



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Andres Aguirre	Project Number J2201
Project Title What Different Types of Microplastic and Biodegradable Plastic Affect Plant Growth the Most?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals To determine which types of microplastic (polypropylene granules, foam, and microplastic made from plastic bag) affects plant growth the most, and also to determine which type of biodegradable plastic (cornstarch, banana peel, algae and coconut) impacts the plant growth.</p> <p>Methods/Materials Three different types of experiments were conducted in which 148 plants were planted with different proportions of soil, microplastic and biodegradable plastic. I measured the plants' daily growth. The first set of experiments consisted of growing pinto beans and making 5 groups of 10 plants in each. Each group was planted with a different proportion of soil mixed in with microplastic (polypropylene) or biodegradable plastic (cornstarch). The second set consisted of growing microgreens: savory mix and making 5 groups of 10 plants in each. Each one was planted with 50% soil and 50% of either cornstarch biodegradable plastic, banana peel biodegradable plastic, algae biodegradable plastic, or coconut biodegradable plastic. The third set of experiments consisted of growing microgreens: savory mix and making 4 groups of 12 plants in each. Each one was planted with a different proportion of soil mixed in with either polypropylene granules, microplastic made from plastic bag, or foam.</p> <p>Results In Experiment 1, in which I compared plants with different proportions of soil, microplastic and biodegradable plastic, the group that grew the less were the ones that contained 75% biodegradable plastic and 25% soil which grew 86% less than the ones with 100% soil. In Experiment 2, in which I compared plants with soil and different types of biodegradable plastic, the group of plants that grew the least were the ones that had 50% coconut biodegradable plastic and 50% soil, which grew 37% less than the ones with 100% soil. In Experiment 3, in which I compared plants with different proportions of soil and different types of microplastic, the group that grew the less were the ones that contained 75% microplastics from plastic bags and 25% soil.</p> <p>Conclusions/Discussion Plastic negatively affects plants, as can be seen by the low growth rate of the plants that contained micro plastic. Biodegradable plastic has been developing as a possible solution to reduce the plastic contamination. This can be seen with the corn starch and algae biodegradable plastic, which merely affected plant growth.</p>	
Summary Statement Since plastic pollution is a severe problem in the world of today, I conducted experiments to determine which plastic impacts plant growth the least and to determine if biodegradable plastic is a good alternative.	
Help Received I did most of experimentation on my own. However, I got advice from Ignacio Vilchis (Ph.D.), Kathryn McCulloch (Ph.D), Leonard Vargas (Olivewood Gardens manager), and from Lourdes Nebel (garden architect).	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Iffat Alamgir	Project Number J2202
Project Title The Effect of Nanosilver in Consumer Products on Daphnia magna in Different Temperatures	
Objectives/Goals The objective of this project was to find out if nanosilver found in consumer products is harmful to Daphnia Magna, and if the temperature of the water affects the way nanosilver affects pond life.	
Abstract Methods/Materials Daphnia Magna cultures, colloidal silver, pond water, ice, light bulbs. Nanosilver solutions of 3 different concentrations were made. 10 Daphnia Magna were put in each solution. This was done 3 times, and each time a different temperature was maintained (Warm/hot, Cold, Room temperature) using light bulbs, ice, etc. A control population for each temperature was also maintained. 3 trials were done for each concentration in each temperature. The amount of Daphnia dead and alive was recorded every 2 hours for 10 hours.	
Results The effect of nanosilver on Daphnia Magna was studied. 3 trials were conducted for each solution, in each temperature. The average Daphnia alive and dead for each concentration in each temperature was then calculated, and compared. Results showed that in the cold environment, an average of only 1 Daphnia magna died in the control (0 ug/L), but in the 25 ug/L nanosilver solutions, most of the Daphnia magna had died around hour 6-8. In the warm/hot environment, an average of 3 Daphnia magna died in the control/0 ug/L, as well as in the 5 ug/L and 25 ug/L solutions.	
Conclusions/Discussion During the room temperature trials, the nanosilver did not have a significant effect on the Daphnia magna. But the death rate of the Daphnia magna had a significantly higher increase in the cold environment than the warm/hot environment, even though the control population of the Daphnia magna in the cold environment fared quite well. From this project you can learn that nanosilver in room temperature environments is not harmful to Daphnia magna of the Phyllopod subclass. However, the temperature of water does affect the way nanosilver affects pond life.	
Summary Statement I found that nanosilver found in consumer products is not harmful to Daphnia Magna in room temperature water, but that the temperature of the water affects the way that nanosilver affects pond life.	
Help Received None. I performed the project and analyzed the results on my own.	



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Solaiman A. Alwazir	Project Number J2203
Project Title Energy Drinks' Effect on the Heart	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this study is to investigate what are the acute effects of drinking energy drinks on the cardiovascular system of <i>Daphnia magna</i>, a fresh water crustacea which is semi-transparent and therefore easily visible heart under a light microscope comparing metabolic process to humans that are also biota organisms both multicellular, heterotrophic, and have bilaterian nerves and muscles.</p> <p>Methods/Materials <i>Daphnia magna</i>, Microscope (full set), Pipettes, Energy drinks: Monster, Red Bull, Powerade, Gatorade, Coffee (black, no sugar), Green tea (no sugar), Water (the control). Applied few drops of energy drink individually on <i>Daphnia magna</i> and counted their heartbeat under the microscope after one minute and after two minutes for 10 trials using a new <i>Daphnia</i> for each trial, and repeating for each drink.</p> <p>Results Monster and Red Bull lowered the heart rate of the <i>Daphnia</i> by 100%, which killed it. Coffee lowered the heart rate of the <i>Daphnia</i> by 5.36%. Gatorade lowered it by 3.95%. Green tea lowered it by 3.22%. Powerade lowered it by 0.89%. Water lowered it 0.46% which is insignificant.</p> <p>Conclusions/Discussion The evidence from the trials revealed that those drinks with the highest amount of caffeine, also from herbal additives in the ingredients, namely the energy drinks, acutely caused the most stressful effects on the ability of the heart to function. The significantly higher content of caffeine in energy drinks than in an average cup of coffee is linked to the adverse physiological effects on the heart, hence linking the possible dangers of energy drinks. The implications of this study is to raise awareness to contraindicate energy drinks to youngsters, those with heart morbidities and comorbidities and the elderly at drinking them and to those healthy individuals drinking them in large quantities or combining them with other caffeinated drinks and other substances that cause stress on the heart muscles.</p>	
Summary Statement I showed the association of energy drinks on cardiovascular changes including death, suggesting energy drinks are dangerous without further observational studies to provide suitable regulations.	
Help Received I designed the experiment by formulating which drinks to use, the parameters of the trials and the organism to be studied and used my electric light microscope at home and my teacher reviewed the results I compiled.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Owen Carr; Luca Fang	Project Number J2204
Project Title How Can We Effectively Repel Ticks with Natural Compounds?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of our experiment is to find a more effective natural repellent for ticks in California or the world by reducing the amount of Lyme disease and Rocky Mountain Fever through this repellent. The current repellents include DEET which is harmful to the environment and Essential Oils that are expensive.</p> <p>Methods/Materials Our materials were water, lemongrass essential oil, vinegar, ice plant, geranium essential oil, pine needles, Tupperware, spray-bottle, and at least two different ticks: preferably at least one American Dog Tick and at least One Blacklegged Tick. We tested the effectiveness of the repellents by seeing how the ticks initially interacted with the natural repellents.</p> <p>Results Blended Ice Plant, Blended Pine Needles, and a combination of Lemongrass Essential Oil and Vinegar, were the most effective at repelling both the Blacklegged Tick as well as the American Dog Tick.</p> <p>Conclusions/Discussion In conclusion, by incorporating Ice Plant and Pine Needles into our bug repellents, we can get rid of an invasive species and improve people's health at the same time while keeping costs low.</p>	
Summary Statement As measured by our experiment, the American Dog and Black-Legged ticks are repelled by, blended ice plant, blended pine needles, and a combination of lemongrass essential oil and vinegar.	
Help Received We'd like to acknowledge Mr. Alex Hoffsteen, who guided us through this project, gave us resources and supported us in times of need. Dr. Fred Watson, a biologist from CSUMB who took time out of his life to give us information. We contacted Dr. Fred Watson through email.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Lola S. Castorina	Project Number J2205
Project Title Can Road Salt Be Used to Control the Mosquito Population?	
Abstract Objectives/Goals The objective of this project was to determine whether road salt could be used to control the mosquito larvae population in stagnant water by determining the salinity concentration required to kill 100% of mosquito larvae within 12 hours. Methods/Materials I first conducted 2 test trials to identify and correct potential errors and problems in my proposed methods. After verifying the viability of my procedure, 25 mosquito larvae were placed in 500 ml samples of pond water with varying road salt salinity concentrations from 0.9 ppt - 25 ppt (at 5 ppt intervals). All mosquito larvae were exposed to identical environmental factors (i.e. light, temperature, and homogenous pond water to maintain identical nutrient content). Three separate trials for each salinity concentration were conducted. The number of deceased mosquito larvae was recorded every hour for 12 hours to calculate mortality rate. After determining that all mosquito larvae died between 15 ppt - 20 ppt within 12 hours, I repeated the identical procedure using a salinity gradient from 15 ppt - 20 ppt at 1 ppt intervals to narrow the results to determine a more exact critical concentration level. Results The mortality rate of mosquito larvae reaches 100% after 12 hours at a road salt salinity concentration of 18 ppt to kill mosquito larvae within 12 hours. Conclusions/Discussion My experiment established that road salt could potentially be used to control the mosquito population by using it to increase the salinity of stagnant water to 18 ppt. While significant research has been conducted on the effect of increased acidity on mosquito larvae, almost no research has been conducted on the effect of increased salinity. Road salt is readily available to governmental agencies because it is used in large quantities to deice roads and could be an economical and efficient method for controlling the mosquito population. The project also found that increased salinity has no effect once mosquito larvae transition to the pupal stage which can occur in as little as 48 hours after hatching. Therefore, road salt must kill mosquito larvae within 12 hours to be effective.	
Summary Statement I showed that road salt could be used to effectively control the mosquito population by increasing the salinity level to 18 ppt to effectively kill 100% of mosquito larvae within 12 hours.	
Help Received None. I designed and performed the experiments myself.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Tristan Conway; Trent Navo	Project Number J2206
Project Title Comparing Different Sport and Energy Drinks for their Boost Level Properties	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Our objective was to test energy drinks and sports drinks for their boost level properties on daphnia.</p> <p>Methods/Materials Obtained Daphnia, tested the heart rate before adding the sports and energy drinks. Added sports and energy drinks, recorded the heart rates and compared the two heart rates to see what boost level properties they contributed to the daphnia.</p> <p>Results The results of our experiment were that the boost level properties of monster energy drink had the biggest effect on the daphnia. The sports drink that had the least effect on the daphnia was the gatorade.</p> <p>Conclusions/Discussion From this experiment, we learned that the monster energy drink had the greatest effect on the daphnia and their heart rates. We also learned that gatorade did not have much an effect on the daphnia or their heart rates.</p>	
Summary Statement This project tests the boost level properties of red bull, monster, PowerAde and Gatorade.	
Help Received My science fair representative assisted with the design for the project and taught us how to do it on our way. Our science fair coach observed while we went through the procedure in her classroom.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Ali A. Derakhshani	Project Number J2207
Project Title The Effectiveness of Different Caffeinated Liquids in Killing Termites	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The experiment was conducted to investigate the effect of different caffeinated liquids on the lifespan of termites. This project is very unique because many people throughout the world are looking for a cheaper, effective, and environmentally safe way to kill termites. This project provides an excellent alternative to harmful pesticides. One can use caffeinated liquids such as coffee or Redbull to get rid of termites instead of spending large amounts of money for extermination. In the future, other caffeinated liquids will be tried on a wider variety of household pests.</p> <p>Methods/Materials For this experiment, 100 termites, 15 ml of Redbull, Coke, and coffee, and 10m Petri dishes were used. Wear protective gloves to avoid getting bit by the termites. I used the brush to make a circle of caffeine around the Petri Dish. Then I placed two termites in each Petri Dish.</p> <p>Results Results indicated that Redbull killed termites the fastest (1.75 hrs). Coffee killed termites in 3.42 hrs, and Coke was the least effective (5.04 hrs).</p> <p>Conclusions/Discussion The objective of the experiment was to test the effect of different caffeinated liquids (Coke, Redbull, and coffee) on the lifespan of termites. Results indicated that Redbull killed termites the fastest (1.75 hrs). Coffee killed termites in 3.42 hrs, and Coke was the least effective (5.04 hrs). It was interesting to observe that higher the caffeine levels, the sooner the termites died. Redbull was the most effective and the hypothesis was proved to be correct. A qualitative observation was that some termites started becoming hyper-active after exposure to caffeine. Others got a shock and died. There were a couple of factors that might have affected the experiment. For example, some termites did not move toward the caffeine as fast as some other termites did. This may have been because they were not hungry, therefore they were not tempted to move toward the caffeine. Also, some termites were larger than others. As a result, the bigger termites might have had higher endurance levels which may have affected how long it took for them to die. In future, the effectiveness of caffeine on different household pests would be tested. Different dosages of caffeinated liquids will be tried to find the minimum dosage necessary to kill other household pests.</p>	
Summary Statement My project is about seeing how long it will take fro termites to die after in contact with different dosages of caffeine.	
Help Received I did the project my self. My teacher, Kavitha Satya helped me come up with the idea.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Harkirat K. Hansra	Project Number J2208
Project Title The Effect of Varying Intensities of Soil Salt Stress on Genovese Basil Plants	
Abstract Objectives/Goals The purpose of this project was to discover how the Genovese Basil plant reacts to different amounts of salt in the plants soil. Methods/Materials Table salt, 4 packets of Genovese Basil seeds, ruler. The plants were tested by mixing salt into the plants soil in multiples of five. To ensure the results were comparable, group one recieved zero grams of salt while group six, the last group, received twenty five grams of salt. To collect the data the height of the plant in inches as well as the plants vigorousness on a scale from zero to five was recorded. Results After each week the plants were measured and their height as well as vigorousness was recorded. After four weeks of measuring each plant, the average height for each group was calculated. The final results concluded that group one through four grew at least, if not less than, one inch while group five and six showed no signs of growth. Conclusions/Discussion Genovese Basil plants are fairly salt tolerant and can withstand soil salt levels ranging between 5 to 15 grams of salt, but will not grow within conditions that are more saline than previously stated. Therefore, this type of plant can be grown in saline conditions that are within its limits.	
Summary Statement I found that Genovese Basil plants are fairly resistant to soil salt stress but only to a certain extent.	
Help Received I recieved no help while conducting this experiment, everything was done by myself.	



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Swaraa Joshi; Inaaya Omer	Project Number J2209
Project Title Does Radiation Impact Living Organisms?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Everyone says radiation is bad for you. Therefore, we wanted to study its effect on different types of organisms in our project. We predicted that exposing both unicellular (yeast) and multicellular (basil and lima beans) organisms to radiation will alter their growth. We chose two types of radiation - a low energy radiation (Microwave or MW) and a high energy radiation (ultraviolet or UV). Specifically: a) How does radiation affect living organisms? Is the effect positive or negative? b) Is the effect of UV different from MW radiation? c) Does radiation impact different living organisms the same way?</p> <p>Methods/Materials Lima beans and basil seeds, Active Dry yeast, Pots, Planting Mix, UV Sterilization lamp, Microwave Expose the basil, lima bean seeds, and yeast to 3 levels of UV (10 min, 60 min, 6h) and MW (20,40,60 sec) radiation. Keep a control for each type, with no exposure. Seeds: Plant the seeds. Take daily pictures since first sprout, and final measurements at the end. Yeast: Add yeast, sugar and warm water. Record height of yeast at 0,15,30, 45 min.</p> <p>Results MW exposure had a negative effect on the growth of lima beans. As the MW radiation level went up, the number of sprouted stalks decreased. There was no difference in number of stalks of basil seeds. Yeast exposed to MW radiation rose more and faster. UV radiation had a positive effect on the growth of plants. For the UV-exposed lima beans, all seeds sprouted to stalks. More stalks were observed for the UV-exposed basil, compared to the control. UV exposure did not effect the rising of yeast.</p> <p>Conclusions/Discussion Overall, our hypothesis that radiation affects both uni- and multicellular organisms, is true. Sometimes, the effect is positive, and sometimes negative. MW had a negative effect on growth of lima beans, did not affect the basil, but better for yeast. UV was better for the basil, but did not affect the yeast or lima beans. We learnt that radiation generally affects the sprouting, but not the actual height of the plants. For the yeast, radiation affected the speed of growth, more than the height.</p>	
Summary Statement Radiation alters the growth of living organisms in a good or bad way; this effect depends on the type of organism and the type and level of radiation exposure.	
Help Received We received help in ordering supplies. We also had help in exposing the yeast and plants to UV radiation, because it was dangerous for us. Our parents reviewed our data and plots and gave us advice on how we can make it more easy to follow.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) John M. Kale	Project Number J2210
Project Title Magnet Powers	
Abstract Objectives/Goals The goal of the project was to test the effect of magnetism on the regeneration of planaria. Methods/Materials Neodymium magnets measured at N42 and N52 (acquired from k&J magnetics), 100 millimeter Petri dishes and a planaria culture (acquired from Carolina Biological Supply). Results Multiple tests showed that the magnetism slowed the regeneration by at least 3 days compared to my control test. Conclusions/Discussion The results showed that magnetism had an acute effect on the regeneration. I conclude that strong magnetic fields can slow the growth of cells.	
Summary Statement I tested the effect of strong magnetic fields on the regeneration of planaria.	
Help Received None, I designed and conducted the experiment by myself	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Zoe A. Macknicki	Project Number J2211
Project Title Effects of Parking Lot Run-off on Mortality Rates of Freshwater Daphnia and Cyclops	
Objectives/Goals The project studies the effects of parking lot run-off on the mortality rates of freshwater Daphnia and Cyclops at the Arcata Marsh.	
Abstract Methods/Materials Log Pond marsh water, parking lot sediment, dissecting scope, glassware, boiling water, coffee filters. Using boiling water to extract the chemical pollutants from parking lot sediment, and adding additional measured sediment to the cooled soaking sediment sample to incorporate any bacteria, use a coffee filter to strain out sediment solids. Use a needless syringe to add filtered sediment run-off to samples of Log Pond water in a range of concentrations: 15mL/100mL, 20mL/100mL, and 40mL/100mL. Measure and observe 20 mL of each treated sample within each concentration to count Daphnia and Cyclops through a dissecting microscope. Observe daily for two weeks.	
Results In lower concentrations, the number of Daphnia and Cyclops decreased only slightly from the numbers in the control. In higher concentrations, Daphnia and Cyclops numbers decreased measurably and Daphnia was able to recover to nearly those of the control, while Cyclops numbers remained low.	
Conclusions/Discussion In times of drought or dry summers, carbon dioxide and chemical pollutants can be deposited in parking lots and, without rains to wash it away, can be flushed into the nearby freshwater ponds in high concentrations when storms do arrive. This study shows that Cyclops is sensitive to pollutants that run into the freshwater watershed by nearby parking lots. Daphnia is less sensitive to increased pollutants, but mortality rates in both Daphnia and Cyclops do increase as the concentration of pollutants increases. Because these organisms are producers, entire food webs can be affected by the decline of their populations. With a decline in Cyclops and Daphnia populations, the entire ecology of the Arcata Marsh (part of the nation's only ecologically responsible water treatment facility that uses microorganisms to clean the city's waste water) will be affected.	
Summary Statement As the concentration of parking lot run-off increases in freshwater ponds, the mortality rates of Cyclops increases significantly while mortality rates of Daphnia increase at a much lower rate.	
Help Received My science teacher taught me about calculating concentrations and how to use the dissecting scope.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Chloe E. Millar	Project Number J2212
Project Title The Effects of Organic vs. Inorganic Insecticides: The Ariolimax californicus's Ability to Locate Primary Food Sources	
Abstract Objectives/Goals The purpose of the experiment was to determine if organic v.s. non-organic insecticides affected the Ariolimax Californicus's ability to detect primary food sources. Methods/Materials 25 similar aged banana slugs, plastic bin (quarantine chamber), eco-earth substrate, (5) 16-inch flat surfaces, 2 inorganic, and 2 organic insecticides, timer, food source. Five 16-inch plots of dirt, 4 of them insecticide covered leaving one as a control, two of the pesticides organic, and two inorganics. Placing a food source at the opposite end, then timed how long it took each slug to reach the food. I used 5 slugs per pesticide, and never repeated one slug for two pesticides. Then averaged the scores for each insecticide to get my results. Results 25 banana slugs were separated into five groups to be tested whether organic vs. non-organic insecticides affected the time they were able to locate food sources, leaving one surface clear of insecticides as a control. 5 different slugs were tested for each insecticide. The inorganic insecticide sevin had the average of 17.828, a 10-minute difference to the control average of 7.736. The other inorganic pesticide Ortho got the average of 11.952, just under the organic average Captain Jack, 12.208. The last organic insecticide Dr. Earth averaged just under 10 minutes at 9.674. Conclusions/Discussion Based on the results concluded from our tested I can clearly state that insecticides do in fact affect the way banana slugs find food. I saw that with the highest average Sevin, was 10 minutes different from the control average. However, one of the inorganic insecticides had a lower average than an organic one, meaning it affected the slug less than an organic. This means there is not a clear distinction between inorganics and organics, however, there is a clear distinction between an insecticide opposed to none.	
Summary Statement By testing 4 different insecticides, 2 organic, and 2 inorganic, and then comparing the averages to the control, I was able to conclude that insecticides meant for insects (not slugs) affect the way that banana slugs find food.	
Help Received My science teacher helped me to narrow down my investigative question as well as having weekly meetings to discuss and critique out weekly progress. I was also given some helpful research papers about the Ariolimax Californicus slime trails by Jan Leonard and John Pearse, UCSC professors.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Charlotte E. Myers	Project Number J2213
Project Title The Effects of Petroleum-Based Fuel Oils on Aquatic Bryophytes	
Abstract Objectives/Goals The objective of this experiment was to determine the petroleum-based fuel oil that has the most negative effect on the growth of aquatic bryophytes. Methods/Materials The materials used in this experiment include gasoline, butane, kerosene, twelve 10-centimeter sprigs of hornwort, two agriculture lights, plastic containers, and a ruler. To perform my experiment, I measured and compared the growth rates of sprigs of aquatic plants submersed in different varieties of fuel oil over a period of ten days. Results The results of this experiment clearly showed that kerosene stunted the process of photosynthesis in aquatic bryophytes most severely. I found that the natural growth rate of nonvascular hornwort is approximately one millimeter per day. However, plants submersed in kerosene decreased in height dramatically due to partial detachment of the central stem caused by an inability to photosynthesize. The plants affected by gasoline and butane also showed signs of minimized photosynthesis, including a reduction of chlorophyll and leaf loss, but were more pronounced in the plants impaired by kerosene. Conclusions/Discussion My results allowed me to attain my objective, as I discovered that kerosene is the most dangerous fuel oil to aquatic bryophytes. This experiment provides a better idea of the impacts of oil spills on marine environments. Scientists may be able to more accurately assess the urgency and danger of an oil spill. Standards and regulations regarding the safe transportation of oil across the ocean can be improved and data about the environmental impacts of these oils can be updated with the research from my experiment.	
Summary Statement By measuring and comparing the growth rates of aquatic bryophytes submersed in different varieties of petroleum-based fuel oil, I determined that kerosene most severely inhibits photosynthesis in aquatic plants.	
Help Received I designed and performed my experiment independently, but I received assistance from my parents in obtaining my materials and from my biology teacher in explaining the scientific method. I also discussed aquatic bryophytes with employees at an aquatic plant retailer.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Jason E. Poole	Project Number J2214
Project Title The Effect Of California Wildfire Ash on the Ability of Tardigrades to Transition Out of Cryptobiosis	
Abstract Objectives/Goals To determine if California wildfire ash added to water effects tardigrades transitioning out of cryptobiosis. Methods/Materials A population of tardigrades was collected. Once collected they were then taken from active state and put into non active state/ cryptobiosis. Next, California wildfire ash was added to distilled water to tardigrades that were in cryptobiosis. After observing it was determined if ash had a effect on the transitioning out of cryptobiosis. Results The results of my investigation regarding if ash from California wildfires affects tardigrades transitioning out of cryptobiosis had no effect on the tardigrade population. The sample groups indicated that ash added to the tardigrades while in cryptobiosis did effect their transition out of cryptobiosis. Conclusions/Discussion My experiment proved that my hypothesis was incorrect and that ash from California wildfires did affect tardigrades from transitioning out of cryptobiosis. I wasn't specific with my hypothesis. I simply was thinking will the tardigrades transition, survive, or not survive. The amount of time it took for them to prove to be out of cryptobiosis was not a factor when I originally came up with my experiment idea and hypothesis. Although, the amount of time it took for the tardigrades effected by ash being longer than the tardigrades exposed to no ash means that ash did affect the transition.	
Summary Statement To determine if micro organisms are effected by ash when transitioning out of their dormant state.	
Help Received Professor Johansson	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Mansib Rahman	Project Number J2215
Project Title The Effect of Natural vs. Synthetic Insecticides on the Mortality Rate of Cockroaches	
Abstract Objectives/Goals The objective of this study is to test natural and synthetic insecticides on the mortality rate of cockroaches. Methods/Materials Used neem oil (2.5 mL), neem extract (2.5 mL), vinegar (2.5 mL), borax (2.5 mL), 30 cockroaches, 3 droppers, measuring teaspoon (2.5 mL), and 12 jars (8cm by 5cm). The dropper was used to get a measured 2.5mL of neem oil and put into the measuring teaspoon. Then it was poured into one of the jars. One cockroach was put in each jar. On a separate jar with no insecticides, a cockroach was put. Results Several trials were run with the same method. Out of all insecticides, neem oil (0.05 hr.) was found to be most effective, followed by neem extract (0.09 hr.), vinegar (0.09 hr.), and borax (36 hr.). Conclusions/Discussion The goal of this experiment was to test the effect of different types of natural and synthetic insecticides on the mortality rate of cockroaches. In the future, different dosages of neem oil and neem extract will be tested to find the minimum amount required to kill cockroaches without any harmful effects on other beneficial insects and pets.	
Summary Statement I used natural and synthetic insecticides to test the mortality rate of cockroaches.	
Help Received My teacher gave me the idea of using neem oil and neem extract. Overall I did the project by myself.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Aisha K. Randhawa	Project Number J2216
Project Title Cell Phone Radiation: Does a Radiofrequency Shield Boost the Lifespan of the Fruit Fly?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals There are known negative risks of cell phone radiation to health. Last year, my science fair experiment found that exposure to cell phone radiation decreases the lifespan of larvae and adult fruit flies. The current project investigates whether using a radiofrequency shield reduces the exposure of cell phone microwave radiation and preserves the normal lifespan of the fruit fly. My hypothesis is that the fruit flies exposed to cell phone radiation without a radiofrequency shield will have a shorter lifespan compared to the shielded ones.</p> <p>Methods/Materials I tested the RadioClear film (purchased from LessEMF.com) with a RF (radio frequency) meter to establish shielding effectiveness. I then exposed a newly hatched fruit fly to a shielded iPhone 6 with airtime on for 15 minutes daily. Ten fruit flies were exposed in each group. The second group was exposed to an unshielded iPhone 6 with airtime on and the control group was exposed to an iPhone 6 with airtime off. Each fruit fly was fed a slice of apple and a spoon of mashed potato mix and housed separately inside a plastic container with a breathable lid. During the 15 minute exposure, the cell phone was placed next to the container. Recordings were made daily to determine if the fruit flies were alive or had died.</p> <p>Results The RF meter showed a 900 fold decrease in the radiation emitted by the RadioClear shielded iPhone. The average lifespan was 13.1 days for the control group, 12.7 days for the shielded group and 8.3 days for the unshielded group. The difference in lifespan between the unshielded fruit flies and the control or shielded fruit flies was statistically significant.</p> <p>Conclusions/Discussion Using an RF meter, I demonstrated that the RadioClear shield significantly decreased the emitted cell phone radiation. The fruit flies exposed to the iPhone shielded with RadioClear lived nearly as long as the controls. Without the shield, the fruit fly lifespan decreased by 37 percent compared to the controls. The data shows the RadioClear shield mitigates potentially harmful cell phone radiation while preserving lifespan of the fruitfly. Shielding may have beneficial health effects for society given the extensive use of cell phones today.</p>	
Summary Statement This project shows that a radiofrequency shielding film mitigates the emitted electromagnetic radiation from a cell phone and prevents a decrease in the lifespan of Drosophila fruit flies.	
Help Received I completed the project myself. I purchased the RF meter and RadioClear Film using the award money I received from last year's California Science Fair. My science teacher and father helped me with guidance, putting the board together and performing statistical analysis using http://www.socscistatistics.com/ .	



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Arhan Rout; Aylin Salahifar	Project Number J2217
Project Title Using Adjuvants to Amplify the Effect of Organic Herbicides to Kill Undesired Plants	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of the experiment was to solve the issue of invasive species which compete for nutrients with desirable plants. As a solution, adjuvants can be added to herbicides to amplify their effects. We wanted to determine which adjuvant, Ammonium Sulfate, Ammonium Nitrate, or Urea + Ammonium Nitrate would enhance Avenger Organic Herbicide the most.</p> <p>Methods/Materials To test our question, we treated three Mentha plants with separate solutions of adjuvant and herbicide in three replicates. The control group was given only the herbicide. We decided to use chlorophyll as a measure of plant health. To attain a quantitative value, we designed a spectrophotometer that registered the intensity of light passing through liquid plant material on a photoresistor. We conducted this test at the beginning, midpoint, and end of the project. Finally, we connected a multimeter to record the final end point as resistance. A dying plant would have a lesser amount of chlorophyll. The lighter the pigment of green, the more light passing through the plant material was recorded on the photoresistor, which was displayed as less resistance on the multimeter.</p> <p>Results Throughout our experiment, the plants treated with Ammonium Sulfate had the greatest decrease from the initial to the final measurement in resistance, having an average of 425 ohms. The Urea + Ammonium Nitrate plants had the next greatest decrease in resistance, with an average of 264 ohms. The Ammonium Nitrate treated plants came in third for the greatest decrease, with an average of 229 ohms.</p> <p>Conclusions/Discussion The Ammonium Sulfate treated plants had the greatest average decrease in resistance because they had the highest Hydrophilic-Lipophilic Balance (HLB). The adjuvants used in the project are surfactants, which break the surface tension between the herbicide and plant leaf, allowing the herbicide to disperse throughout the plant. The HLB indicates the strength of the hydrophilic and hydrophobic tails of the surfactant and shows which ones are most compatible with certain herbicides. Ammonium Sulfate was the most successful, as the organic water-soluble herbicide required a surfactant with a higher HLB.</p>	
Summary Statement By measuring the chlorophyll content in Mentha leaves, we concluded that Ammonium Sulfate is the most effective adjuvant at increasing the penetration of an organic herbicide into the undesirable plant.	
Help Received Our mentor, Mrs. Kumar, helped us understand the mechanics of building a spectrophotometer, and guided us on how to quantify the data we received from it.	



CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

Name(s) Jack Terbush	Project Number J2218
Project Title The Effects of Wi-Fi Radiation on Raphanus sativus	
Abstract Objectives/Goals The purpose of this project is to determine if electromagnetic radiation (EMR) emitted by Wi-Fi routers adversely affects the health of radish plants (<i>Raphanus sativus</i>). The bigger question is does Wi-Fi radiation have adverse effects on the health of all living organisms, and studying plants is a first step in the quest to answer that question. Methods/Materials This experiment improves upon previous methodologies used to test the effects of Wi-Fi on plants, by better controlling and tracking the variables. Four trials were conducted, each trial simultaneously testing five plants with and five plants without Wi-Fi exposure. The Wi-Fi location was moved after each trial between the two test locations, in order to control for environmental factors and location bias. Both sets of plants were grown under fluorescent grow lights. Soil and water conditions were controlled across all trials. Plants were measured each day, for 14 days, for each trial. Results The data supported my hypothesis, showing that the health of the plants were negatively affected by exposure to Wi-Fi radiation. The average height of plants exposed to Wi-Fi was 8.565cm and those not exposed to Wi-Fi grew to 11.965cm, or 3.4cm taller. Also the plants exposed to Wi-Fi had erratic growth patterns and the leaves looked less healthy. Conclusions/Discussion Plants in the experiment were negatively affected by Wi-Fi radiation. Other studies have shown Wi-Fi radiation to have a negative impact on living organisms. More experiments need to be conducted to learn how Wi-Fi radiation impacts the health of plants and animals, in order to set limits and protective guidelines to protect the health of all living organisms.	
Summary Statement To test if man-made electromagnetic radiation (EMR) has adverse effects on living organisms.	
Help Received	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Lillian J. Todd	Project Number J2219
Project Title Kikuyu Grass Be Gone	
Abstract Objectives/Goals The objective of this study is to see if any common household substances can control Kikuyu Grass in established lawns. Methods/Materials Constructed a temperature and lighting-controlled greenhouse. Planted 10 trays with sod grass and Kikuyu Grass. Allowed the Kikuyu grass to establish and then introduced different household substances and measured their effects on both the Kikuyu Grass and the sod grass. Results Salt and baking soda were found to have the best result controlling the Kikuyu Grass. These substances also did serious harm to the established lawn grass. Ran a recovery phase to see if the lawn grass would recover. During the recovery phase the lawn grass treated salt recovered and the Kikuyu Grass did not. Conclusions/Discussion The tray treated with salt did the best at controlling Kikuyu Grass while allowing the desirable lawn grass to recover. It is important to control Kikuyu Grass since it is an invasive species and causes harm to parks, golf courses, and crops. I'd like to continue exploring salt to control Kikuyu grass keeping in mind the overall impact of introducing salt to an environment.	
Summary Statement I used household substances to control Kikuyu Grass in established lawn grass.	
Help Received My dad helped me design my greenhouse. I built the greenhouse myself. I choose the household substances and conducted the experiments myself.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Sofia S. Wallace	Project Number J2220
Project Title Acid Rain and the Food on Your Table	
Abstract Objectives/Goals It is well known that the burning of fossil fuels causes the acidification of rain. Plant life makes up the base of our food chain and food supply. We must understand the relationship between the acidification of rain and the health of our food supply. This study aims to evaluate the quantitative and qualitative changes in plant growth and health that acid rain causes to the Sugar Ann pea plant. Additionally, I explored the relationship of acid rain and the taste of the Sugar Ann pea plant. Methods/Materials Methods: In a controlled environment, 21 Sugar Ann pea plants were germinated. They were then divided into 7 groups of 3 plants. The plants were watered using pH levels ranging from 4.0-7.0 in 0.5 increments. Quantitative data (height) and qualitative (plant health) was then monitored over a 55 day growing period. The data was then analyzed using Microsoft Excel. A single blind pea taste study was completed at the end of the 55 day growth period. Materials: Sugar Ann pea seeds, regular water (pH 7.0), distilled white vinegar, electric pH detector, Microsoft Excel. Results Plant growth in terms of height was optimal in the pH 5.0-7.0 (neutral) range. Average plant height at the end of the growth period was highest in the pH 6.0-7.0 (neutral) range. No trend was found in the time to pea pod formation vs. pH (productivity) during the growth period. When qualitative plant health characteristics were analyzed across the range of pH values, a strong relationship was found. Significantly earlier and more frequent leaf wilting and crumbling was observed in the pH ranges 4.0-5.0 (acidic). The occurrence of weak plant tendrils was also much more frequent in the more acidic samples. No identifiable trend was found when soil pH vs. taste was evaluated. Conclusions/Discussion My experimental setup succeeded in demonstrating the threat that acid rain poses to our food supply. Even in my garage, with 21 plants and a 55 day growing period, my results showed the harmful effects of acid rain on the growth and health of my pea plants. The results of my experiment are conclusive evidence that the burning of fossil fuels which leads to acid rain will harm our plant supply. Leaders must make laws to reduce the burning of fossil fuels. This experiment can help to prove that these laws will protect our food supply.	
Summary Statement The effects of acid rain on the growth and health of the Sugar Ann pea plant.	
Help Received Eric Wallace, who is a biology major and is my father, helped me to create my model and analyze my data.	



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY**

Name(s) Isabella V. Worley	Project Number J2221
Project Title Are There Effective Alternatives to Full Strength Roundup?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I wanted to see if there are effective alternatives to full strength Roundup. If weeds are treated with various herbicides, my hypothesis is that ammoniated soap of fatty acid will be the most effective in killing weeds</p> <p>Methods/Materials I sectioned off 6 plots of weeds and sprayed the first section with a combination of 20% vinegar, orange oil, and soap, the second section sprayed with ammoniated soap of fatty acid, the third section sprayed with 20% of full strength Roundup, the fourth section sprayed with 50% of full strength Roundup, the fifth section sprayed with full strength Roundup, and the sixth section was the control. To avoid cross contamination each ingredient had its own sprayer. I observed and took pictures at hour 6, days 1 to 14, 21, 28, 35, 42, 49, and 56. I rated how each section did using a scale.</p> <p>Results Both natural herbicides showed rapid results, however, both did not have lasting effects due to regrowth of weeds occurring at the end of experiment. 20% vinegar, orange oil, and soap appeared dead at Day 1, while ammoniated soap of fatty acid appeared almost dead at hour 6. In both natural herbicides, regrowth of weeds started at Day 7. 20% of full strength Roundup showed no effectiveness throughout the experiment. 50% of full strength Roundup and full strength Roundup showed similar effectiveness on weeds at the end of experiment. Both 50% and full strength Roundup showed slow onset of killing weed and both showed no regrowth at end of experiment.</p> <p>Conclusions/Discussion The two natural herbicides had the quickest onset in killing weeds but regrowth of weeds occurred after 1 week. 50% of full strength Roundup showed similar effectiveness to full strength Roundup in how fast it worked on the weeds and how effective it was in killing weeds. In conclusion, only 50% of full strength Roundup and full strength Roundup appeared to be completely effective at the end of my experiment.</p>	
Summary Statement My objective is to see if there are alternatives to full strength Roundup.	
Help Received	