



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Maryam Bharucha	Project Number J2001
Project Title The Race to Relief: Which Aleve Pill Dissolves the Fastest?	
Abstract Objectives/Goals This experiment was performed to determine which type of pill dissolves in the stomach and reaches the bloodstream the fastest. The hypothesis was that the caplets and tablets would have the same rate of dissolution. Methods/Materials The pills used were Aleve Caplets, Aleve Tablets, Aleve Gel Caps, and, Aleve Liquid Gels. It was verified by simulating the stomach acid and comparing each pills rate of dissolution. Stomach acid was simulated by boiling off the water in fresh-squeezed lemon juice. The acidity of the modified lemon juice increased to have a pH between one and two. The pill was dissolved in the solution and the amount of time taken for complete dissolution was recorded. This was repeated for each of the pills separately. The experiment was repeated five times for a total of five trials per pill. Results The pills with the lowest dissolving rate were the gel cap pills, dissolving at an average of 3,508 seconds while the pills with the highest dissolving rate were liquid gel pills, dissolving at an average of 971 seconds. Conclusions/Discussion This suggests that the liquid gel pills have the fastest rate of dissolution in the stomach. It could be inferred that the medicine from the liquid gel pills would reach the bloodstream the fastest.	
Summary Statement My project is about the dissolution rate of the various types of Aleve pills in a simulated pH of the stomach acid.	
Help Received My mother supervised me while I conducted my experiment. My teacher, Selena Khan, advised on how to improve and perfect my project. She also proofread it before I printed the final copy.	



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) Akua Brown; Reiko Silva	Project Number J2002
Project Title What Nontoxic Substances Best Attract Ants?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Ants are considered nuisances because they infest our homes, businesses and schools. In the U.S. alone, ants cause billions of dollars of destruction every year. Scientists are trying to find new and effective methods to safely control ants. Information on food preferences and foraging habits are necessary for developing improved baits to control ant infestations. Our project was designed to test which common household substance would attract the largest quantity of ants. We hypothesized that bacon grease would be the most attractive to the ants based on the fact that pavement ants (<i>Tetramorium caespitum</i>) prefer grease and protein based foods. Our experiment was conducted on a sidewalk where pavement ants are one of the more common species to the region.</p> <p>Methods/Materials We tested 11 different household substances including water, turkey, In-N-Out hamburger meat, Nature's Domain dry cat food, bacon grease, McDonald's fries, Mother's Circus Animal cookies, guava jelly, Pixie Stix, maple syrup, and Elmer's liquid glue. Our control was water, because it is colorless, odorless, and tasteless. We chose our materials because they are non-toxic and generally found in both residential and commercial areas. We placed one tablespoon of each substance on strips of blue masking tape on the pavement. We counted the ants at 15 minute intervals for a period of 90 minutes. Twenty trials were conducted for a total of 30 hours of observation. To keep variables constant, we conducted our trials between 4 pm and 5:30 pm.</p> <p>Results Maple syrup attracted the greatest number of ants with a total of 10,225 ants observed (69%). Jelly came in second with a total of 3,503 ants (24%). Bacon grease was one of the least attractive substances with merely 56 ants recorded (0.4).</p> <p>Conclusions/Discussion Developers of ant bait can benefit from research about ants' food preferences to improve their effectiveness. Consumers of ant bait could also use this information to place the ant baits near a substance that would attract ants. After 30 hours of observation and counting 14,844 ants, our data did not support our hypothesis. The ants clearly favored sugar based substances, over bacon grease. With further research, it may be possible to create homemade ant baits using maple syrup or jelly to draw out ants and get rid of them. Use of nontoxic baits would eliminate the danger that poisonous baits pose to young children and pets.</p>	
Summary Statement Attracting more than 10,000 ants, we found that maple syrup attracts the most ants after testing common household substances.	
Help Received Our parents provided research materials, and together with our coach, Miss. Kendia Herrington provided guidance and supervision during our experimentation.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Phoebe L. Failor	Project Number J2003
Project Title Detecting Vitamin C in Fruits	
Objectives/Goals My hypothesis for detecting what fruit has the most vitamin C is that oranges will have the most. People always say how healthy oranges are for you and that they are Vitamin C rich.	
Abstract Methods/Materials Step 1: Gather all your supplies. Step 2: Create a starch mixture by making a paste with 1 tsp. of corn starch and 1 tbsp of cold water. Add paste to 1.5 cups of water in a small saucepan and bring to boil. Step 3: Creating the Control - Create Vitamin C solution by crushing 500 mg of a Vitamin C supplement and add 500 ml of water. Put 20 ml of the Vitamin C solution into a glass and mix in 1/2 cup of water. Stir in 1 tsp of the starch mixture. This will be the Control number. Step 4: Place one drop at a time of 2% Iodine into the Vitamin C solution, counting the number of drops it takes to turn the Vitamin C solution dark blue. As you add each drop of Iodine remember to stir it in. Count the number of drops and record this as your Control sample. Step 5: Testing Fruits # Squeeze 20 ml of juice from the selected fruit. Strain out any pulp. Place juice into a clean glass and add 1 tsp of the starch mixture, stirring to dissolve. Drip Iodine one drop at a time into the juice until the solution changes to dark blue. Record the number of drops. Step 6: Repeat Step 5 for each fruit you want to test. Step 7: Determining which fruit has the most Vitamin C # Calculate and record the Vitamin C content by dividing the number of drops used for each fruit tested by the control number to determine how much Vitamin C per ml each fruit has. Kiwi, Lime, Mango, Lemon, Orange, Tomato, Tangerine, Red Grapes, Raspberries, Green Grapes, Cups, Bowls, Iodine, Corn Starch, Eye Dropper, Science Journal, Tri-Fold Board, Measuring Cups, 500 mg Vitamin C Supplement.	
Results Based on my testing, the fruits with the most Vitamin C are listed from greatest to least: 1. RASPBERRIES # 0.5142 mg of Vit. C per ml. 2. TANGERINE - 0.4285 mg of Vit. C per ml. 3. ORANGE - 0.2857 mg of Vit. C per ml. 4. LEMON - 0.2571 mg of Vit. C per ml. 5. MANGO # KIWI - 0.2285 mg of Vit. C per ml. 6. LIME - 0.2 mg of Vit. C per ml. 7. TOMATO - 0.1142 mg of Vit. C per ml.	
Summary Statement Determining which fruit has the most Vitamin C out of ten selected fruits.	
Help Received My dad took me to get the materials and assisted me with typing.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Ryan C. Fong	Project Number J2004
Project Title Coffee: Hazardous for Consumption? An Investigation of Polycyclic Aromatic Hydrocarbons in Various Coffee Roasts	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The focus of my project is to determine if there are carcinogenic polycyclic aromatic hydrocarbons at harmful levels in brewed coffee. My hypothesis is that I believe that I will find detectable harmful levels of carcinogenic polycyclic aromatic hydrocarbons (PAH) in various brewed coffees.</p> <p>Methods/Materials Ten different brewed coffees were subjected for polycyclic aromatic hydrocarbon analysis. One liter of each coffee was extracted with dichloromethane using a continuous liquid-liquid extractor. After 18 hours, the dichloromethane coffee extracts were separated from the aqueous coffee part and concentrated. The samples were also cleaned using silica gel to remove non-polycyclic aromatic hydrocarbons compounds. The final sample extracts were analyzed using a gas chromatography mass spectrometer.</p> <p>Results All of the brewed coffees contained polycyclic aromatic hydrocarbons. Although there are many polycyclic aromatic hydrocarbons, only the high EPA profile compounds PAHs were analyzed for. Benzo(a)pyrene is one of the most potent PAH. Benzo(a)pyrene was detected between 0.017ug/L and 0.026ug/L. I also evaluated the total PAHs that I analyzed for. The total PAHs ranged from 0.048ug/L to 0.211ug/L.</p> <p>Conclusions/Discussion The results did support my conclusions, but levels were not high enough to exceed the maximum contamination level of Benzo(a)pyrene for drinking water criteria of 0.2ug/L. Although the coffee blends that were analyzed did not exceed 0.2ug/L Benzo(a)pyrene maximum contaminant drinking water limit, they did exceed California's Public Health Goal limit, which is 0.004ug/L. Moreover, in Europe the standards are usually more stringent. For example, the limit for Benzo(a)pyrene in consumer's tap water is 0.01ug/L. At that level, all of the brewed coffee roasts are above the European water threshold. For future project research possibilities, I may look at espresso type drinks since they are brewed at higher temperatures and pressures. I would also like to evaluate people who process coffees. Are they exposed more since they touch the coffee beans and can possibly inhale PAHs?</p>	
Summary Statement My project investigated the presence and levels of polycyclic aromatic hydrocarbons in coffee.	
Help Received Used lab equipment at Agriculture & Priority Polluants Lab with father's supervision. Starbucks donated coffee.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Sarah Rose George	Project Number J2005
Project Title Some Growing Media Are Better than Others for Growing Plants	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals If Bush Blue Lake Garden Beans are grown in a controlled environment using different fertilizers, then the results should indicate improved growth when using Roots Organics Soilless Hydroponic Coco Media.</p> <p>Methods/Materials Three different types of growing media were used to grow Bush Blue Lake Garden Beans: Fox Farm Ocean Forest Potting Soil and Roots Organics Soilless Hydroponic Coco Media, and soil collected from an empty housing lot. Ninety-six pots, 32 of each type of growing media, were filled and 3 bean seeds were planted in each pot. All pots were grouped on a table under florescent lighting and watered every 3-4 days. Height of all plants was measured weekly, for a total of 8 weeks, and recorded. Using the tallest plant in each pot; compared the height, number of leaves, and number of bean pods produced in each type of media.</p> <p>Results The bean plants grown in the Roots Organics Soilless Hydroponic Coco Media grew the tallest and produced the most bean pods of all three groups. The bean plants grew to an average height of 35.75 centimeters as compared to 27.78 centimeters grown in the Fox Farm Ocean Forest Potting Soil and 14.7 centimeters grown in the empty housing lot soil. The bean plants grown in the Roots Organics Soilless Hydroponic Coco Media produced an average of 2.47 pods as compared to 1.91 pods in the Fox Farm Ocean Forest Potting Soil and .84 pods in the empty housing lot soil.</p> <p>Conclusions/Discussion My hypothesis was correct. The Bush Blue Lake Garden Bean plants grew best in the Roots Organics Soilless Hydroponic Coco Media.</p>	
Summary Statement This project compares growth of bean plants and amount of harvest when planted in different growing media.	
Help Received My father helped me install the grow lights and adjust the height as the plants grew. My mother helped me stake the plants and took photos of each step of the project.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Jared R. Griffith	Project Number J2006
Project Title Toothpaste: Which One Really Works the Best?	
Abstract Objectives/Goals Objective: The purpose of this project was to determine which toothpaste really worked to protect the eggshell against the acidity of vinegar. Methods/Materials Materials and Methods: Seventy eggs were coated with the different brands of toothpaste and submerged in the same amount of vinegar placed in 9 oz cups and left for 24 hours. After the specified time had elapsed, the eggs were checked and the amount of remaining shell was noted in the log book. Results Results: The results proved the hypothesis to be incorrect. Instead of Colgate Paste working the best, Colgate Gel and Aqua Fresh protected the eggshell the best as evidenced by the amount of remaining shell on the eggs. Conclusions/Discussion Conclusion: In conclusion, Colgate Gel and Aqua Fresh were the toothpastes that protected the eggshell the most against the vinegar's acidity. This shows that those two toothpastes would protect the enamel coating of teeth against acid in daily diets.	
Summary Statement This project was to determine which toothpaste would protect the enamel of teeth the best.	
Help Received Mother helped complete the board.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Juhaina Habeebulla	Project Number J2007
Project Title Natural Preservative vs. Mold	
Abstract Objectives/Goals My objective was to determine if ginger would be a good natural preservative for home baked bread and its optimal storage condition. Methods/Materials Method: I baked 5 different loaves of home baked bread using the same exact basic ingredient. I added a specific quantity of ginger to one, honey to the second, cloves to the third, cinnamon to the fourth, and kept the fifth as it is for control. I also used one store bought bread to compare. After baking I sliced the different kinds of bread, placed them in Ziploc bags, labeled them and placed them in four different environments, counter top, dark room, moist, and refrigerator. I observed them on alternate days and kept track of the growth of mold through pictures and measurement. I repeated this process three times. Materials: home baked bread with honey, home baked bread with ginger, home baked bread with cinnamon, home baked bread with cloves, home baked bread with no natural preservative, store bought bread, cotton balls, Ziploc bags, and stationary materials as per needed. Results Ginger was not a good natural preservative as I had anticipated. Honey turned out to be the best natural preservative. The best storage condition was the refrigerator or the dark room. Conclusions/Discussion Ginger has been used for centuries as a natural preservative in food, which was the reason why I decided to test bread with ginger as a preservative. Out of all the different natural preservative ginger was the first to mold, therefore the least mold resistant. Honey was determined to be the best natural preservative. It was the last one to mold among the home baked bread. The best suitable storage environment was determined as refrigerator or dark room.	
Summary Statement My project is about finding a good natural preservative that could be used in bread which will increase its shelf life as good as store bought.	
Help Received My older sister helped me bake the breads; Mom helped me place it in zip loc bags and label them.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Katie I. Huston	Project Number J2008
Project Title Yeast + Sugar Substitutes: Rise or Fall?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project was to determine if it was possible to have yeast react when using the sugar substitutes aspartame (Equal), sucralose (Splenda), and saccharin (Sweet'N Low) and which would produce the most carbon dioxide. My hypothesis was that it is possible to get a reaction with yeast and sugar substitutes and that sucralose would work the best by creating more carbon dioxide.</p> <p>Methods/Materials A contraption was made to catch the carbon dioxide that the mixture of sweetener, yeast, and water may produce. A tube connected two bottles; one bottle contains the yeast mixture and the other bottle (upside down in a tub of water) would trap the carbon dioxide by displacing water from inside the bottle. Three trials each were done for sugar, Equal, Splenda, and Sweet'N Low. To measure how much carbon dioxide was trapped, I marked the water level, then filled the marked bottle with water up to the line and finally poured it over into a glass measuring cup. A formula was used to convert ounces into cubic centimeters.</p> <p>Results All three sugar substitutes reacted with the yeast. Aspartame (Equal) was the sugar substitute that worked the best when combined with yeast and warm water by producing the most carbon dioxide.</p> <p>Conclusions/Discussion I believed the artificial sweeteners would react with the yeast because their chemical makeup includes some of the same compounds as sugar. The experimental data supported the first part of my hypothesis in that I did get a reaction from sugar substitutes indicating that it should be accepted. However, the data did not support the second part of my hypothesis that stated sucralose would work best. Sucralose did not react the best indicating the second part of my hypothesis should be rejected. Aspartame (Equal) worked the best when combined with yeast and warm water.</p>	
Summary Statement My project is about determining if it is possible to have yeast react with the sugar substitutes aspartame (Equal), sucralose (Splenda), and saccharin (Sweet'N Low) and which would produce the most carbon dioxide.	
Help Received My mother helped me type my report and helped me glue information to my display board. My dad helped me build my contraption by drilling the hole in the cap.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Janelle M. Jordan	Project Number J2009
Project Title Dye Hard: Speeding Up the Coloring Process of Carnations	
Abstract Objectives/Goals "Let it soak for several days" read the instructions. Huh? By the time it would be fully colored, the carnation will be wilted. There must be a better way! So began my experimentation to determine if there was a method to rapidly colorize carnation flowers before they died. Methods/Materials White Carnation Flowers, Water, Vinegar (Balsamic, Rice, Distilled White, and Red Wine), Dye. After researching what substances are used when dyeing, I selected Vinegar as my chemical of choice. But, which type of vinegar, if my project did succeed, would speed up the process the most? Balsamic, Rice, Distilled White, or Red Wine? I mixed the dye with each vinegar, purchased Carnations, split the ends of the flowers and placed them in the mixture. Results The results of my testing did not support my hypothesis that balsamic vinegar would color the carnation the fastest and strongest. Conclusions/Discussion In my first testing I made many mistakes and although balsamic did well then, after testing more times, I found that it actually did not speed up the coloring process the most. I found that either white distilled vinegar or rice vinegar would be the best choice from the results. The next time i have a chance to take this project further, I would test it with blue food-coloring, to make sure that. If you wanted to change the color of white carnations to any color before they wilted or died, you could try this, in order to decorate a room, for photo shoots, or for a personal gift to a loved one. Then I charted how long it took each mixture to colorize the flower, on a color scale that i made, until saturation.	
Summary Statement Discovering ways to chemically speed up the process of colorizing carnations before they wilt	
Help Received Family took pictures for me - I typed my own report and designed/built my board.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Isaac Y. Kim	Project Number J2010
Project Title Stop and Listen: How to Prevent Hearing Damage While Listening to Popular Music on Your Smartphone	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Data showed one in five adolescents in United States have some form of hearing damage. A previous research showed that listening to personal music players at more than one hour per day each week at 85 decibel (dB) or more for at least 5 years can lead to permanent hearing damage. The objective of this project was, in order to avoid hearing damage using earphones, determine safe volume settings for two most popular smartphones while listening to top 10 songs of 2012.</p> <p>Methods/Materials Using a digital sound level meter, measurements were taken over 180 second period to determine average sound level and a maximum sound level while playing 10 songs using Apple iPhone 5 and Samsung Galaxy S III with manufacturer supplied earphones at various volume settings.</p> <p>Results At 100% of maximum volume setting for both smartphones, not only all 10 songs' average sound levels were above 85 db, but majority of them were above 100 db, which is not only a sound of jackhammer at 1 meter, but also 64-fold above what is already considered dangerous at 85 db. At 75% of maximum volume setting for iPhone 5 and at 80% for Galaxy S III, average sound level for 7 out of 10 songs for iPhone 5 and 10 out of 10 songs for Galaxy S III were above 85 db. None of the songs' average sound levels were above 85 dB at around 50% of maximum volume setting.</p> <p>Conclusions/Discussion To avoid hearing damage using earphones, one should never set volume level above 75% of maximum volume of the smartphones. Listening to songs at or below 50% of maximum volume setting is safe. Listening to music above 85 dB is not a mere personal choice, but a health hazard. Without conscious effort by adolescents and adults to control volume of the music, more adolescents are likely to suffer hearing damage in the future.</p>	
Summary Statement To prevent hearing damage using earphones, determine safe volume settings for two most popular smartphones while listening to top 10 songs of 2012.	
Help Received Father helped supplying the materials and designing of the board. Actual research done by the student.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Kerris L. Lassley	Project Number J2011
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Project Title
Which Household Substance Will Increase the Ice Nucleation Process of Dew on Oranges?

Abstract

Objectives/Goals
The purpose of my science project is to determine which household substance will increase the ice nucleation process of dew on oranges. The reason I am doing this investigation is to find out how to speed up the freezing process of dew on oranges. By doing this I will find a method for farmers to protect their crops from frost damage, which causes farmers to lose thousands of dollars each year.

Methods/Materials
1.LABELS 10.FLOUR
2.FREEZER 11.DISH SOAP
3.SPRAY BOTTLE 12.SALT
4.MEASURING CUP 13.FLOUR
5.MEASURING SPOON 14.SUGAR
6.FREEZER THERMONITER 15.BAKING SODA
7.HYDROMETER 16.KNIFE
8.REFRACTOMETER 17.JUICER
9.BEAKER 18.WATER

I am using water droplets in my investigation to determine how to speed up the freezing process of dew on oranges. In the first group for my control I will be spraying plain droplets of water on oranges and placing them in the freezer and time it to see how long it takes for frost damage to occur. Then I will record results in a data book. I will repeat test with salt, baking soda, flour, sugar, and dish soap. Performing 10 tests per variable.

Results
The results of my investigation to determine which household substance will increase the ice nucleation process of dew on oranges show that all of my variables increased the freezing process, causing less damage to the oranges.

Conclusions/Discussion
After completing my project, which household substance will increase the ice nucleation process of dew on oranges, I have found my hypothesis to be incorrect. The dish soap did increase the process of freezing on oranges however the flour was most effective. Water by itself froze quickly, and caused significant damage in 24 hours, along with the other solutions. The baking soda, sugar, dish soap, and salt solutions did increase the freezing process slightly, causing less damage to the oranges.

Summary Statement
I have tried to speed the freezing process by adding household substances to water to see if it increases the freezing process which will allow smaller ice crystals to form causing less damage to the fruit.

Help Received
Mother helped with typing



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Henry G. Low	Project Number J2012
Project Title Fungus Busters: Which Antifungal Agent Is the Most Effective?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Fungal infections such as athlete's foot, ringworm, and jock itch are very common problems. To counteract these infections, one must use antifungals. There are many different antifungals that you can get at local pharmacies. In my project, I tested three of the most common antifungals: clotrimazole, terbinafine, and tolnaftate. The objective was to find out which of these three antifungal agents is the most effective at killing fungi.</p> <p>Methods/Materials First, I built a gas collecting system to collect the CO₂ created by yeast, the fungus I used. The gas collector consisted of graduated cylinders, buckets, water, bottles, and tubing. To find the effectiveness of the antifungals, I measured how each medication affected the amount of CO₂ produced by the yeast. For my control group, I created a yeast mixture and poured it into the sealed bottle. The yeast produced CO₂ which displaced the water in the graduated cylinder. I waited 20 min. and then measured the water displacement in milliliters. The process was repeated with each antifungal agent mixed into the yeast. I conducted three trials for each antifungal agent and the control group.</p> <p>Results The amount of CO₂ correlated with the amount of yeast in the bottle: the more effective the antifungal was, the less CO₂ that was produced. Clotrimazole had an average water displacement of 128 mL, terbinafine had 133 mL, tolnaftate had 199 mL, and the control group had 240 mL.</p> <p>Conclusions/Discussion My hypothesis that terbinafine was the most effective antifungal agent was proven incorrect. Clotrimazole was actually the most effective, terbinafine was second, and tolnaftate was the least effective. If you ever get a fungal infection, I would recommend using a medication that has clotrimazole as its active ingredient.</p>	
Summary Statement In my project, I tested the effectiveness of three different antifungal agents in killing fungi.	
Help Received My parents helped me to assemble the gas collector and also took pictures of my experiment.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Fiona L. Robbins	Project Number J2013
Project Title An Orange a Day Keeps the Doctor Away!	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to determine the various Vitamin C levels in differing orange juice samples (bottled orange juice, frozen orange juice, and freshly squeezed orange juice), and how or at what rate those Vitamin C quantities increase or decrease over time.</p> <p>Methods/Materials The data was obtained by titrating juice from Minute Maid orange juice samples as well as freshly squeezed orange juice. This procedure took place when the titrant (orange juice) was added to the indicator solution (iodine) until the indicator solution's color changed, reflecting the endpoint of titration and the Vitamin C level in the orange juice samples. Additionally vice versa when one drop of the titrant (iodine) was added once a day for two weeks to the indicator solution (orange juice) until the indicator solution's color changed reflecting the endpoint of titration and at what rate the Vitamin C quantities increased or decreased over time.</p> <p>Results The data showed that the freshly squeezed orange juice did, as my hypothesis stated, have the highest initial Vitamin C level having the most drops in average, 73, of the titrant (orange juice) needed to turn the indicator solution (iodine) colorless, while both the frozen and bottled orange juices needed lower amounts of drops to turn the indicator solution colorless. In addition, it did have its Vitamin C level deteriorate fastest with an average of 8 days until the titrant (orange juice) lost its color, this explaining the oxidization- reduction reaction theory.</p> <p>Conclusions/Discussion My experiment exhibits that people are getting less Vitamin C from a cup of their "favorite" store-bought orange juice compared to freshly squeezed orange juice (as my hypothesis was proved correct with freshly squeezed orange juice having the highest concentrated Vitamin C level, and having its Vitamin C level decrease fastest). Vitamin C is required for various metabolic reactions in humans, animals, and plants. My experiment is consequential to the real world because it shows people that the store bought juices they are drinking are less nutritious. It might be worth the extra effort to squeeze your own juice if you will be consuming it within 8 days.</p>	
Summary Statement My project is about the variations of concentrated Vitamin C levels in disparate orange juices.	
Help Received none	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Karishma Shah	Project Number J2014
Project Title Bacterial Colonization on Apples and the Efficacy of Various Cleansing Methods	
Abstract Objectives/Goals The objective of this experiment was to measure the growth of bacteria on apple surfaces and compare the effectiveness of a plain water rinse to a commercially available fruit and vegetable cleanser, Veggie Wash, at reducing bacterial counts. Methods/Materials A total of 80 apples were tested in this experiment. Each apple was cut into three pieces and each petri dish was divided into three sections. A sterile cotton-tipped swab was used to wipe the surface of one of the apple slices without cleaning it at all. It was then used to inoculate one section of the petri dish. This served as the control. The surface of the second piece of apple was rinsed with Arrowhead brand bottled water and swabbed on the second section of the petri dish. Next, the surface of the third apple piece was washed with the fruit and vegetable soap Veggie Wash and swabbed on the third and last section of the petri dish. This procedure was repeated for each apple (each apple having one slice for the control, one for the plain water rinse, and one for the Veggie Wash rinse) and petri dish in the first trial. The petri dishes were then placed in an incubator set to 37 degrees Celsius for 6 days. Every day, the bacterial colonies were counted, recorded, and photographed. Each trial contained 10 apples. A total of 8 trials were conducted. Results Overall, the average bacterial colony count in the untreated, control group was 7.75. The average bacterial colony count in the group that was treated with plain water was 1.7. The average bacterial colony count in the group that was treated with Veggie Wash was 2.2. Conclusions/Discussion Apples are one of the most popular fruits in the United States, but they happen to be among the dirtiest as well. This experiment demonstrated that there is a considerable amount of bacterial growth from the surface of apples that are bought from the grocery store. Rinsing the apple surfaces with plain water was found to be just as effective at removing bacteria as Veggie Wash.	
Summary Statement This experiment compared the effectiveness of a fruit and vegetable cleanser (Veggie Wash) to a plain water rinse at removing bacterial on apple surfaces.	
Help Received Ms McCabe (science teacher) provided advise and loaned incubator; Parents helped purchase supplies; Brother helped take photographs	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Reena M. Somani	Project Number J2015
Project Title Sweeteners and Sweetness: Is There a Non-Harmful, but Tasty, Sweetener for Teens?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective is to compare the tastes and safety of popular brands of sweeteners and find a non-harmful, but tasty sweetener that the teens will like. My hypothesis is Truvia will be the least harmful because it is obtained from natural substances. But, because it is made of a leaf extract, it may not taste good.</p> <p>Methods/Materials Four popular brands of sweeteners (Sweet N Low, Equal, Splenda, and Truvia) were selected for the taste experiment, and solutions were prepared for each sweetener by dissolving 1 packet in 240ml water. 3ml of each solution were measured with a dropper and 6 samples were prepared for tasting of sweeteners. After cleansing the palate, 3 male and 3 female subjects were told to taste randomly placed samples and record their results on a scale of 1 to 5, compared to the solution of cane sugar. Experiment was repeated 3 more times. Extensive research was performed to gather information about these sweeteners, paying particular attention to safety of use.</p> <p>Results Equal's taste was consistently very close to sugar, while Sweet N low was rated extra sweet by all subjects. 5 out of 6 subjects liked the taste of Truvia, whereas Splenda was noted to have a weird, bitter after taste. Safety research indicated Truvia was the least harmful sweetener, showing no toxic effects in diabetic or non-diabetic people. Other sweeteners have been linked to cause bladder cancer, lymphomas, and leukemia in rats; minor genetic damages in mouse cells, suppressing beneficial bacteria, and interfering with certain drugs.</p> <p>Conclusions/Discussion My hypothesis was proven partially incorrect, as 5 out of 6 subjects liked the taste of Truvia. While Splenda claims that it is made from sugar, it does not taste like sugar because of the three chlorine molecules, which make it 600 times sweeter than sugar, leading to taste bud desensitization. Since Equal and sugar taste so similar, many companies have been adding it to several drinks, such as diet sodas, even though it is the most controversial of sweeteners. Research indicated that Truvia showed no side effects in diabetic or non-diabetic people. In fact it helps feed beneficial micro flora in the gut for a healthy immune system. Since it is fairly new, long term human safety studies are warranted. In conclusion, if you are diabetic, you may need to use a sweetener to keep your blood sugar in check, and, in that case, Truvia looks promising.</p>	
Summary Statement Project compares taste and safety of different sweeteners and shows that Truvia, which is made from natural leaf extract is least harmful and tastes better, but its use must be limited until it is proven safe in long term human studies.	
Help Received Mom helped with poster board, typing, and supervised my experiment; Sister helped with statistical analysis; Dad and Grandma helped with Journal.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Makena K. Stimmler	Project Number J2016
Project Title Luscious Lips! Testing Lip Care Products for Moisture Retention	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This science experiment tests what lip care product would preserve the most moisture in humans# lips over a two hour period. There are so many different types of lip care products, but this experiment narrowed the products down to the three most recognizable types of lip care products: lip balm, lip gloss, and lip butter. I believed that applying lip butter to ficus leaves would result in the longest preservation of moisture rather than lip balm, lip-gloss, or lip wax because the lip butter has a larger amount of oil compared to the other products.</p> <p>Methods/Materials Lip Balm, Lip Gloss, and Lip Butter are the lip products used in this experiment. Lip wax was also included in this project because it acted as a constant lip protectant since all the lip care products in the experiment use beeswax as an ingredient. Ficus leaves acted as lips in this experiment because research found that both human lips and the leaves contain several different branching veins and require constant care and attention. Place the measured amount of lip balm into the desired measurer. Scoop the lip product out of the measurer and onto the correct leaf. Spread the product evenly around the leaf. Take the measurement of moisture percentage for each leaf by placing both pins of a moisture meter directly left of the leaf#s primary vein. Each measurement must be taken directly in the same holes that the meter#s two pins originally pierced during the first measurement. Set a timer every ten minutes and repeat taking measurements until 120 minutes have been obtained. Repeat trial twice more for a total of three trials using three intensities: .63 milliliters, 1.25 milliliters, and 2.5 milliliters of each lip care product.</p> <p>Results For the first intensity, each lip care product#s total lost moisture was: lip balm lost 5.7%, lip-gloss lost 3.6%, lip butter lost 4.5%, lip wax lost 5.7%, and the control lost 6.8%. In the second intensity, each lip care product#s total lost moisture was: lip balm lost 4.3%, lip-gloss lost 1.8%, lip butter lost 2.9%, lip wax lost 6.2%, and the control lost 5.7%. For the final intensity, each lip care product#s total lost moisture was: lip balm lost 4.7%, lip-gloss lost 2.8%, lip butter lost 3.7%, lip wax lost 4.7%, and the control lost 4.3%. Overall, lip-gloss preserved the most moisture while lip wax preserved the least moisture. In conclusion, my hypothesis was not supported.</p>	
Summary Statement My science fair project tests four different types of lip care product to see which one will retain the most moisture over a two-hour period.	
Help Received	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Jolie M. Stoner	Project Number J2017
Project Title Burning Calories	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My project was to determine which after school snack has the most calories. I believe potato chips will have the most calories.</p> <p>Methods/Materials Using a homemade calorimeter, I burned a small amount of 6 different afterschool snacks. I then measured the heat released by each snack sample as the heat was absorbed by a water bath.</p> <p>Results Almonds had the most calories because they burned the longest and had the greatest average temperature difference. The Special K Snack Bar had the least calories.</p> <p>Conclusions/Discussion My conclusion is that almonds have the most calories out of the snacks that I tested. I thought oily potato chips, a junk food, would have the most calories.</p>	
Summary Statement My project tested the calorie content in various afterschool snacks.	
Help Received Mother helped me type report; Father helped me construct calorimeter, produce charts, and supervise fire safety.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Sage A. Strieker	Project Number J2018
Project Title Put the Fire Out: Choose an Antacid That Stops Your Heartburn	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective was to design a system that would help people decide which antacid to take when they suffer from occasional heartburn. To do this, I created a six-step system for evaluating overall antacid quality, and I tested it on six antacids. On the basis of my research, I thought that Tums, which contains calcium carbonate as its only active ingredient, would rank highest in overall antacid quality.</p> <p>Methods/Materials Two separate criteria determined overall antacid quality: the average speed of action of an antacid and the lowest average effective portion of its recommended dose. I created simulated gastric juices and used them to test the six antacids in these two areas. Next, I assigned each antacid two performance numbers: one for the speed and one for the dosage. Finally, for each antacid, I added the two numbers and ranked the antacids according to the totals. This was my ranking of the antacids for overall quality.</p> <p>Results For overall quality, Tums ranked first; Walgreens Original Antacid Tablets ranked second; Di-Gel, Gaviscon, and Gelusil tied for third; and Brioschi ranked fourth. For average speed of action, Tums ranked first, Walgreens ranked second, Gaviscon ranked third, Di-Gel ranked fourth, Gelusil ranked fifth, and Brioschi ranked sixth. Tums and Walgreens tied for the lowest average effective portion of the recommended dose. They were followed by Gelusil, Di-Gel, Gaviscon, and Brioschi, in order.</p> <p>Conclusions/Discussion Each antacid contained one or more of four main active ingredients, which, I believe, influenced my results. Tums, with calcium carbonate only, had the highest overall quality, which confirmed my hypothesis. Next was calcium carbonate with magnesium hydroxide (Walgreens), aluminum hydroxide with magnesium hydroxide (Gaviscon, Di-Gel, and Gelusil), and sodium bicarbonate (Brioschi). Since the antacids performed so differently in the two areas, it might be helpful to expand this system by including more factors that people consider when they buy antacids.</p>	
Summary Statement In my project, I designed a system to help people suffering from occasional heartburn to choose the antacid that is best for them.	
Help Received Nick explained pH meter. Mike and Ron helped with large images for display board. Mother shopped, helped prepare items for display board, proofread, diluted pH Down with water, ran stopwatch. Aunt helped with proofreading, editing, and formatting report.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Serena E. Tang	Project Number J2019
Project Title Investigating the Concentration Levels of PCBs in Farmed Fish Feed	
Abstract Objectives/Goals The focus of my project was to investigate if two of the most widely used brands of fish feeds, Rangen and EWOS, are one of the major sources of Polychlorinated Biphenyl (PCBs) contamination in farmed salmon. Prior research studies indicate that wild-caught salmon contain fewer PCBs than farm-raised salmon. Therefore, I hypothesized that both Rangen and EWOS fish feeds will contain PCB contaminations of at least 0.05 parts per million. Methods/Materials First, the collected samples were separated and properly labeled. The PCBs (if any) were then extracted from the samples by using a Methylene Chloride/acetone solvent. These extracts were concentrated by evaporating the Methylene Chloride/acetone solvent with a Rotovap. Then, the MC/acetone solvent was exchanged into Hexane solvent. Acid was then added to the samples in order to remove the organic components and clear up the solvent. After that, the solvent was put onto a Gas Chromatography (GC) instrument for analysis. Results No PCBs were found in either brand of fish feed, Rangen nor EWOS. Conclusions/Discussion My experiment concludes that Rangen and EWOS fish feeds are not one of the major sources of PCB contamination in farmed salmon.	
Summary Statement To investigate if Rangen and EWOS fish feeds are one of the major sources of Polychlorinated Biphenyl (PCB) contamination in farmed salmon.	
Help Received I used the facilities and equipment at Appl Labs; mentored there by Sharon Dehmlow, Danielle Abrahms, Monica Aguilera, and Leonard Fong. Jennifer Weibert and my mother helped me with my board layout. Jonathan Bowns, Kay Barrie, and Jennifer Weibert assisted me with editing.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Harley Q. Thompson	Project Number J2020
Project Title Mercury Canned from the Sea	
Abstract Objectives/Goals The objective of this project was to determine mercury concentrations in packaged tuna and to see if it is within safe levels to eat. Methods/Materials Tuna samples in cans and pouches were collected and analyzed on a DMA-80 Direct Mercury Analyzer. Mercury concentrations were compared to the Fish Containment Goal for mercury adopted by the California Department of EPA. The concentrations were also compared by cans vs. pouches, albacore vs. light tuna, and oil vs. water. Results Mercury concentrations in tuna varied widely. In this study, mercury concentrations ranged from 0.000 to 0.674 $\mu\text{g/g}$. The largest difference was between albacore and light tuna, with albacore having greater amounts of mercury. Out of 35 samples, 49% were greater than the Fish Containment Goal of 0.220 $\mu\text{g/g}$ and 7% were over the limit of no consumption. Conclusions/Discussion You should know about mercury levels in tuna because mercury is a toxic chemical that has shown to be a health hazard. The data from this project shows that mercury concentrations can be greater than limits set by the EPA for consumption. The data suggests that light tuna packed in oil has the least amount of mercury.	
Summary Statement Mercury concentrations in packaged tuna.	
Help Received Mother helped make figures; Used lab equipment to analyze samples at Marine Pollution Studies Lab at Moss Landing Marine Labs under the supervision of analyst Jessica Mesek.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Shannon R. Woodside	Project Number J2021
Project Title Sugar Affects Homemade Marshmallows	
Objectives/Goals In my hypothesis, I believe if I use different types of sugar in a marshmallow recipe then the melting, cutting and density tests will have different results because of the sugar composition. The types of sugars were C&H Granulated sugar, C&H Powdered sugar, C&H Light Brown sugar, C&H Washed Raw sugar, C&H Baker's sugar, C&H Superfine sugar, and Sunny Select Sucralose sugar.	
Abstract Methods/Materials My marshmallow recipe contained 3 steps: "blooming" the gelatin, making the sugar syrup, and combining the two mixtures together. Then the mixture was mixed for ten minutes. It was poured in a container and was untouched for four hours. For the melting test, an 8 gram marshmallow was put in two cups of boiling water(100 C). For the cutting test, an 1 inch marshmallow was cut at the edge of a cheese slicer with quarters. For the density test, a square marshmallow was weighed and volume measured.	
Results My three tests gave different results 1. The melting test showed that C&H Powdered sugar took 1.30 minutes to melt while C&H Superfine sugar took almost twice the amount at 3.00 minutes. 2. The cutting test showed that C&H Granulated sugar took the least amount of quarters to cut at 3 and C&H Powdered sugar took the most at 30. 3. The density test showed that C&H Granulated sugar was the most dense at 0.48 grams per cubic centimeters and C&H Baker's sugar was the least dense at 0.18 grams per cubic centimeters.	
Conclusions/Discussion After testing each of the seven sugars three times (21 batches), I realized that the composition of each sugar effected the melting, cutting, and density of the marshmallow.	
Summary Statement The purpose of my project was to find how different sugars effected my marshmallow recipe.	
Help Received Parents helped proofread my writing, helped with my tests, and display board.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Nolan W. Yamada	Project Number J2022
Project Title Which DoTerra Essential Oil Is Most Effective in Killing Bacteria in the Oral Area?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals My objective was to determine which DoTerra essential oil was the most effective in eliminating bacteria in the oral area</p> <p>Methods/Materials I used sterile swabs to wipe Bascilus Subtilis on petri dishes then dipped filter paper circles to dip in the essential oil and place in the petri dish. I then inverted them for 48 hours. Afterwards I gave my coach all the harmful bacteria for proper disposal.</p> <p>Results My study found that the DoTerra essential oil lemongrass killed the most bacteria but when tested against oral bacteria it killed little to no bacteria.</p> <p>Conclusions/Discussion In conclusion my research found that my project was incorrect. I should have used a wider range of oils, bacteria and nutrients. I also should have started my project sooner so I could have done more trials</p>	
Summary Statement My project is about discovering which DoTerra essential oil is best to kill bacteria.	
Help Received Mom bought all supplies. Mrs. Loflin suggested what supplies to get and she read over my drafts.	



CALIFORNIA STATE SCIENCE FAIR 2013 PROJECT SUMMARY

Name(s) Allison G. Raymundo	Project Number J2097
Project Title Organic Substitutes for Antibacterial Hand Sanitizer	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Antibacterial solutions, such as alcohol and the chemical triclosan, are found in hand sanitizers and antibacterial hand soaps. These chemicals are potentially dangerous to human and animal health, and the environment. Instead of using those chemicals why not use a natural substitute that's good for the planet and not dangerous to your health? In order to do that we need natural substitutes that are just as effective as the chemicals. This experiment tests three main oils that supposedly have antibacterial properties and compares them against store bought products that contain chemical antibacterials. The main research question was: How do natural alternatives compare to chemical and store bought antibacterials?</p> <p>Methods/Materials Household bacteria was collected and grown in petri dishes with nutrient agar. Then several natural (grape seed, coconut, and tea tree oils, witch hazel, Clean Well) and chemical antibacterials (Purel, bleach, triclosan soap) were applied to the bacterial colonies. Petri dishes were photographed before and after. Visual results were recorded and compared.</p> <p>Results The results of the first experiment showed few visible results, even with known, proven store bought antibacterial products. In a second experiment, using larger amounts of each antibacterial, I found visible results with witch hazel appearing to have the best results. Overall, no product completely destroyed the bacteria colonies.</p> <p>Conclusions/Discussion None of the hypotheses were proven correct and the results were unexpected. It is surprising that the three store bought products had little to no effect on bacteria colonies. I expected instant or fast visible results from these products. When I did not, I attempted a second experiment including bleach. While bleach did have an instant effect, after it evaporated its effects did not continue, leaving many colonies behind. Similarly, antibacterials when added in larger quantities worked better; However, like the bleach, the effect did not last after 15 minutes. The exception to this result was the witch hazel, which continued to show some antibacterial effects after 2 hours. This could be due to the fact that the witch hazel did not evaporate. While the oils do not evaporate, the visible effects did not continue after 15 minutes.</p>	
Summary Statement This experiment tested organic antibacterials against chemical store bought antibacterial hand sanitizer to determine if natural substitutes could be used in place of potentially dangerous chemical and alcohol based hand sanitizer.	
Help Received Mother helped photograph experiment and assisted in putting together the display board.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Andres S. Gonzalez	Project Number J2098
Project Title Which Household Product Will Preserve a Carved Pumpkin from Developing Mold and Dehydration?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The purpose of this experiment is to determine which household product will preserve a carved pumpkin from developing mold and dehydration. The main concern with carved pumpkins is to fight off the inevitable mold that begins to grow on the pumpkin flesh and destroys the pumpkin from the inside.</p> <p>Methods/Materials I decided to conduct my experiment in two parts. During the preliminary test I tested 20 household products and compared them to my control which had no product added. These products included: water; soapy water; Clorox Bathroom Cleaner; Windex; vinegar; hairspray; alcohol, Lotrimin, vegetable oil; Neosporin, Clorox Antifungal Cleaner, lemon; lime; white glue; hydrogen peroxide; Tinactin; sealer; Polysporin; vaseline; and bleach. Once the product was applied I measure the loss of mass and the area of the top square on the pumpkin cube daily for seven days. From the preliminary test I identified five products that worked best. I then used these products in a final test where the pumpkin cubes were cut larger than the preliminary test and were measured the same way for a total of 21 days.</p> <p>Results My hypothesis was that Clorox Antifungal Cleaner would best preserve the pumpkin flesh from dehydration and mold growth by maintaining the highest mass and the highest area of the top square on the pumpkin cube. My hypothesis was not supported by the data from this experiment. The data showed that Polysporin preserved the pumpkin flesh the best. This product maintained the highest mass and the largest area from the top square on the pumpkin cube. By day twenty-one Polysporin lost an average mass of only 4.40 grams while the Clorox Antifungal Cleaner lost an average mass of 13.4 grams. By day twenty-one Polysporin lost an average area of only 0.700 cm², while Clorox Antifungal Cleaner lost 4.70 cm² of its average area.</p> <p>Conclusions/Discussion If a pumpkin needs to be preserved for over 3 weeks Polysporin does an amazing job. The only drawback to this product is that it is expensive. A tube of Polysporin that contains 14 grams and can cost close to five dollars. Theme parks and other businesses that profit from customers would likely be willing to spend the cost of coating their carved pumpkins with Polysporin, but your average family is better off soaking the pumpkin daily in water and 1% Clorox Antifungal Cleaner.</p>	
Summary Statement To determine which household product will preserve a carved pumpkin from developing mold and dehydration.	
Help Received My mom helped me cut the pumpkin cubes so they were the same size. My dad helped me add electrical lights to my board.	



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Shayle Gupta	Project Number J2099
Project Title Physical Block vs. Chemical Screen: Which Type Is More Effective?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Ultraviolet (UV) light from the sun causes damage to human skin cells that may destroy the ability of the skin cells to control cell division, leading to types of skin cancer. Thus, people are encouraged to protect their skin from the potentially harmful effects of UV light by using protective creams. Chemical screens and physical blocks have different ingredients that work in different ways. The screens only protect us from some of the harmful rays (UVB), while the blocks protect us from almost all of the harmful rays (UVA and UVB). With enough sun exposure, UV light is lethal to bacteria. In this experiment, I compare different kinds of ingredients to evaluate their effectiveness to protect bacteria from the effects of UV light. I use bacteria as a substitute for the human skin in this experiment. I will test the ability of the creams to protect the bacteria from sunlight, and then use that information to consider the effect of the same cream on human skin.</p> <p>Methods/Materials This is a two-week experiment. Week 1: I inoculated Petri dishes with bacteria that I swabbed from my mouth. I waited 1 week to let them grow. After this first week, I performed a colony count. Then, I measured 1.0ml of each cream for the Petri dishes and then covered them with this covering of sun protection. I exposed the dishes to UV light (the Sun) with them all having the same exposure time. I then again waited a week and let the UV light kill some of the bacteria. After the second week, I again performed a colony count of those bacteria that survived exposure to the UV light. The experiment required a total of 16 Petri dishes: 6 unprotected controls (2 no bacteria, 2 no UV exposure, 2 with UV exposure), 6 for chemical screens, and 4 for physical blocks.</p> <p>Results Creams with zinc oxide and titanium dioxide protected bacteria from the sun. Dishes protected with Zinc Oxide had the most bacteria survive UV rays. Titanium Dioxide (the other physical block) also protected the bacteria well. The chemical screens were all less effective in protecting the bacteria from UV rays.</p> <p>Conclusions/Discussion Physical blocks deflect UV rays while chemical sunscreens absorb and convert UV rays thus your skin is less damaged by the UV rays compared to no protective cream. Physical blocks such as Zinc oxide and Titanium dioxide protect best from the sun's UV rays. While it is good to wear a sunscreen, it is best to wear a sunblock.</p>	
Summary Statement This research tested the different efficacy of sun protectant ingredients to block the ultraviolet light killing of bacteria used as a proxy for human skin protection of cancer-causing sun damage.	
Help Received This project was my concept, but my parents helped with the typing and photography. My father helped me confirm the bacterial colony counting. My neighbor helped with the board pasting.	