperature their environment is around them. The temperature altered the crickets' cellular activity and thus, effected their cellular rates of respiration. From the results one can conclude that crickets have a higher cellular respiration rate in warmer temperatures and a lower cellular respiration rate in cold temperatures.</p>	
Summary Statement Our project is about the aerobic cellular respiration of crickets and how its effected when the crickets are placed in different temperatures.	
Help Received My science teacher, Ms. Morris, helped us gather the materials needed for the experiment and supervised us while we conducted it in her classroom.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Andrea Alexander	Project Number S2202
Project Title Sexual Dimorphism of the Market Squid, <i>Doryteuthis opalescens</i>	
Abstract	
Objectives/Goals This experiment tested a method of differentiating male and female Market Squids based on the squids' mantle to arm length ratio.	
Methods/Materials One hundred and fifty three squids were used in this study. The mantle length and third arm length of each squid were measured manually with a standard ruler in millimeters. The squids were then dissected to determine their sexes. The collected data was then compared to see if the ratio of the two measurements alone, mantle length to arm length, showed any relationship to the sex of the given squid.	
Results This study showed that the computed mantle:arm length ratio means were significantly different between females and males, with 2.67 for females and 1.80 for males. Though some overlap in the data occurred, statistical analysis shows a P-value less than 0.05, and therefore the hypothesis can be accepted. In addition, the 95% confidence interval from 0.77 to 0.97 captures the difference in true mean ratio of mantle to arm length in females over males.	
Conclusions/Discussion There is a statistical difference between male and female market squid: female market squid will have a mantle length to arm length ratio that is greater than that of the males.	
Summary Statement This project tested whether male and female Market Squids can be distinguished based on their external appearances.	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Nelson Chandler; Aaron Levins; Austin Moss-Ennis	Project Number S2203
Project Title The Effect of Magnetism on Planaria Regeneration	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of the experiment is to determine if magnets have an effect on the regeneration of planaria.</p> <p>Methods/Materials Groups of thirty, fifty-four, and sixty planaria were gathered, separated into six groups, and twenty of them were bisected.</p> <p>Results The stronger the magnet strength, the slower the bisected planaria grew.</p> <p>Conclusions/Discussion Magnet strength did not affect the non-bisected planaria; however, the non-magnetized group of non-bisected planaria in the first trial had offspring whereas the magnetized group did not. In conclusion, magnets have a negative effect on the regeneration of planaria.</p>	
Summary Statement To test the legitimacy of magnet therapy through planaria, a test that resulted in negative effects.	
Help Received Cousin cut sheet metal into squares; Mother helped with board set up.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Petra L. Grutzik	Project Number S2204
Project Title Linking Expression and Function of FoxP2 in Adult Songbirds Using Operant Preference Testing	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Mutations in the human gene, FOXP2, cause severe speech and language disorders in humans. This study examines the functional relationship between the transcription factor FoxP2, its impact on song quality of adult male zebra finches (<i>Taeniopygia guttata</i>) whose song learning parallels human speech learning, and conspecific communication in adulthood. FoxP2 mRNA decrease when juvenile and adult birds sing alone (undirected song) and increase when adult male zebra finches sing a highly stereotyped song in courtship (directed song). Male zebra finches sing to court females and females can discriminate between undirected and directed songs. I hypothesized that FoxP2 overexpression directly improves the quality of undirected songs making them more preferable to the female but can also be detrimental to the quality of directed songs.</p> <p>Methods/Materials I use an adeno-associated virus (AAV) to increase FoxP2 in Area X of adult male zebra finches to assess whether FoxP2 overexpression improves the quality of songs. I use an operant feedback preference test that requires the female bird to fly to a specific side of the cage to elicit playback of a particular song by interrupting an infrared beam. Repeated triggering of the same stimulus relative to the other indicates a preference for that song type.</p> <p>Results Constitutively high FoxP2 caused male undirected song (UD) to be more preferable than undirected song prior to FoxP2 overexpression and male directed song (FD) to be less preferable than directed song prior to FoxP2 overexpression.</p> <p>Conclusions/Discussion My experiments suggest females are able to detect the changes FoxP2 causes in song. FoxP2 directly enhances communication between songbirds by making the undirected song sounds more like the directed song. However, the female does not always prefer the more stereotyped song and thus FoxP2 overexpression may be detrimental to conspecific communication. These preferences affirm the idea that FoxP2 is active in adults and is important for mediating vocalizations throughout the lifetime of the animal and not just during song learning. Overall, these tests help us understand the role of FoxP2 in communication between songbirds and thus the significance of this gene in typical and atypical human speech and its relationship to human language disorders.</p>	
Summary Statement This study examines the functional relationship between the transcription factor FoxP2, its impact on song quality of adult male zebra finches whose song learning parallels human speech learning, and conspecific communication in adulthood.	
Help Received Used lab equipment at UCLA under the supervision of Dr. Stephanie White; Used MatLab code from Dr. Sarah M.N. Woolley from Columbia University	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Andrew S. Hong	Project Number S2205
Project Title Differences in Gene Expression Underlie Convergence in Bioluminescent Squid Photophores	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals A fundamental problem in zoology is how convergent evolution works at the molecular level. <i>Euprymna scolopes</i> and <i>Uroteuthis edulis</i> are distantly related species of bioluminescent squid that have very similar photophores (light organs) that demonstrate structural convergence. The goal of this work is to determine whether the species use the same kinds of genes or use different combinations of genes to regulate their photophores.</p> <p>Methods/Materials I extracted RNA from ten <i>E. scolopes</i> and nine <i>U. edulis</i> individuals, converted RNA to DNA and used qPCR to determine the amount of expression for eight different genes in the photophores. I used the delta-delta CT method to determine gene expression levels in one species relative to another and used the Mann-Whitney U-test, a nonparametric alternative to the t-test, to determine whether the levels of gene expression for each gene are significantly different for the two species.</p> <p>Results <i>E. scolopes</i> and <i>U. edulis</i> had significantly different levels of expression ($p < 0.05$) for six of the eight genes. Expression levels of opsin (light perception), cryptochromes (blue-light receptors), and crystallin (lens) genes were significantly different. There was too much variance in the expression of the two immunity genes (NFkappaB and peroxidase).</p> <p>Conclusions/Discussion Differences in gene expression in the photophores demonstrate that the two species use different combinations of genes to regulate their photophores. Bioluminescence is useful in biomarkers and other forms of bioimaging. Another application is simply a better understanding of Earth's history. Convergent evolution is a major part of Earth's history, and observing genomic and functional similarities and differences in the two squid species can help us better understand how evolution occurred on Earth.</p>	
Summary Statement This project compared gene expression levels in two convergent species of bioluminescent squid to determine the molecular basis of convergent evolution.	
Help Received Used lab equipment at UCSB under the supervision of Sabrina Pankey.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Samuel Z. Lang	Project Number S2207
Project Title Tea or Copper? Environmentally Friendly Repellents for Helicid Snails and Deroceras Slugs	
Abstract Objectives/Goals This is my 4th year of science experiments on worms, slug/snails. Previously, I discovered that tea, especially the liquid form of high concentration of green/red tea, is lethal to most invertebrates; tea is also a better repellent than carbaryl/metaldehyde-based molluscicides (pests that ate the poison bait may still eat plants before death). The purpose of the current project is to compare copper tape vs. tea waste leaf liquid, to discover which is more effective environmentally friendly gastropod repellents in protecting delicate plants from gastropod pests. Methods/Materials Subjects: Helicid Snails (pomatia and aspersa), Deroceras Slugs (reticulatum, agreste, etc.) Repellents: copper tape, high concentration tea waste leaf liquid (Green/Red). The repellent tray is required for liquid application; it prevents tea from leaching into the soil and harm earthworms. Build the tray with a spacious central safe area surrounded by a three inch wide repellent zone lined with copper tape or filled with a thin layer of tea, then place desired seedlings around the tray. Testing: place subjects in central safe area with a wet paper towel for sustenance. Observe and document subject activity with camera, record data for subject escape, condition, interaction with repellent, and damaged plant count. Repellent performance is gauged by subject escape rate. Results The escape rate on copper were 15 to 25+%, and damaged plant rates varied from 3 to 20+% in 8hr testing period. In contrast, there were almost no escapes and damaged plants with both red/green tea tests. It is beyond a statistical doubt that both tea waste leaf liquids (high concentration) were superior repellents and molluscicides. Conclusions/Discussion Although there was obvious hesitation upon contacting copper, both slugs and snails could pass through the copper zone and enter the plant area without being visibly harmed. Saponins, caffeine, and tannins are possible toxic substances in tea. All slugs immersed in tea died. Snail clusters often lost balance and toppled into tea zone. If shell in first, snails would have a chance to return to safety. Rarely, snails may escape by using other stricken snails as #stepping stones,# which may be prevented by increasing the depth of tea level, In conclusion, Tea Waste Leaf Liquid (high concentration, both kinds) is a more effective snail/slug repellent and molluscicide compared to copper tape.	
Summary Statement This project compared two environmentally friendly alternative gastropod repellents/molluscicides applied to protect delicate plants, and found that tea waste leaf liquid was a better repellent than copper tape.	
Help Received Parents provided materials, and boosted morale. My schoolteacher Mr. Hammond told me how to apply to the CSSF.	



CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) Joseph I. Losner	Project Number S2208
Project Title The Attraction of the Beneficial Insect <i>Chrysoperla rufilaberis</i> to Wintergreen	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The world's food production is partially dependent upon effective pest control toward insects. Insecticides are problematic as they are often toxic and because insects often develop resistance toward them. There are other treatments that are not chemically based that include using carnivorous insects to drive away the herbivorous insects; however the problem encountered is keeping the insect at the plant site. Herbivore induced plant volatiles (HIPV) have been discovered as a communicant between carnivorous insects and plants. They function to attract predators that destroy the herbivorous insect attacking the plant. The purpose of these experiments was to test the attraction of <i>Chrysoperla rufilaberis</i> (Green Lacewing) larvae to the HIPV Wintergreen (methyl salicylate) and their prey, Green Peach Aphids.</p> <p>Methods/Materials This experimental design used choice chambers as a means for testing the environmental preference of Green Lacewing larvae. The choice chambers had three parts, a sealed control chamber, a sealed test chamber and a ventilated middle chamber that connected the control and test chamber. Methyl salicylate was tested at 0.1, 1, 10 and 100% in the presence and absence of aphids.</p> <p>Results The results showed that Lacewing larvae were attracted to aphids (positive control) validating the choice chamber method. In the middle and test chambers with aphids in combination with methyl salicylate (0.1 and 1%) there was a significantly greater number of Lacewing larvae than the control chambers ($p < 0.05$). The preference for the middle chamber was also shown with the control tests and may indicate a preference for ventilation. However methyl salicylate alone (0.1, 1, 10 and 100%) was not shown to be an attractant to the Lacewing larvae.</p> <p>Conclusions/Discussion The results confirm that the Green Lacewing larvae do function as beneficial insects as they were attracted to aphids in the test chambers. Several studies have been carried out with adult Lacewing species and have shown the ability of methyl salicylate to function as an attractant. The results in this study do not support methyl salicylate as an attractant for <i>Chrysoperla rufilaberis</i> larvae. This would indicate a difference in the ability of the methyl salicylate to attract the adult form of <i>Chrysoperla rufilaberis</i> versus the larval form.</p>	
Summary Statement The purpose of these experiments was to test the attraction of <i>Chrysoperla rufilaberis</i> (Green Lacewing) larvae to the HIPV Wintergreen (methyl salicylate) and their prey, Green Peach Aphids.	
Help Received Help was provided by high school teacher/mentor Dr. Jane Willoughby	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Margot L. Mafra Spencer	Project Number S2209
Project Title Insect Identification Using Laser and Wing Beat Frequency	
Objectives/Goals The objective was to determine whether it is possible to identify flying insects using a photoelectric device and wing beat frequencies (WBFs). If an automated trap can be used to identify pests in a field using WBF, control measures can be targeted to where and when a pest is present. A library of WBFs can be generated to help growers monitor all the insects present in their fields.	
Abstract Methods/Materials Method: Approximately one hundred fifty individual insects of three different species (one mosquito species and two fruit fly species) were placed into separate photo transmitter cages and monitored with recording devices for 2-3 days in a temperature controlled room. Recorded wing beat frequency (WBF) data was analyzed and graphed using specialized software. Materials (partial list): live insects - <i>A. aegypti</i> (common mosquito), <i>D. melanogaster</i> (benign fruit fly), <i>D. suzukii</i> (pest fruit fly) photo-electric device (laser, electronic board, AA batteries, recorder) insect cages software to analyze WBF	
Results The wing beat frequencies of the three insect species observed were determined. <i>A. aegypti</i> = 433 Hz, <i>D. melanogaster</i> = 223 Hz, and <i>D. suzukii</i> = 226 Hz. We were able to easily distinguish the <i>A. aegypti</i> from the <i>Drosophila</i> , however, within the <i>Drosophila</i> genus, it was nearly impossible to differentiate the <i>D. melanogaster</i> from the <i>D. suzukii</i> .	
Conclusions/Discussion <i>D. suzukii</i> has invaded crops across the United States by using its serrated ovipositor to cut through fresh fruit to lay eggs, harming the growers' business. The common fruit fly, <i>D. melanogaster</i> , lays its eggs into fruit that is already damaged and rotten, so farmers would discard that fruit anyway. Both <i>Drosophila</i> species look similar, causing confusion as to whether they have the fruit fly pests or the benign fruit fly in their fields. If the fruit fly pest could be identified using an automated trap, farmers can be notified and treat their crops accordingly. Although it does not seem possible to distinguish between the two <i>Drosophila</i> using WBF alone, there were differences observed in circadian rhythms, so that it might be possible to use other flight characteristics in combination with WBF to distinguish between similar species.	
Summary Statement Can we identify flying insect pests using a laser and wing beat frequency?	
Help Received Eamonn Keogh, PhD (UCR Computer Science) provided lab space and equipment; Yan Ping Chen, PhD Cand. (UCR Computer Science) provided data analysis; Agenor Mafra-Neto, PhD (Father/ ISCA Technologies) discussion, experimental design and provided insects and access to laboratories.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Nykolas A. Maxey	Project Number S2210
Project Title Inhibiting Zophobas morio Larva Development with UV Light	
Abstract Objectives/Goals In Phase I my research project goal was to arrest the development within the larval stage of Zophobas morio (mealworms). I applied UVB light to exposed Zophobas larva in a mid-instar stage. The results indicated an arrest of molting and no pupal development into further adult stages, unlike the control groups. Research is suggesting possible DNA damage, and/or destruction of Prothoracicotropic Hormone (PTTH) producing cells and ecdysone triggering mechanisms required for molting and pupal development. Methods/Materials Having seen that there is an unexplained arrest of growth taking place, my Phase II goal was to examine a possible mechanism. I thought it improbable that UVB light would penetrate the exoskeleton of the larval stage of Zophobas morio (mealworms) enough to interfere with the PTTH producing cells. Since these cells are located very close to the brain and eyes of the larvae, my thought was that this was the entry source of the light causing damage to those cells. Basically, I painted over the eyes with a non-toxic correction fluid and tried exposure again using my previous 7 day exposure routine of my Phase I project. Results My results indicated that there was a strong statistical correlation between successful development in the #painted# group, and again, lack of development in the untreated group suggesting that the eye channel is the UVB light entry source that damages the PTTH producing cells preventing molting and pupal development. All individuals in the treated group surviving the typical mortality rate had arrested development. No individuals pupated. All individuals in the untreated group surviving the typical mortality rate experienced pupation. No individuals in this group failed to pupate. Conclusions/Discussion Data would seem to support my hypothesis that the entry point of the damaging UVB light is through the eye channels. It is logical that my speculation that the two pairs of PTTH producing cells have been permanently damaged or destroyed being in close proximity to a logical entry point for the UVB light through the eye structure and head nearest the brain, rather than the destruction of the entire ecdysone producing glands. By painting over the eyes with a non-toxic correction fluid, I prevented the UVB light from following a course to these PTTH producing cells and allowed them to continue PTTH production without presumed destruction to the cells.	
Summary Statement The purpose of this project is to examine the mechanism by which UVB light may enter the larval stage of Zophobas morio and cause PTTH producing cell damage of the DNA producing a dimer for those cells, thereby arresting larval development.	
Help Received I performed all the work on my own in a classroom lab.	



CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) Cheyenne E. Newallis	Project Number S2211
Project Title Breeding Season of the Cephaloscyllium ventriosum or Pacific Swell Shark in Captivity	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The question to be answered is what is the breeding season of the Cephaloscyllium ventriosum. The main objective was to record a definite breeding season of the California swell shark in captivity.</p> <p>Methods/Materials One large community tank measuring 24 inches high and with a diameter of 144 inches was used. The tank is home to 12 swell sharks. The tank has 2 water pipes on opposite side of the tank. The tanks also contained 2 live Gorgonians, one large, one small, and several rocks covered in algae turf as well as an air tube with a net basket over it protecting it from the sharks. This provides an assortment of items for the sharks to lay eggs on. Each Saturday, in the morning, several water quality parameters (salinity, ammonia, and Ph) were recorded from a log and the water temperature was taken in terms of Celsius. Then, the tank is scanned for eggs on the gorgonian plants, the floor, on tubes, or under rocks. When eggs are found, they are carefully taken out and immediately put into a shallow tub filled with salt water. Then, the tendrils are cut short enough just to make a couple knots at the top. The bottom tendrils were fully removed so the shark would not get tangled in the process of hatching. Then, a label with the the date was placed through the top hole and secured. When all eggs were tagged, they were placed on their month string in chronological order and then the two sides of the string were tied back to form a circle so the eggs would not come off.</p> <p>Results There was no correlation between water temperature in captivity and the amount of eggs laid. Because of this, statistical tests were not possible. However, longer observations of egg laying behavior by the sharks in this tank may show a correlation to seasonal changes, like daylight or slight temperature fluctuations. The graph is a double axis graph comparing the water temperature in captivity to the ammonia levels.</p> <p>Conclusions/Discussion There was no correlation between water quality factors and amount of fertile eggs laid. However, the graph that compared temperature and number of eggs laid showed a correlation. This might have been because the water quality log was taken bi-weekly and the egg data was taken weekly. Further research will be conducted to finish following the breeding season for 1 year.</p>	
Summary Statement Recording a breeding season of swell sharks in captivity.	
Help Received Research took place at the Cabrillo Marine Aquarium; Dr. Kiersten Darrow always answered any questions; Marissa Velarde overlooked my project and helped me every saturday; Dwight Causey helped me with statistics and poster organization; My parents drove me to the aquarium every saturday morning	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Jacob S. Partida	Project Number S2212
Project Title Examining the Significance of Dens and Manipulable Environments of Wild-Caught and Captive-Raised Octopus bimaculoides	
Abstract Objectives/Goals Octopuses in the wild live in an environment in which they can manipulate their surroundings, though this is not always true in captivity. This experiment strived to determine if a manipulable environment may reduce the impacts of stress experienced by octopuses in captivity. Methods/Materials Nine captive-raised and nine wild-caught Octopus bimaculoides were kept in separate tanks each with a different type of environment: deprived, supplied, and manipulable. Once a week for four weeks, each octopus was tested for four different indicators of stress: growth by weight, incidence of inking in response to a stressor, change in respiration rate in response to a stressor, and behavioral reaction in response to a stressor based on an established ethogram. Data from each test was analyzed with two-factor ANOVA tests. Results An interaction of both factors -- origin and environmental treatment -- yielded significance for behavioral reaction in response to a stressor ($p=0.029$) and changes in respiration in response to a stressor ($p=0.017$). Conclusions/Discussion Thus the origin of an O. bimaculoides and the manipulability of its environment significantly impact their ability to respond to stress in a captive environment. An octopus in captivity would benefit from living in a manipulable environment. This study, as well as possible future trials and studies on different species of octopus with a larger sample size, will give a more concrete understanding of how octopuses should be kept in captivity.	
Summary Statement The project focused on determining if a manipulable environment in captivity would help octopuses better cope with stressful events.	
Help Received Used facilities, organisms, and materials at Cabrillo Marine Aquarium's Aquatic Nursery. Staff helped analyze statistics and correctly care for animals.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Jurgen Pramps; Mikaela Slade	Project Number S2213
Project Title Terrestrial Salamanders of the San Lorenzo Valley	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to determine the micro- and macro- climate factors that lead to the presence of terrestrial salamanders in our study area, Henry Cowell State Park.</p> <p>Methods/Materials A 20-meter measuring tape was used to set up 14 transects, each 12 meters in length. A single transect is composed of 5 plywood artificial cover objects (ACOs), each placed in succession 3 meters apart. Every 14 days monitoring takes place, where the boards are lifted, the number of salamanders is counted, and climactic factors are recorded using a LabQuest II Pro device.</p> <p>Results Significantly more salamanders are found in our sites during the moister periods of 12/15/13 to 3/30/14 compared to the drier periods from 6/2/13 to 12/15/13. There are significantly more Yellow-eyed Ensatina salamanders compared to any other species found in our study area. Salamanders are more commonly found during times of high soil moisture, high relative humidity, low soil temperature and low air temperature.</p> <p>Conclusions/Discussion Salamanders congregate under the ACOs during times of higher precipitation as the soil moisture and relative humidity increase and the soil temperature and air temperature decrease, which suggests that salamanders respond to climatic factors when looking for a suitable habitat.</p>	
Summary Statement This project is conducted to monitor salamanders, an ecological indicator species, and view the factors that lead to their presence in our study area.	
Help Received Our teacher, Jane Orbuch, guided the project foundations and our mentor, Stefanie Bourcier, assists in the overall project maintenance.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Elizabeth M. Salmond	Project Number S2214
Project Title Livin' the Hydra Life: Regeneration of Brown Hydra Heads Under Varying Light Wavelengths	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To determine if speed and extent of regeneration of brown Hydra heads is affected by exposure to varying wavelengths of light after dissection.</p> <p>Methods/Materials Obtain 3 polished glass light filters of different wavelengths. Obtain 5 Petri dishes. Darken bottoms/sides with black duct tape or paint to block out light. On 4 lids place a cardboard square the same size light filters in middle of lids. Spray paint 5 lids black (one will be all black). Fill dishes halfway with clean spring water. Dissect a Hydra at mid-body, separating food end and place it in first dish. Repeat until 5 foot ends in each dish. Place lids on dishes. Place a glass color filter on three of the lids lining up on open spots from squares. Place an infrared glass filter (Heat Absorbing Filters) on each color filter to block out infrared light. Place 4th lid (painted with open square) and 5th lid (painted completely black) on last 2 dishes. Turn on LED light over dishes during daylight hours. Using microscope, check each dish at regular intervals post amputation: 6, 9, 18, 24, and 36 hours. Using head regeneration chart, count how many Hydra in each dish are at each of 6 stages.</p> <p>Results I did 2 trials so 10 total per dish. Tracking Final Head Count of Hydras, most successful was group exposed to blue light, having 9 of 10 fully regenerated heads with tentacles. Control group had 7 of 10. Green group was third with 2 out of 10. Red group did not produce any fully regenerated heads, although 1 made it to Stage 5 and 6 made it to Stage 4. Dish with no light at all did worst with none reaching Stage 5 or 6. Tracking regeneration speed, blue group regenerated at a faster rate than all others. The worst of filters again was red group which had only 1 at Stage 3, the rest remaining at Stage 2 after 6 hours. Worst of all was blackened dish.</p> <p>Conclusions/Discussion Hydras need some light to regenerate. Surprisingly, those exposed to blue visible light fared better than control group, both in speed and extent of regeneration. Further research would be helpful as to why this occurred. My research also revealed that without visible light or with only red light, Hydras do not thrive and regeneration is inhibited. For future application, studying Hydra regeneration is beneficial for researching how cells differentiate and know which body part to #grow into.# Knowing the prime environment to enable such studies will be helpful in this regard.</p>	
Summary Statement This project tracks both the speed and the extent of regeneration of brown Hydra heads and tentacles under varying wavelengths of visible light using a 6-stage regeneration scale.	
Help Received Mom helped set up spreadsheets, Dad took me to buy equipment, HOYA OPTICS assisted with selection of light filters.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Alia M. Salomon	Project Number S2215
Project Title Hermit Crabs of Northern California: Bay vs. Coast	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of my project was to determine whether or not native Northern California Hermit Crabs prefer different shells, depending on whether they live in bay or coastal habitats.</p> <p>Methods/Materials After researching and recording common Hermit Crab species, characteristics and shell preferences for each location, I visited Bodega Bay and Fitzgerald Marine Reserve during low tides. With a magnifier, I observed and then recorded descriptions of species found, their shells, and their habitat in my journal and through photographs taken with my iPhone, noting the differences and similarities between the locations. After researching environmental characteristics (wave height, temperatures, and vegetation) I charted my findings.</p> <p>Results Although the same types of shells were available in both locations, the crabs in the bay inhabited certain types of Gastropod shells, while the same species of crabs on the coast chose completely different types of shells that were more hydrodynamic and colorful.</p> <p>Conclusions/Discussion Crabs in the bay chose large, dark, round shells, enabling them to camouflage in rocky shores, and offer protection when faced with water flow in the area. The shells chosen on the coast are more hydrodynamic due to the greater water force in the area, and colored more brightly, to match the vegetation in the area and the diet of the Gastropod. Hermit Crabs select shells based on safety from predators, the ability to camouflage, shell stability in the local water flow, and fit for their bodies.</p>	
Summary Statement Shell selection of Hermit Crabs in bay and coastal habitats of Northern California is highly influenced by environment.	
Help Received My mother drove me and my boyfriend to the two locations. They both helped locate crabs for me to observe. I also interviewed Rebecca Trinh, an undergrad student at UC Berkeley also studying crabs, who gave me a better understanding of Hermit Crabs in general. This interview is included in my display.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Connor T. Schademan	Project Number S2216
Project Title The Dietary Preferences of the Common Garter Snake in the Big Chico Creek Ecological Reserve	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to determine the dietary preferences of the Common Garter Snake in the Big Chico Creek Ecological Reserve by using scent testing of various prey to see if their diet might include the California newt. These newts are known to carry a potent neurotoxin that is lethal to humans in small doses.</p> <p>Methods/Materials I caught a total of 9 garter snakes at various times throughout the spring and fall of 2013 at the reserve. While looking for snakes, I also caught the prey animals needed for the scent tests: fish, frog, newt, slug and earthworm. The snakes were kept in a terrarium for at least 3 days prior to scent testing to habituate them to their new environment. I also habituated the snakes to the action of the scent tests. The scent animals were put in their own separate terrariums. I created prey scents by putting each of the 5 prey animals in a clean jar with 100 ml of filtered water and let them sit for 20 minutes, then removed the animals. I used a double control of cologne and water for a total of 7 scents. I then introduced the scents into the snake terrarium in a random order one at a time for 1 minute each using a Q-tip dipped in a single scent and sticking it into the snake tank. The number of tongue flicks per minute for each of the 7 scents was counted and each scent was tested on each snake 3 different times for a total of 21 tests per snake. The snakes were given a 5 minute break between each of the 3 sets. I then sexed, marked, measured, and weighed each of the snakes prior to releasing them in the same spot they were found. I released all of the scent animals after testing.</p> <p>Results I averaged all tongue flick data for each scent. Averages tongue flicks per minute were relatively high for fish, frogs, and newts and lower for the control and other scents tested. I then generated a bar graph to show this data.</p> <p>Conclusions/Discussion My conclusion is that snakes are eating fish, frogs, and newts, but not slugs or earthworms because they scored so closely to the control scents. This data suggests the snakes and newts in the reserve are likely engaged in an evolutionary arms race. This study gives us insight into the types of environments where this arms race is occurring and encourages us to preserve places like the BCCER to further such evolutionary relationships.</p>	
Summary Statement I wanted to know if the Common Garter Snakes living on the Big Chico Creek Ecological Reserve are feeding on poisonous California Newts by testing their dietary preferences.	
Help Received Mother and father helped with driving to the reserve and formatting report ; Matt Holding with Ohio State for advice and guidance; Mr. Jeff Mott, Dir. of Big Chico Creek Ecological Reserve for permission to collect specimens and encouragement	



CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s) Caleb L. Smith	Project Number S2217
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Project Title
Quantitative Analysis of Mitochondria's Role in Drosophila Lifespan

Abstract

Objectives/Goals
Determine the role that mitochondria plays in Drosophila melanogaster lifespan

Methods/Materials
Flies and Daily Care: This experiment uses flies with mitochondria that are tagged with green fluorescent protein (GFP) The flies were used in conjunction with cameras that could quantify fluorescence in order to portray a representation of mitochondrial quantity. The cameras used programs called VideoGrabber and FloureScore to gather video of individual flies and quantify the amount green fluorescence, respectively.
The cohort had eighty-eight flies and was aged out to twelve days before being video assayed. Each fly was kept in an individual vial capped with a Rayon ball.
Vials were stored at 25 degrees Celsius. Flies were fed a dextrose-based food. Every other day, flies were moved into vials with fresh food. Flies were moved from vial to vial by tapping the vial so that the fly fell to the bottom and then quickly inverting and dumping the fly into a new vial, which was quickly capped with a Rayon ball.
The cameras utilized the VideoGrabber software to capture the videos of each individual fly with the FloureScore program to quantify GFP. Flies had GFP measured in the video assay center and then were observed until death, when the length of each fly's lifespan was recorded. In the lifespan assay, the length of lifespan for each fly was recorded and paired with its respective number and GFP quantity in an Excel spreadsheet.
Excel spreadsheet data were then plotted with the amount of GFP on the y-axis and the lifespan of the fly on the x-axis. A regression analysis was conducted in order to determine if there was a relationship between GFP (which was assumed to be representative of the amount of mitochondria) on the y-axis and lifespan on the x-axis.

Results
slope: $y = .3513x + 132.02$
p value = .0248
 r^2 value: .0585
Lifespan Avg. = 64.5 Days
GFP Avg. = 194.56

Summary Statement
Mitochondrial quantity is indicative of lifespan in Drosophila melanogaster flies.

Help Received
John Tower and Chaitanya Nadig helped answer my genetics questions and assisted in camera usage, respectively.



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Lauren J. Smith	Project Number S2218
Project Title Bird Biodiversity in Henry Cowell Redwoods State Park	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals In this project, I monitored the biodiversity and abundance of birds in four different habitats (meadow, river-meadow, river-redwood, and redwood) in Henry Cowell Redwoods State Park. Previously, I determined that overall bird biodiversity does not vary much among the four habitat types, but the types of species vary among habitats. This year my hypothesis was that there would be (1) seasonal differences in bird biodiversity and abundance reflecting seasonal changes in representation of permanent residents, seasonal residents, and transients/migrants, and (2) interannual changes in biodiversity and abundance that reflect changes in climate.</p> <p>Methods/Materials I surveyed eight sites once or twice a month along a predetermined loop at Henry Cowell from October 2011 through February 2013, recording all the birds I saw and heard at each site over a 10-minute period, and recording weather conditions. The materials that I used included 8.5x32 binoculars, a Kestrel weather meter and compass, a waterproof notebook and pencil, and the Sibley Guide to the Birds of North America (iPhone App with audio).</p> <p>Results My results confirm that bird biodiversity does vary across the seasons and from year to year, and that recent climatic patterns have affected the biodiversity and abundance of birds in the park.</p> <p>Conclusions/Discussion I can draw various conclusions from the data I have collected over the past two and a half years. I have concluded that biodiversity and abundance do not vary significantly among the four habitats I examined; they do, however, vary significantly across the seasons and from year to year. I have also concluded that climate has had an effect on the biodiversity of birds in Henry Cowell, but instead of declining diversity due to the drought, the park appeared to serve as a refuge for a variety of species that may have been displaced from harder hit areas.</p>	
Summary Statement This project is about the changes in bird biodiversity and abundance in Henry Cowell Redwoods State Park in relation to changes in climate and seasonal representation of year-round and seasonal residents, migrants, and transients.	
Help Received My dad/project mentor, Dr. Jeff Smith, monitored with me and helped with data analysis using Microsoft Excel.	



CALIFORNIA STATE SCIENCE FAIR 2014 PROJECT SUMMARY

Name(s) Montana A. Sprague	Project Number S2219
Project Title The Magnetic Personality of Butterflies	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of the project was to investigate whether or not Painted Lady butterflies can track magnetic fields to find food. Painted Ladies migrate to central Illinois every August from various locations, at approximately the same time as Monarch butterflies. The hypothesis was inspired by the belief of some scientists that the Monarch butterfly, a cousin of the Painted Lady, uses the magnetic fields of the earth to migrate. Since Painted Ladies migrated in a similar pattern as the Monarchs, it seemed logical that they might also navigate using magnetic fields. The background research has shown that most migratory creatures use some form of magneto-reception for navigation, even to places they have never been before. If butterflies have that capability, it is conceivable that their internal navigation system might lead to the development of new technology. Also, by understanding the basis of migration patterns, people could possibly help save endangered butterflies by being able to predict their destinations.</p> <p>Methods/Materials This project required the construction of six butterfly enclosures made from chicken wire. Each enclosure contained six butterflies and a plate of assorted fruit. In three of the cages, a grade N48 neodymium earth magnet was placed under the plate, while the other three cages (control group) had no magnet. The butterflies were allowed to feed on the fruit plates for one week, after which the fruit plates were removed. Then, an empty plate and a box were placed in each of the six enclosures, with a magnet under three of the boxes. The number of butterflies that flew within 20 centimeters of the box confirmed how many tracked the magnets.</p> <p>Results The results of this experiment clearly supported the hypothesis. The butterflies in the cages with magnetized plates tracked the food up to five times more frequently than the others. These results lead one to conclude that butterflies do in fact tend to track magnetic fields.</p> <p>Conclusions/Discussion In conclusion, the butterflies were certainly drawn to the magnets, supporting the hypothesis. While other researchers have drawn similar conclusions in the past, the outcomes were attributed to other variables, such as color, smell, or sight. With these variables removed from consideration, it is reasonable to conclude that Painted Lady butterflies are indeed capable of tracking magnetic fields.</p>	
Summary Statement This project investigated whether or not Painted Lady butterflies can track magnetic fields to find food.	
Help Received Carol Boggs, PhD, who during the course of this experiment left her position as a professor at Stanford University to accept a Department Director position at the University of South Carolina, read the initial project proposal and provided helpful information regarding the behavior of butterflies.	



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Hannah J. Washburn	Project Number S2220
Project Title Symbiosis of <i>O. aureus</i> and <i>C. quadricarinatus</i> in an Aquaponic System	
Abstract Objectives/Goals The objective is to determine if <i>O. aureus</i> (Blue Tilapia) and <i>C. quadricarinatus</i> (Red Claw Crayfish) can be raised together to create protein diversity in an aquaponic system. Methods/Materials A recirculating tank with Blue Tilapia was used for the tilapia control. One tilapia was added to another tank for the independent variable. Red Claw Crayfish were separated into 2 groups, a control group of 11 crayfish and an independent variable group of 21 crayfish. The crayfish control group was put into a recirculating tank above the Blue Tilapia control group and the independent variable group was added to the tank with the 1 tilapia to test symbiosis. The first day of testing all tilapia and crayfish were weighed and the temperature of all 3 tanks was taken and documented. The tank temperatures were taken daily along with counting of the tilapia and the crayfish for the next 28 days. On the 29th day all remaining tilapia and crayfish were counted and weighed. Results After 28 days of monitoring, the control group of 10 Blue Tilapia had no losses. This group had an average biomass increase of 5.2 grams. The control group of Red Claw Crayfish had an average biomass increase of 9 grams. The control group had 4 crayfish die during testing; 3 of the crayfish bodies were intact and did not appear to have died from trauma. The symbiotic relationship between the test crayfish and tilapia sharing the same tank revealed that the tilapia had an increase of 15.8 grams in biomass while the crayfish suffered significant losses. During the testing period 13 crayfish died, all of the dead crayfish had missing legs and pincers or were in half suggesting that the crayfish were attacked and partially eaten by the tilapia. The tilapias considerable weight gain suggests that may have been the case. Conclusions/Discussion Widespread adaptation of aquaponics could potentially alleviate hunger by growing sustainable fruits, vegetables, and proteins year round, however the findings obtained in this study reveal that Blue Tilapia and Red Claw Crayfish can be sustained in an aquaponic environment but due to the predator/prey dynamic of their commensalistic relationship they would have to be separated.	
Summary Statement I'm trying to create diverse protein food source in a single aquaponic environment.	
Help Received Used the geodesic biodome at the City of Clovis Water Treatment Facility; Sisters took photos	