Name(s)	Project Number
Talar A. Alexanian	**J1301**

Project Title

Does the Elapsed Time of Crushed Garlic Have an Effect on Bacterial Inhibition?

Abstract

Objectives/Goals
The purpose of my experiment is to determine if elapsed time between crushing garlic and its usage will have an effect on bacterial inhibition. My hypothesis is that as time intervals increase, zones of inhibition will decrease.

Methods/Materials
Inoculum of Bacillus Atrophaeus TSB culture was prepared for incubation. Bacteria were spread on six blood agar petri dishes to ensure a confluent lawn of growth. 0.2 grams of crushed garlic was applied to petri dish specimens at 15 min. time intervals, (0 - 60 min. and 24 hrs.) Four petri dishes became control groups. All were incubated overnight. Zones of inhibition were measured and recorded.

Results
During the 1st experiment, no zones of inhibition were observed.The next two experiments indicated an increase in zones of inhibition. The 4th trial showed an increase in zones of inhibition during the 1st 30 minutes, followed by a gradual decrease.

Conclusions/Discussion
My hypothesis was correct; however, more time intervals and experimental trials should be performed in order to establish more accurate results.

Summary Statement

My experiment is to determine if the elapsed time between crushing garlic and its usage will have an effect upon bacterial inhibition.

Help Received

Ms. Anahid Kazarians and my parents, Berj and Linda Alexanian.

Name(s)	Project Number
Brian N. Bhaskar	**J1302**

Project Title

Dare to Share Your Water: A Study of Bacteria in Backwash

Abstract

Objectives/Goals
To determine if drinking a water bottle after excercise with either a straw or by mouth will contaminate the remaining water in the bottle with bacteria from the mouth.

Methods/Materials
After one hour of excercise, I asked 15 subjects to drink from a water bottle, once by mouth and once by straw. The subjects were asked to drink 3/4 of the water in the bottle. A one milliliter sample of the remaining water was removed and poured into the culture medium. After 48 hours at room temperature, the colonies were counted. A control was taken.

Materials:
Petri dishes
Culture medium
Calibrated dropper
Straws
0.5 liter arrowhead water bottles
gloves and mask
marker
magnifying glass

Results
100% of the 30 samples (15 by mouth and 15 by straw) grew bacterial colonies on the culture plates. The drinking by mouth method contaminated the water bottles more than the drinking by straw method.

Conclusions/Discussion
I concluded that drinking water by mouth or by straw will contaminate the remaining water in the bottle. My experiment suggests that the way you drink the water will effect the amount of bacteria that is backwashed. Sharing other people's water, after sporting events, will expose you to illnesses from their backwashed bacteria and viruses.

Summary Statement

My project is about how water bottles are contaminated with bacteria after drinking.

Help Received

My mom typed for me and my dad bought the supplies. Guidance from Mr. Schottlach.

Name(s)	Project Number
Sudarshan(Sudi) Bhat	**J1303**

Project Title

The Antiseptic Power of Vinegar

Abstract

Objectives/Goals

My objective is to see if certain three different genera of bacteria will react in a different manner to different types of vinegars.A few of them are Red Wine vinegar, Distilled white vinegar, Garlic wine vinegar, and Apple cider vinegar.My main goal is to find out which vinegar has the strongest antiseptic power.

Methods/Materials

Materials: -Distilled white vinegar-Apple cider vinegar-Garlic wine vinegar-Red wine vinegar-Bacteria: Escherichia coli, Bacillus cereus, Staphylococcus epidermidis -Other: Nutrient agar, nutrient broth, Petri dishes, blank discs (all completely sterile), forceps, an inoculating loop, a Bunsen burner, a few paper cups, a hot plate, an incubator, a few sterile pipettes, a permanent pen, and a ruler (with centimeters)-as all test are measured in centimeters.

Method:

First, I subcultured each bacterium separately in nutrient broth. I incubated these for 48 hours at a temperature of 37°C. Next, I pipetted 0.3 ml of each culture of the bacteria onto four Petri dishes and swirled it around with nutrient agar. Then, I soaked twelve blank discs in each type of vinegar and put the soaked discs on two layers of paper towel to absorb the excess liquid. I then put the discs onto each section of the agar and tapped the discs a bit. I incubated all 12 plates in an inverted position for 48 hours at a temperature of 37°C. After 48 hours had elapsed, I measured the diameter of each inhibition zone in centimeters and recorded it. Using the statistical analysis- #The Analysis of Variance# and the #Least Significant Difference# (LSD), I got the results to determine which parameters there were significant differences.

Results

In the course of the experiment, I learned a lot about three types of bacteria and about how they react to different types of vinegars. The different types of bacteria react differently to different types of vinegar. I found that Garlic Wine vinegar works best against most of the bacteria, Apple Cider vinegar works best against B. cereus, and that Red Wine vinegar works best against S. epidermidis.

Conclusions/Discussion

As expected, any type of vinegar inhibits the bacterial growth. In my experiment, I tried to bring out any special advantages of using complex vinegars like Garlic Wine vinegar or Apple Cider vinegar as opposed to using Distilled White vinegar. Using the Analysis of variance, I found that the different bacteria react differently to different types of vinegar.

Summary Statement

This project explores the power of four different types of vinegar (white distilled, apple cider, red wine and garlic wine)against three genera of bacteria (E. coli, B. cereus, and,S. epidermidis).

Help Received

My advisor helped me get materials and execute this experiment in the proper way without going wrong. My parents also helped by encouraging me to do science fair this year.

Name(s)	Project Number
Phillip M. Brockett	**J1304**

Project Title

How Effective Is the School's Disinfectant During the Day?

Abstract

Objectives/Goals
The objective of this project is to find out how long the school's disinfectant lasts on interior and exterior door handles during the day.

Methods/Materials
Using the school#s disinfectant, disinfect ten door handles outside of the school building and ten door handles on the inside of the building. Swab the door handle with a cotton swab after disinfecting the door handle. Use a different cotton swab for each door. Next, take a cotton swab and swab a labeled petri dish to transfer bacteria. Place petri dishes in the incubator. Repeat swabbing door handles every two hours for the remainder of the day. Wait 24 hours, and then count how many colonies of bacteria there is on each petri dish and write results.

Results
Door handles 3, 6, 7, 9, and 10 had no bacteria colonies growing on them in the beginning of the day after cleaning them. The rest of the door handles had 2-4 colonies of bacteria growing on them. At the end of the day each door handle had bacteria growing on it. Each door handle had 20-50 colonies of bacteria growing on it at the end of the day. This is because more people touched the door handles and the bacteria had more time to multiply.

Conclusions/Discussion
The door handles had more bacteria on them at the end of the day because each door was touched and had bacteria transferred to it during the day. As the day went on, more people were able to touch the door handles and the bacteria was able to multiply and reproduce. The disinfectant was more effective right after using it on the door handles, but became less effective as the day went on.

Summary Statement

This project is about finding how long and how effective the school's disinfectant is against bacteria.

Help Received

School provided the disinfectant and the door handles.

Name(s)	Project Number
Christiana Y. Chen	**J1305**

Project Title

The Distribution of Xylella fastidiosa Through a Grapevine

Abstract

Objectives/Goals
The objective of this project was to determine how a plant germ, Xylella fastidiosa, moves inside a grapevine. This bacterium grows inside grapevine, cuts off the water supply, and causes a deadly disease, called Pierce#s disease.

Methods/Materials
First, I got a sick grape plant. I chose 4 leaves and collected them in a plastic bag. I labeled and took them to a microbiology lab. Under a cleanhood, I sterilized the surface of the leaf petioles with 10% Chlorox and rinsed them 3 times in sterile water. I sectioned the petiole, squeezed out the saps and cultured the bacterium in the saps in PW medium at 28 C. Six and ten days later, I went back to the lab and counted the bacteria. Two healthy grape leaves were used as control.

Results
Saps from most sick petiole sections showed the growth of bacteria. My dad confirmed them as X. fastidiosa. Different sections of the same petiole had different number of bacteria. No bacterial growth from healthy leaves.

Conclusions/Discussion
After recording my data, I observed that the number of bacteria from each section of the 4 petioles was very different. I concluded that the bacterium distributed in the grapevine unevenly, following the spreading process of moving, colonizing, moving, colonizing, and so on.

Summary Statement

Xylella fastidiosa distributes through a grapevine unevenly.

Help Received

Mom and Dad helped editing the poster. The USDA lab at Parlier, Ca, provided a microbiology lab and research materials. I was under the supervision of my Dad and his assistant, Rebecca Alvarez.

Name(s)	Project Number
Connor C. Chooljian	**J1306**

Project Title

Comparing Different Fruit Pastes as a Preservative in Baked Goods

Abstract

Objectives/Goals

The purpose of my project is to determine if adding fruit pastes to baked goods will help inhibit mold growth, thereby giving the baked products a longer shelf life.

Methods/Materials

Obtain different dried fruits such as dates, raisins, apricots, prunes, and figs. Put each different kind of fruit paste in the cookie dough and bake them. Check the pH level of each cookie. After checking the pH level place the rest of the cookie in an incubator for 21 days and check for mold growth. If there is no mold growth in 21 days blend the rest of the cookie with 1 bottle of buffer with 1 milliliter of the cookie dough in a petri dish. Cover the blended mixture with blood agar and place the petri dishes back to the incubator for 7 days.

Results

When I was finished the dates had an average mold growth of .25 inches of mold growth. The raisins had an average growth of .08 inches of mold which is pretty good. Fig, apricot, and prune had no mold growth, which gave them the longest shelf life.

Conclusions/Discussion

After completing my project I found that different fruit pastes in baked products would help them have a longer a shelf life. I learned how to check the pH level of different products. I also learned how to make fruit paste with a grinder. I would probably put raisin paste in products because the cookie with the raisin paste stayed very moist.

Summary Statement

Testing different fruit pastes in baked goods to extend the shelf life of products using natural and healthy ingredients.

Help Received

Thomas Jones a micorbiologist taught me mow to check for pH levels and lab work.

Name(s)	Project Number
Julia M. Dendle	**J1307**

Project Title

Antibacterial Products: Do They Work, and Is This a Good Thing?

Abstract

Objectives/Goals
Experiments were performed to determine whether or not antibacterial products are actually any better than regular cleaning agents at eliminating bacteria. Today, products that claim they are antibacterial are being accepted into healthy households. Supposedly, the antibacterial products are better at inhibiting growth, but may be spreading resistant bacteria. Fifteen antibacterial products and fifteen products that do not claim they are antibacterial were compared for better performance in the inhibition of E. coli bacteria.

Methods/Materials
To test the performance level, the products were plated and incubated overnight. E. coli bacteria were exposed to the plates. One product was then chosen from each group and diluted. The antibacterial product was serially diluted by hundredths and thousandths. The non-antibacterial product was diluted by hundredths. E. coli bacteria were pipetted into the dilutions to compare performance when diluted. The bacteria that continued to grow were plated on antibiotics.

Results
Antibacterial products are more consistent in the inhibition of E. coli bacterial growth than non-antibacterial products. Significant growth did not immediately appear until the dilution was 1:3200. However, the growth was condensed in a string-like substance, so spectrophotometer readings were not as accurate as possible. Because resistance sometimes takes a longer period of time to establish, no bacterial resistance appeared. Even though the antibacterial product performance may seem to be good, it may be lowering human tolerance levels towards certain bacteria due to lack of exposure.

Conclusions/Discussion
Antibacterial products are more efficient in the inhibition of bacterial growth of E. coli. They also show no immediate bacterial resistance.

Summary Statement

Antibacterial products may or may not be more effective than products that are not specified as being antibacterial, and may promote the development of resistant bacteria.

Help Received

Name(s)	Project Number
Kalan Downen; Danielle Kenoyer	**J1308**

Project Title

Which Soap Prevents Bacteria Growth Best?

Abstract

Objectives/Goals
The purpose of our project was to determine which soap worked best: Dove, Bath & Body, Soft-soap, or Dial. The information gained from our project could be used to help people in the hospital to keep their patients from getting sick. It could also be used by homeowners who desire a clean environment.

Methods/Materials
The experiment involved conducting two test runs with each of the four soaps. To perform the experiments we first prepared Petri dishes with a nutrient agar. After that, we used cotton swabs to collect bacteria from human hands. This was done by quickly sliding an uncontaminated swab across a hand, slightly opening the lid of the Petri dish, and swiping the swab across the agar one time. In the first test run the hands were unwashed. For the second test run the hands were washed before bacteria samples were taken.

Results
The results of our experiment did not support our hypothesis that Bath & Body would work best. Rather, Dial prevented bacteria growth best. The information gained from this project could be used to help people in the hospitals use the right soap so that they are less likely to get their patients sick again.

Conclusions/Discussion
The information gained from our project did not support our hypothesis, indicating that Dial worked best on preventing bacteria growth. We used our visual contact to verify the rate of change in bacteria growth. We learned that when using Dial soap you kill off most of the bacteria. We believe the reason for this is because the Dial soap had more disinfectant substances to kill off germs than the other soaps did, which allows it to kill off more bacteria than the other soaps did.

Summary Statement

The purpose of our project was to determine which soap worked best: Dove, Bath & Body, Soft-soap, or Dial.

Help Received

Jay Kenoyer helped type, Mr. scott, Annett Downen, and Adam Kenoyer.

Name(s)	Project Number
Taras B. Dreszer	**J1309**

Project Title

The Art of Brewing Hydrogen: Improving Gas Yield of Hydrogen-Producing Bacteria

Abstract

Objectives/Goals
I am trying to produce hydrogen as a clean alternate energy source, by using hydrogen-producing anaerobic bacteria (of the Clostridium genus). From prior exterimentation, I know that gas yield of these bacteria must be increased. The goal of this series of experiments is to increase gas yield of these bacteria by improving growth conditions.

Methods/Materials
Hydrogen producing anaerobic bacteria (collected from dirt) were grown in 30 ml. test tubes, in a growth medium. The growth medium was prepared by boiling corn-stalk and collecting the liquid. The biogas collected at the top of inverted test-tubes. The corn-stalk solution was displaced into balloons attached to the bottom of the test-tubes. A series of experiments were conducted, testing various living conditions against controls. Conditions were judged by measuring biogas produced.

Results
Fertilizer because of nitrates and phosphates, iron filings, and heat in the form of sunlight all helped gas production. Lye (pH: approx. 9) and lemon juice (pH: approx. 5) prevented gas production.

Conclusions/Discussion
The results strongly supported my hypothesis. Sunlight (probably because of heat), iron filings, and fertilizer help gas production. My results do not show the improvement necessary to run a hydrogen economy on anaerobic bacteria. Although the results were not as good as I hoped, the project was successful because of the skills that I have acquired, and because of what I learned about the growth of the bacteria. Hopefully, dramatic improvement in hydrogen production from these bacteria can yet be obtained, and I want to continue with this goal.

Summary Statement

I have shown that gas yield of hydrogen-producing anaerobic bacteria can be increased by improving growth conditions.

Help Received

My father, Timothy Dreszer, discussed ideas and helped with set-up. Matthew Knope, my science teacher, discussed ideas. Prof. Bruce E. Logan, gave me useful advice.

Name(s)	Project Number
Josiah J. Garza	**J1310**

Project Title
Algae -N- Detergent

Abstract

Objectives/Goals
My Objective was to see if laundry detergent affected algae growth. I wanted to see if laundry detergent that flows into our rivers and streams affects plants life.

Methods/Materials
I collected twelve samples of algae. I added three different types of laundry detergent to nine of the algae specimens. I left three jars of algae with no detergent. I set them outdoors and monitored their growth daily for ten consecutive days. I then repeated the experiment with new specimens.

Results
The laundry detergent helped the algae to grow. I was able to compare algae with detergent and algae without detergent. I saw significant growth each day as I measured their size.

Conclusions/Discussion
My hypothesis was incorrect. The laundry detergent helped the algae to grow. Information in this project expands our knowledge because now we know that algae grows if laundry detergent flows into our rivers and streams, which will kill all living animals and plants in the water.

Summary Statement
I added laundry detergent to algae to see how it affected it's growth.

Help Received

Name(s)	Project Number
Carlyn J. Girard	**J1311**

Project Title
Karuk Antibiotics

Abstract

Objectives/Goals
I wanted to test plants used by the Karuk Tribe in Humboldt County to see if they had antibacterial affects on bacteria that cause skin infections.

Methods/Materials
I tested nuts from the Pepperwood tree (Umbellularia Californica) and a salve made from Western Coltsfoot (Petastites Frigidus). I compared how well they prevented growth of two pure strains of bacteria (Staphylococcus Epidermis and Pseudomonas Fluorescens) and four wild strains of bacteria I collected from my skin. I tested them using agar plates and measured the no-growth zone around the antibiotics.

Results
Both the Pepperwood and the Coltsfoot had antibacterial affects on the skin bacteria. The no-growth zone for the control Neosporin sample averaged 0.5 cm radius over 12 different test sites. The no-growth zone for Pepperwood nuts tested with Staphylococcus Epidermis had an average radius of 0.7 cm. The average no-growth radius for the Coltsfoot salve was 0.5 cm against Bacillis Subtilis. Neosporin had a radius of 0.4 cm against Bacillis Subtilis. Against the Streptobacillis bacteria, the Coltsfoot salve had a radius of 0.6 cm.

Conclusions/Discussion
I was able to demonstrate that Pepperwood Nuts and Coltsfoot have significant antibacterial affects on common skin bacteria. Pepperwood nuts in the form of a poultice of ground Pepperwood nutmeat and olive oil showed a larger no-growth zone than Neosporin against Staphylococcus Epidermis bacteria. Coltsfoot was effective against Bacillis Subtilis and Streptobacillis bacteria. Many bacteria that cause infections are showing more and more resistance to our modern antibiotics. My results show that these traditional Native American medicines may be a source of new antibacterial medicine.

Summary Statement
I tested plants used by the Karuk Native American tribe to treat infections to see how well they stopped the growth of skin bacteria.

Help Received
Josephine Peters taught me about her herbal remedies and gave me the plants for my experiment. Dr.Terry Jones at Humboldt State University taught me how to do the agar testing. My parents watched me handle the bacteria. My brother helped me classify the wild bacteria at his school's biology lab.

Name(s)	Project Number
Benjamin J. Griffith	**J1312**

Project Title

Bacteria Wars

Abstract

Objectives/Goals
Which household cleaner out of the following (Clorox, Formula 409, Pine-Sol, & Windex),will outperform its competition by killing the bacteria on a surface that it is applied too?

Methods/Materials
Wash hands, use sterile gloves, label petri dishes, make bacteria food with water, un-flavored gelatin & beef bouillon. Pour mixture in each labeled petri dish. Label sections of counter & separate with tape. Section #1= Clorox Test. Section #2= Formula 409 Test. Section #3= Pine-Sol Test. Section #4= Windex Test. Crack open two eggs into a bowl, let sit for 1 hour @room temperature. With a brush, wipe the eggs on to each sectioned-off piece of counter top. Use sterile swabs & take a smear of each section. Then gently glide it across its petri dish. Be careful not to touch the prepared petri dishes with your hands. Repeat the prior step, three more times with new sterile gauze pad each time and change gloves after completing each section. The Control Group is this first group of dishes, which represents countertops with egg, swabbed & put into the dish, but no cleaner. The Experimental Group are countertops that were covered with egg, but cleaned with a specific cleaner, then swabed, then applied to a petri dish. This experiment was conducted three times, results totaled & averages were graphed and analyzed.

Results
The control group grew several types of bacteria, mainly brown dots that were 1/16" in diameter & white cloudy formations or blobs that were 1/8" to 1/4" in diameter. White cloudy growth grew in globs that ranged form 1/16" to 1/4"in size.

The experimental group was effective in reducing or eliminating the volume and types of growth that were seen in the control group. By graphing the results of the Control Group versus the Experiment Group for Sections 1-4, it was apparent that the chemicals of the household cleaners reduced the bacteria that grew in the petri dishes.

Conclusions/Discussion
In first place, Clorox beat out its competion by having the best overall performance in killing brown & white growth, & having no other bacteria grown in its petri dish. In second place was Windex, which killed brown & white growth, & had no other bacteria grown in its dish. In third place, Pin-Sol killed brown & white growth, & had only a small orange growth. In last place was Formula with the worst results of killing brown growth bacteria and also growing the largest other green growth.

Summary Statement

My project was about testing four household cleaners effectiveness in killing bacteria in an environment with conrols and variables.

Help Received

My dad helped me to regester on-line, and encouraged me to work hard and do my best.

Name(s)	Project Number
Thomas J. Hammerly, Jr.	**J1313**

Project Title

Wash Your Hands

Abstract

Objectives/Goals

The OBJECTIVE of this Project is to determine the effectiveness of a conscientious Hand Washing Program in preventing the spread of pathogens in the workplace.

Methods/Materials

The METHODS for this Project had been very precise. The three Control Groups, composed of volunteers, had been defined for this Project. The members of Group I did not wash their hands after leaving the restroom. The members of Group II washed their hands with soap and water before leaving the restroom. The members of Group III washed their hands with soap and water before leaving the restroom. In addition, they washed their hands with soap and water at the Hand Wash Station. After washing their hands with soap and water, each member also applied an alcohol based sanitizing lotion to their hands, that air dried. This Station had been located in the hallway leading into the Main Work Production Area.

Hydrated sponges had been utilized to take surface samples from the hands of each volunteer. These samples had been tested for a Total Plate Count. This test determines the presence of all forms of pathogens in the samples. The second experiment is the Generic E-Coli Test. This test determines the presence of all types of Escherichia coli in the samples. The third experiment determines the presence of Staphylococcus aureus in the samples.

LIST OF MATERIALS: 40 Dehydrated sponges; 40 25ml bottles of Buffered Peptone Water; 40 Stomacher Plastic Bags; 40 Plastic Media Plates with clear Covers; 40 Biochrome Staph Aureus Media Plates with clear Covers; 40 Plastic Disposable Syringes for the Micro-Pipette; 40 Vials of Purple Media [TPC]; 40 Vials of Yellow Media [CEC]; 40 Micro-Pipette disposable collection tips.

Results

The RESULTS of these experiments had shown the pathogen growth levels from the samples taken from the surface of the hands, of the members of each of these Control Groups.

Conclusions/Discussion

A review of the RESULTS of these experiments had lead to the CONCLUSION that a systematic program of hand washing will significantly reduce the spread of pathogens in the work place.

Summary Statement

This Project proves that a systematic program of hand washing, with water, soap, and sanitizing lotion, will significantly reduce the spread of pathogens.

Help Received

My father helped me type the project report and build the display board. I used the equipment and materials available at the quality analysis laboratory, at the Brawley Beef Plant, under the guidance of Mr. Armando Ramirez. The human subjects were volunteers, employed at the Brawley Beef Plant.

Name(s)	Project Number
Ivan G. Hodges	**J1314**

Project Title

Determining Which Area of a Local Playplace Has the Most Bacteria

Abstract

Objectives/Goals
I wanted to find out if a local playplace (a fast food restaurant's)had bacteria present on the play apparatus. I know that the playplace appears to be clean, but I've never seen anybody clean it up inside, or outside the structure. I didn't know if there were any codes/laws that say how often or how much cleaning is required in these structures. I figured that if no law said that they had to clean it, then they probably weren't cleaning it up very often, if at all.

Methods/Materials
I collected samples/cultures from three different places on the play structure. I collected them with a sterile cotton swab (Q-tip). I then S-Streaked an agar treated petri dish with the swab. I labeled the dishes, and put them into an incubator for 48 hours. I collected cultures five different times. I also cleaned the test areas after my testing each time, and collected a culture after cleaning to see if the cleaning stopped the culture's development. I put 10% bleach solution in each petri dish, and sealed it before I discarded it.

Results
I found out that the cleaning method I'd chosen (alcohol wipes) did a great job in cleaning up almost all the bacteria. I also discovered that the tall slide had more bacteria than the small slide, and the rail. The main thing I found out was, that the restaurant did not clean the playplace, and that bacteria was "breeding" uncontrollably on the play structure.

Conclusions/Discussion
I was able to find out everything I'd hope to discover. I wasn't surprised by my results, but I'd bet that the public would like to know what I learned. I'm certain the restaurant would quickly change their uncaring attitude toward the play structure. It's hard to believe with everything we know about bacteria today, that there aren't rules/codes/guidelines about these playplaces, and the cleaning necessary to make them safe.

Summary Statement
Discovering how clean a playplace at a local restaurant is kept

Help Received
Advisor and his wife helped with typing and assembling my display board/databook

CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY

Name(s)	Project Number
Celine Izsak	**J1315**

Project Title

Save Our Seas 3

Abstract

Objectives/Goals
Over the past three years I have been studying crude oil and ways to help prevent oil spills. This year my project was to determine what aquatic environment freshwater or saltwater has the highest amount of weight lost with the use of oil-hungry bacteria as a result of oil degradation over a 5-day period. I hypothesized that the freshwater aquatic environment will have the highest amount of weight lost as a result of oil degradation over a 5-day period.

Methods/Materials
I used 12 sterile containers with caps,3 for the freshwater control, 3 for the saltwater control, 3 for the freshwater with bacteria, 3 for the saltwater with bacteria. All my controls contained crude oil and water, and all my containers with bacteria contained oil-hungry bacteria. Half of the controls and half of the containers with bacteria had kosher salt to make a saltwater environment. Then over a 5-day period I weighed each container each day with a stamp postal scale to see the reduction of oil in the different environments.

Results
On day five the results for the freshwater control was that it lost 1/4 oz. and it weighed a total of 2 1/2 oz. On day five the results for the saltwater control was that it lost 1/4 oz. and it weighed a total of 2 3/4 oz. On day five the results for freshwater with bacteria was that it lost a total of 1/4 oz. and it weighed a total of 2 3/4 oz. On day five the results for the saltwater with bacteria was that it lost a total of i/4 oz. and it weighed a total of 2 3/4 oz.

Conclusions/Discussion
My hypothesis was correct that the oil-hungry bacteria would clean up the most oil in the freshwater aquatic environment. I learned that the oil hungry bacteria reacts better and faster in freshwater environments. I have found out that oil-hungry bacteria works in a saltwater environment well but it is a little slower then the freshwater environment when it comes to oil degradation.

Summary Statement

My project was to determine what aquatic environment freshwater or saltwater has the highest amount of weight lost with the use of oil-hungry bacteria as a result of oil degradation over a 5-day period.

Help Received

Parents purchased materials.

Name(s)	Project Number
Ross C. Johnston	**J1316**

Project Title

To Bloom or Not To Bloom? Is Iron the Key Nutrient in the Growth Rate of Phytoplankton?

Abstract

Objectives/Goals
My goal is to determine if iron added to coastal ocean water, slough water and river water changes the growth rate of phytoplankton.

Methods/Materials
Materials:(6)5-gallon plastic bottles; coastal ocean water; Elkhorn Slough water; Aptos Creek water;(9)65mg iron tablets; microscope; microscope slides\covers; eyedroppers; plastic cups; plastic well trays; CO(2) and O(2) Test Kits. Methods: Collected 2 bottles of water from each of the locations (ocean, slough, river); Collected and recorded salinity and temperature data from each of the sites; Observed samples from all bottles of water under the microscope and counted the numbers of phytoplankton; Added one iron tablet to one bottle of beach water, slough water and river water; Kept one bottle from each collection site as a control; Made and recorded daily observations; Repeated experiment by collecting a second sample of each water type, again keeping three bottles as controls (one bottle from each source) and adding iron as a variable to the second group of three bottles. Made visual observations of second plankton bloom. On a third trial, conducted O(2) and CO(2) quantitative tests.

Results
The day after I added the iron tablets (less than 24 hours), I saw a dramatic change in the water samples containing iron. Microscope observations confirmed that the water turned vibrantly green in the bottles to which iron was added because of an increase in phytoplankton. An increase by Day 2 was shown in the three iron-added water bottles. On Day 4, I observed a decrease in the phytoplankton numbers. I followed the same procedure for my second sample collection; it also resulted in the iron-added water showing an increased phytoplankton growth rate. On my third sample trial, I repeated the experiment and quantified O(2) and CO(2) levels.

Conclusions/Discussion
The only variable between the control and experimental waters was the addition of the iron tablet; I conclude that iron is the key nutrient in the growth rate of phytoplankton because, without iron, photosynthesis cannot occur. Without photosynthesis, carbon dioxide will not be removed from the atmosphere and global warming will continue to increase; A second and third trial experiments with water from the same three sites reconfirmed that phytoplankton bloom when exposed to iron; therefore, iron is a key nutrient controlling phytoplankton growth.

Summary Statement

Iron is the key nutrient in the growth rate of phytoplankton.

Help Received

I interviewed Dr. Kenneth Coale (Moss Landing Marine Labs); My dad drove me to each of the sample sites.

Name(s)	Project Number
Morgan S. Keefe	**J1317**

Project Title

The Use of Alloplastic Implants as Antibiotic Delivery Devices in Facial Reconstructive Surgery

Abstract

Objectives/Goals
The objective of this project was to determine whether alloplastic implants can be used to deliver antibiotics to the site of implantation during facial reconstructive surgery.

Methods/Materials
Using controls and an identified bacterial population plated on Mueller Hinton Agar, I tested the variables of time and type of immersion of the implant in antibiotic with regards to the effectiveness of bacterial killing for the alloplasts e-ptfe and Phdpe.

Results
Negative pressure infultration of the implants showed a highly significant bacterial killing over the controls.

Conclusions/Discussion
Alloplastic implants bieng used in surgical reconstruction can be used to deliver antibiotics to an implant site, which can subsequently decrease the risk of infesction.

Summary Statement

Determining if alloplastic implants can be used to potentially deliver antibiotics to a surgical implant site. (in-vitro)

Help Received

Captain Michael Keefe helped with protocol design; Microbiology Laboratory at Naval Medical Center San Diego helped with materials and design of culture technique; Dr. Derrin Wester helped with statistical analysis; Captain Kelly S. Keefe helped with board design.

Name(s)	Project Number
Katie C. Krulisky	**J1318**

Project Title
What Are You Stepping Into?

Abstract

Objectives/Goals
In order to see if footwear is an environment in which bacteria flourish, and if so, which type of shoes (leather/fabric) grow and withhold the most bacteria.

Methods/Materials
9 pairs of unworn shoes were swabbed with a sterile cotton applicator and inoculated on the Petri dishes. The dishes were then incubated for 24 hours. The average number of bacteria clusters per a row in the unworn shoes #Leather# was 86 and #Fabric# was 148.5. When inoculating Terra#s worn shoes a metal loop and a cotton swab were used in separate Petri dishes. Since the cotton swab (180 bacteria clusters per row) showed more results than the metal loop (71 bacteria clusters per row) I decided to stick with the sterile cotton applicators for the rest of the experiment. After the shoes were worn for 5 hours they were swabbed again.

Results
The averages of bacterial clusters per row were 241.5 in leather shoes and 118.75 in fabric shoes. After each shoe wash measured before wear and after wear various shoes were worn with one of the following foot-powders: Dr. Scholl#s, Personal Care, Odor-Eaters, Gold-Bond, crushed penicillin, or they were simply frozen for 12 hours. Upon completion it was concluded that worn leather shoes had significantly more bacteria than unworn leather while unworn fabric had more than worn fabric. Out of all the powders and other suggested bacteria-killing procedures crushed penicillin proved most effective, killing all of the bacteria, with freezing the shoes proving next efficient, decreasing the bacteria count by 55%.

Summary Statement
My project is about the variations of bacterial growth between leather, fabric, and how they change with different foot powders.

Help Received
Mother helped take photos and retrieve supplies

Name(s)	Project Number
Jordan R. Lawson	**J1319**

Project Title

Which Method of Handwashing Removes the Most Bacteria?

Abstract

Objectives/Goals
To determine which method of handwashing, out of the three used, removes the most bacteria from your hands.

Methods/Materials
The three methods used were washing with plain water, soap & water, and hand sanitizer. I used 10 test subjects and had each of them wash their hands with each method. After washing I had them press their fingers into petri dishes, then monitored the growth in the petri dishes over a period of several days. I counted the bacteria colonies from each petri dish of each of the methods and came up with the average for each method.

Results
The soap & water method had the least amount of growth overall.

Conclusions/Discussion
I thought that the hand sanitizer would have the least growth, but it turned out to be the soap & water. I think that the length of time rubbing the hands together and the fact that you rinse away whatever was loosened by the rubbing played a big factor.

Summary Statement

My project is about finding the best way to wash your hands so that you effectively remove bacteria from them.

Help Received

Mother took some pictures; teacher got petri dishes; neighbors were test subjects

Name(s)	Project Number
Sarah J. Leads	**J1320**

Project Title

Superbugs

Abstract

Objectives/Goals

My objective was to find out if there were resistant bacteria on common places we touch(ie. hand railing, door handle, key board, faucet handle, and light switch).

Methods/Materials

In my experiment I tested five different common places: hand railing, door handle, key board, faucet handle, and light switch. Then I took four different commonly used antibacterial products, Listerine, Purell, 409, and amoxicilin (antibiotic), and saw if any of the bacteria on the different places were immune to any of the products listed. If they were immune to all four, I would be able to conclude that they are antibacterial resistant bacteria, or on the verge to becoming resistant.

Results

In conclusion there were no "Superbugs" on any of the five different common places. E. Coli and Microsocus Luteus, bacteria found on common places, were both immune to Listerine. E. Coli was found to be immune to Purell as well as to the Listerine.

Conclusions/Discussion

My hypotheis was not supported in my experiment. I thought that there would be antibacterial resistance found on some of the common places, due to the constant misuse of antibiotics and antibacterial products, but there wasn't. I now know from my experiment and research that there are a great amount of bacteria found on commonly touched places, and that each of these different types of bacteria are quickly becoming immune to some of our defense mechanisms like taking antibiotics.

Summary Statement

My project was about finding out if there are any antibacterial resistant bacteria on some of the common places we touch(ie. hand railing, door handle, key board, faucet handle, and light switch).

Help Received

I had help from a biology teacher, Cheryl Powers, at a high school lab.

Name(s)	Project Number
Anirudh G. Madabhushi	**J1321**

Project Title

Do Spices Affect the Growth of Bacteria?

Abstract

Objectives/Goals

To determine whether the growth of Staphylococcus epidermidis is affected by different spices. I believe that ajwain, asafoetida, black pepper, cardamom, cumin, garlic, mustard seeds, and turmeric will have the highest inhibitory effect

Methods/Materials

The spices used in this experiment were ajwain, asafoetida, bay leaves (laurel), black pepper, black mustard seeds, cardamom, chile pepper, coriander seeds, cinnamon, cloves, cumin, curry leaves, fenugreek seeds, garlic, ginger root, sesame seeds, tamarind, and turmeric. 1.5 grams each of these spices were put into a test tube along with 7 mL of distilled water. These solutions were then boiled at 100 degrees Celcius for 5 minutes. They were then put into a centrifuge for 10 minutes. Each of these solutions were soaked into filter paper disks and they were placed onto sheep blood agar plates inoculated with Staphylococcus epidermidis. These were placed inside an incubator for 24 hours, after which I measured the zone of inhibition from each filter disk. I performed 4 trials.

Results

None of the filter paper disks had any zone of inhibition around it. This happened on all four trials.

Conclusions/Discussion

After this experiment, I conclude that my hypothesis was incorrect because none of the spices had any inhibitory effect against the bacteria. This could have happened for several reasons. First of all, enough of the spice extract may not have gotten into the solution. This could be solved if the spice was allowed to boil in the solution for a longer time. Another explanation could be that the intense heat during boiling may have destroyed the essential active ingredients in each spice that inhibit the bacteria. This could be solved if the spice was allowed to boil at a lower temperature. In conclusion, these spices do not any inhibitory effect against Staphylococcus epidermidis if tested with this method and if I were to improve this experiment, I would allow the spices to boil at a lower temperature for a longer period of time.

Summary Statement

My project is about different spices and their effect on the growth of Staphylococcus epidermidis.

Help Received

Mom took me to lab, provided spices, and helped me prepare journal. Grandfather helped boil spices. Used lab equipment of Monte Vista Medical Lab under supervision of Mr. Jeff Cordill.

Name(s)	Project Number
Adam Z. McCloskey	**J1322**

Project Title

Bacteria Fighting Silver

Abstract

Objectives/Goals

To find out if silver can keep un-refrigerated milk fresh longer by killing the bacteria which sours milk.

Methods/Materials

By introducing a silver dollar as well as colloidal silver into seperate cups of milk I want to prove silver keeps milk fresh when unrefrigerated. Materials: Milk, silver dollar, silver rods (.999 pure) camers, sea salt, 24 volt power supply, Agar, petri dishes, computer, printer, distillrd water, notebook, sterile swabs, one ounce of colloidal silver.

Results

Both the solver dollar and the colloidal silver kept the un-refrigerated milk fresh. The silver dollar kept it fresher for two days longer then nothng at all. The colloidal silver however kept the milk fresh for 10 dyas (seven days of the experiment and three days after).

Conclusions/Discussion

Silver can and will keep milk fresh without refrigeration, at least for awhile. I have also proven Colloidal Silver keeps milk fresher lomger than a Silver Dollar alone. Because of the bacteria growth on the petri dishesd, I feel the silver also kills certain bacteria as the untreated milk grew a large green bacteria which neither treated milk grew. This experiment also shows the colloidal silver inhibits spoilage in un-refrigerated milk for a longer time because the colloidal silver mixes with the milk. Although silver keeps un-refrigerated milk fresh, theres nothing like refrigeration to keep milk freah and cold.

Summary Statement

Silver inhibits bacteria growth and keeps milk fresh without refrigeration.

Help Received

Dad helped me make the colloidal silver and set up the petri dishes with agar.

Name(s)	Project Number
Mara A. Minner	**J1323**

Project Title

Effect of Temperature on Gas Production of Active Dry Yeast and Rapid Rise Yeast

Abstract

Objectives/Goals

The purpose of my project was to determine the optimum temperature for yeast to produce carbon dioxide, and to see if Rapid Rise Yeast would produce gas faster than Active Dry Yeast.

Methods/Materials

I made a solution of Active Dry Yeast, sugar, and warm, distilled water. I placed a test tube of the solution in a water bath at my test temperature (0, 20, 40, and 60 degrees C) and measured how much gas was being produced every minute for fifteen minutes, using aquarium tubing and an inverted graduated cylinder filled with water. I repeated the procedure using Rapid Rise Yeast in my yeast solution.

Results

Tests at 0, 20, and 60 degrees C did not produce very much gas with either type of yeast. Yeast at 40 degrees C obviously produced the most gas in both types of yeast. By the end of 15 minutes at 40 degrees C, Rapid Rise Yeast had produced 28% more gas than Active Dry Yeast.

Conclusions/Discussion

I was incorrect when I hypothesized that 60 degrees C would be the optimum temperature, but I was correct that Rapid Rise Yeast would produce gas at a faster rate than Active Dry Yeast. I later decided to test the solutions I had tested at 0 and 60 degrees C to see if they were still alive. Yeast placed at 0 degrees C produced gas when brought to 40 degrees C. Yeast that had been brought to 60 degrees C still did not produce gas at 40 degrees C. Therefore, when yeast gets too hot, it dies, but when it gets too cold, it is temporarily deactivated.

Summary Statement

My project was to find out the best temperature for yeast to produce gas and whether Rapid Rise Yeast really produces gas at a faster rate than Active Dry Yeast.

Help Received

My mom took the pictures and recorded some of the data as I measured. My dad helped me set up the graphs on the computer.

Name(s)	Project Number
Marjon Y. Momand	**J1324**

Project Title

New Antibiotic from the Mold Trichothecium

Abstract

Objectives/Goals

The goal of this experiment is to see which mold will produce the most potent antibiotic. This experiment will open up new antibiotics that can cure people from bacterial infections. The hypothesis was that the mold Eurotium would produce the best antibiotic.

Methods/Materials

The materials used were 26 petri dishes, 7 different types of mold, 500 mL of Agar, 1 L of Luria Broth, Bacto-Agar, pipet aid pumps, 1 sheet of Whatman no. 1 filter paper, 10mg of Ampicillin, butanol, kanamycin and E. coli bacteria. Agar plates were made out of Luria Broth so E.coli bacteria could grow upon them. The E. coli bacteria was incubated overnight. Seven of the Agar plates had mold on them, so they were used for this experiment. The molds that were grown were Altenaria, Eurotium, Mortierella, Aspergillus, Arthrinium, Phoma and Trichothecium. The mold was collected and butanol was added to the mold after being centrifuged. The molds were placed on discs of filter paper. The filter papers were put on the Agar plates. The plates included two discs of the mold, positive controls and a negative control. The positive controls were kanamycin and ampicillin. The negative control was butanol. In one day, the killing zone was seen for each plate. The killing zone was measured by getting the radii of the three areas around the discs.

Results

Trichothecium mold had the largest killing zone comapred to the molds Altenaria, Eurotium, Mortierella, Aspergillus, Arthrinium and Phoma. The average of the 2 discs of Trichothecium was 1.3mm. Kanamycin had larger killing zones (7.0mm-8.6) than the other positive control: Ampicillin (0mm-4.6).

Conclusions/Discussion

The hypothesis was proven incorrect. The mold trichothecium had the largest killing zone with 1.3mm. This was the mold that killed off the most E. coli bacteria. Further research will be done on testing Trichothecium on other types of bacteria.

Summary Statement

The mold trichothecium produces an antibiotic that is able to kill E. coli bacteria.

Help Received

Father helped with supervising experiment and providing laboratory materials.

Name(s)

Alyx D. Munden

Project Number

J1325

Project Title

Algae and Acid Rain

Abstract

Objectives/Goals

To determine whether water that contains a measurable level of acid (with pH level less than 7-simulating acid rain) will affect the cellular structures of the algae Spirogyra, Volvox, and Micrasterias

Methods/Materials

Cultures of algae are obtained from a school biological and chemical supply company for the following algae: Spirogyra, Volvox, and Micrasterias.

Each of these algae will be Subcultured to three glass containers prepared for optimal growth. Subsequently, each specimen will then be divided into 3 conical tubes labeled by pH values 7.0, 6.0, and 4.5, which represents normal algae cultivated in pollution-free water (7.0), low-acid water (6.0), and high-acid water (4.5) solutions. Algae will be removed and examined using a 200x microscope, with observations recorded and interpreted daily for 3 days. The constants for this experiment was light (indirect sunlight) and temperature. The variables were the pH, alga species, and time alga was exposed to an acid water environment.

Results

The alga cultures Volvox and Micrasterias were somewhat resistant to acid rain, while the cell wall structure of the alga Spirogyra was altered by acid rain. Some alga are resistant to acid rain as was demonstrated in my experiment with Micrasterias and Volvox, while others, like Spirogyra are quite sensitive to an acid rain environment.

Conclusions/Discussion

In conclusion, my hypothesis was partially correct. In normal water Spirogyra maintained its structural integrity with the chloroplast in a spiral arrangement. However, with low acid water (pH5.5) the cell wall was partially destroyed and the chloroplasts appeared in clumps. Furthermore, with high acid water (pH 4.0), the cell wall was completely destroyed (by day three) exhibiting free chloroplasts in clumps and single arrangements. In contrast to my hypothesis, the Micrasterias appeared resistant to the acid environment. Further research determined that this algae is acidiophilic, preferring an acid environment, and is therefor commonly found in acid marshes! Volvox did not grow well and this alga was difficult to find. Volvox, on observation, appeared to exhibit a phenomenon called inversion, whereby, the colony turns itself inside out. There did not appear to be any significant changes for this alga. The results of my experiment illustrate a variation of response to environmental changes where some species are more susceptible than others.

Summary Statement

The growth and microscopic observation of algae in an acid environment.

Help Received

Name(s)

Nicholas C. Nelson

Project Number

J1326

Project Title

Microbe Levels in Almonds

Abstract

Objectives/Goals

The objective of this project is to determine if there is a significant difference in the level of microorganisms in Field Meat almonds when compared to Huller Run almonds. Field Meat almonds are almonds that have fallen out of their shell prior to entering the almond hulling and shelling process. Huller Run almonds are almonds that are removed from the hull and shell at the processing facility.

Methods/Materials

Ten samples were taken from ten different lots. Each lot had two separate samples. The first sample was composed of Field Meat almonds and the second sample was composed of Huller Run almonds. All samples were clearly labeled by lot and type. I then took 90-gram samples of Field Meat and Huller Run almonds and placed them in separate plastic bags with buffer solution. I then shook each plastic bag in order to remove the microbes from the almonds. I then diluted the solution from each sample and put 1ml of the diluted solution on two different kinds of petrifilm. I used one type of petrifilm that detected aerobic plate count levels and a second type of petrifilm that detected E-coli-/coliform levels. The next step was to put the samples in the incubator for the proper period of time. 48 hours was required for aerobic plate count test and 24 hours for the e-coli/ coliform test. I then took the almonds out of the incubator and counted and recorded the colonies.

Results

The results indicated that in most cases the Field Meat almonds had more microorganisms than Huller Run almonds from the same lot.

Conclusions/Discussion

Statistical analysis of the data I collected indicates that Field Meat almonds have significantly more microorganisms when compared to Huller Run almonds. In general the almond industry does not make this separation. As a result, field meat almonds are mixed with Huller Run almonds. Separating Field Meat almonds from Huller Run almonds could be a new practice that is used in the almond industry. Improving good manufacturing practices is a goal of the almond industry and all food processors.

Summary Statement

This project evaluates the different levels of microorganisms in Field Meat almonds and Huller Run almonds.

Help Received

Dr. Linda Harris, PhD. at UC Davis, was my mentor, providing guidance and the necessary supplies; Harris Woolf almond processing provided the incubator and almond samples. My parents Pat and Dean Nelson provided assistance. My dad is the quality control chairman for the Almond Board of California.

Name(s)	Project Number
Lauren E. Palmer	**J1327**

Project Title

Drool and Saliva: Is a Dog's Mouth Cleaner than a Human's?

Abstract

Objectives/Goals

My experiment was to determine if an old saying had foundation in fact; "A dog's mouth is cleaner than a human's." Last year, two kids in my class were quarreling about whether or not a dog's mouth was cleaner than a Human's. Ever since then, I've pondered if canines had cleaner mouths than humans; for this year's science fair experiment, I have decided to find an answer to this question.

Methods/Materials

I swabbed saliva from twenty-five dogs and twenty-five humans with variables reduced as much as possible. To see how much bacteria was in my participants' oral cavities, I put some of each participant's saliva on a specially prepared blood agar plate, diluted small amounts of the original saliva 1-3 times (depending where it was placed on the agar plate), and then put the dishes in an incubator for 72 hours at 98.6ºF. Every 24 hours, I checked the bacteria colony growth (while wearing gloves), counted the amount of bacteria colonies on each section of the agar plate, and recorded my data. To compare results, I created a control group by putting an agar plate with no saliva on it in the incubator (no bacteria grew).

Results

Canines had consistently lower averages of bacteria growth compared to humans, and very few reached the highest category of growth (growth in all three segments) whereas most humans reached the highest category. Humans all had growth on day three, but 28% of dogs had no growth at all on day three. Unlike most humans who had a total of at least 250 bacteria colonies on their agar plate, most dogs had 100 and below.

Conclusions/Discussion

To my surprise, the mouth of man's best friend was cleaner than his master's.

Summary Statement

The purpose of my project was to determine whether a dog's mouth was cleaner than a human's by measuring the number of colonies of bacteria in each species' sailva.

Help Received

Mom and Dad edited papers; Dr. Bill Ruehl provided incubator, agar plates, sterile swabs, books on microbiology and set up an appointment at a veterinary hospital; Erika Horst handled all dogs when I took the saliva samples; 25 people and 25 dogs let me swab their mouthes for saliva.

Name(s)	Project Number
Aaron M. Patterson	**J1328**

Project Title

Determining the Relationships between Spoilage Rate and the Dehydration of Fruit

Abstract

Objectives/Goals
To determine if dehydrating the fruits stops or inhibits spoilage rate.

Methods/Materials
I pick two citrus, two stone, and two other commonly eaten fruits.
Then I dehydrated the fruits for the same time, but took out some slices of each fruit at different times. I used bacteria I culturated from my oral siliva.
Amount of bacteria would on or around the fruit to see how long it should take for the friut to spoil. The fruits are orange, grapefruit, plum, peach, apple, and a banana.

Results
The two citrus fruits and the plum let off an acid to repel the bacteria. The other three fruits all encouraged or let the bacteria grow.

Conclusions/Discussion
The citrus fruits and the plum don't spoil as easily as other fruits without acids.

Summary Statement
Determining if there is a point after dehydrating the fruits that spoilage rate would stop or inhibit.

Help Received
parents helped type

Ap2/05

Name(s)

Andryus K. Planutis

Project Number

J1329

Project Title

The Mystery of Stubborn Milk: What Factors Can Inhibit the Fermentation of Milk?

Abstract

Objectives/Goals

The production of yogurt from milk using live milk-fermenting bacteria as a starter culture does not always give reproducible results. I wanted to find out what factors could inhibit the fermentation of milk. I hypothesized that non-organic milk produced with antibiotics and pesticides may contain traces of these compounds that can inhibit the growth of lactic bacteria and thus prevent milk from fermentation.

Methods/Materials

In my first experiment I investigated the speed of milk fermentation. 150mL samples of 5 varieties of organic and non-organic milk were inoculated with equal amounts of live milk-fermenting bacteria. The samples were incubated at 37ºC. The pH and thickness of milk were checked at 0, 8, 20 and 25 hours of incubation. The time to obtain the final product (yogurt) was also recorded. The experiment was repeated 3 times. In my second and third experiments I studied the inhibition of bacterial growth by milk. Since lactic bacteria required special growth conditions, I used Escherichia coli instead. I inoculated the best and the worst fermenting varieties of milk with 2 strains of E. coli and after incubation I plated the dilutions of milk on a growth agar. The next day I counted the number of colonies.

Results

After 20 hours of incubation at 37ºC only the organic milk samples were fermented. After 25 hours all milk brands were fermented except non-organic Ralphs milk. Organic milk had a quicker and greater decrease in pH (from 6.5 to 4.83) during fermentation than non-organic (from 6.5 to 5.33). The antibiotic-sensitive strain of E. coli grew better in organic (3.9×10^8 bacteria/mL) than in non-organic milk (2.7×10^8 bacteria/mL). The penicillin-resistant E. coli also grew faster in organic milk (9.4×10^7 bacteria/mL) when compared with non-organic (2.8×10^7 bacteria/mL).

Conclusions/Discussion

These results support my hypothesis. Beneficial lactic bacteria such as Lactobacillus acidophilus ferment organic milk better than non-organic. Non-organic milk inhibits the growth of bacteria including E. coli. This inhibition in case of Ralphs milk can not be explained by the presence of penicillin alone. Organic milk, with its better ability to support the growth of beneficial bacteria, should be used for young children, for people with weak immune system, and for cancer patients who take probiotics (live beneficial microorganisms) to restore their bacterial population after radio- or chemotherapy.

Summary Statement

Brands of organic and non-organic milk were tested for the ability to inhibit bacterial growth and milk-fermenting activity in order to find the brand preferred by beneficial lactic bacteria used in food processing and in medical treatment.

Help Received

Dr. Holcombe from UCI Medical Center let me work in the laboratory and use the lab equipment. Lab personal taught me how to make dilutions. Mother helped to gather all the materials. My science teacher gave support and encouragement.

Name(s)	Project Number
William C. Roller	**J1330**

Project Title

Are You Chicken?

Abstract

Objectives/Goals
My objective is to determine the presence of salmonella bacteria from whole, uncooked chickens from different suppliers/proccesing plants.

Methods/Materials
I conducted my experiment by using strict sterile techniques and microbiological procedures. This was done to avoid contamination of my specimens and to ensure the safety of myself and others during the process of experimenting with potentially dangerous bacteria. The sterilization techniques consisted of using iodine, a diluted Chlorine bleach, and Isopropyl Alcohol to sterilize the area and my lab tools. Sterile gloves, masks, and lab tools also used. A culture medium known as MaConkey auger was used as a filter to isolate salmonella type bacteria. This auger is selective and differential because it prohibits the growth of Gram positive bacteria and it distinguishes if the bacterium produces lactose or not. Salmonella is both gram negative and lactose non-fermenting. With controlled incubation and aseptic transfers, I was able to isolate specific colonies that fit the characteristics of salmonella. Later, using an oil emersion microscope, I was able to eventually see gram negative rod shaped bacteria that fit all the characteristics of salmonella. I stained the bacteria using Indian ink in order to see it.

Results
The results show that all of my cultures with the exception of my controls, that I had gram negative bacteria. Foster Farms had about 136 large colonies; Safeway had about 160 small-medium colonies, and Whole Foods, about two small colonies. The controls were all completely clean and absent of bacterial growth. Ninety-five percent of these colonies were non-lactose producers. Under the microscope I examined Foster Farms and Safeway bacterial colonies and found rod-shaped bacteria. I did not see evidence of rod shaped bacteria, or salmonella, for Whole Foods under the microscope.

Conclusions/Discussion
My hypothesis was partially correct. The assumption that Foster Farms and Safeway's chickens could be contaminated with the greatest quantity of salmonella was correct. However, I thought that Whole Foods would have some presence of salmonella. I was wrong. My experiment provides confirmation with government testing statistics that over 20% of processed chickens have some level of salmonella and that there is still a need for better processing techniques in order to prevent chickens to be contaminated with salmonella and other bacterium.

Summary Statement
To determine the presence of salmonella if certain chicken brand contain salmonella.

Help Received
My father supervised my experiment in order to maintain a steril enviorment and ensure my safety.

Name(s)	Project Number
Lisa Smith	**J1331**

Project Title

Yeast: Good, Bad, or Worse?

Abstract

Objectives/Goals
My objective is to discover how yeast grows, so people know to limit their intake of sucrose, lactose, or fructose to help prevent yeast infections. I also want to know other ways in which the fermentation process affects our daily lives. If I put yeast in three thermos bottles, one with sucrose, one with lactose, and one with fructose, then the yeast will produce more energy in the thermos with the sucrose.

Methods/Materials
The three thermos bottles had stoppers, tubing, and a thermometer. Inside of each, there was yeast and water, plus sucrose in one, fructose in another and lactose in the last. Three Erlenmeyer flasks had equal amounts of limewater and a stopper with tubing. The thermos bottles and Erlenmeyer flasks were connected with tubing. The temperature inside each thermos was taken at every hour for 6 hours. The pH in each thermos was taken before and after. Any odor, precipitate and cloudiness were noted.

Results
Throughout all three tests there were bubbles, cloudiness and precipitate in the sucrose and fructose flasks only. The sucrose thermos had the highest average temperature. There was a smell in all the thermos bottles, but was strongest in the thermos with sucrose and fructose. The pH changed from 6 to 4 in sucrose, 6 to 5 in fructose and lactose. These results pertain to my objectives because they indicate that the yeast grew differently in each sugar source.

Conclusions/Discussion
The yeast grew better in the sucrose, as shown by the foul smell (ethanol), bubbles (carbon dioxide), the most precipitate (calcium carbonate), and the lowest average pH (organic acids) after the tests. A standard test for the presence of carbon dioxide is its reaction with limewater, forming a milky-white precipitate of calcium carbonate.
All of the above findings support my hypothesis that the sucrose is a better food source for fermenting yeast than fructose or lactose.
Yeast aids in the digestion of food but if a person has too much yeast, they can get a yeast infection, they can help cure it by limiting their sucrose intake, along with anti-fungal medications. Yeast also is used in pastry making and alcoholic drinks. Yeast is indead good for people, but too much is bad, and some sugars make it worse.

Summary Statement

My project is about finding out which food source provides fermenting yeast with the most energy, sucrose, fructose or lactose.

Help Received

Name(s)	Project Number
William J. Stahnke	**J1332**

Project Title

Nutrient or Pollutant: How Do Changes in Nutrient Loading Affect Algae Growth and Water Quality?

Abstract

Objectives/Goals
My objective is to determine how changes in nutrient loading affect algae growth and water quality, and its link to pollution. My hypothesis is that a small amount of nutrient input will yield a normal algae growth rate, but too much will inhibit growth.

Methods/Materials
250 mLs of red micro algae were placed in (3) 2000 mL Erlenmeyer flasks, each containing 1800 mL salt water, identified as Flasks A, B, C, with 2, 5, and 7 mL of fertilizer introduced to each flask, respectively. I observed for two weeks changes in algae growth in each flask, measuring changes in dissolved oxygen, pH, ammonia levels, and Secchi depth.

Results
The results indicated that changes in nutrient loading can affect algae growth and water quality. Flask A, which contained the least amount of nutrients, yielded the greatest amount of algae growth, with the highest levels of D.O. and ammonia, shallower Secchi depths and lower pH. Flasks B/C contained the highest nutrient inputs, but yielded lower levels of growth, with lower D.O. and ammonia levels, deeper Secchi depths, and higher pH.

Conclusions/Discussion
My experiment illustrated how lower nutrient levels yielded a more normal result, one that parallels what occurs in nature when it is not disturbed. The higher nutrient levels were not, in fact, beneficial to the environment, but instead inhibited normal growth and reduced water quality. The experiment demonstrated how a normal factor can become abnormal when man interferes.

Summary Statement

My objective is to illustrate the relationship between nutrient input and algae growth, and ultimately their link to pollution.

Help Received

Name(s)	Project Number
Amanda A. Tom	**J1333**

Project Title

The Toothbrush Danger

Abstract

Objectives/Goals
The common toothbrush has the potential to be a serious vector contributing to the development of illnesses and diseases. The purpose of my experiment is to find the most simple and effective at home method to make a toothbrush microorganism-free before every use.

Methods/Materials
Twelve toothbrushes were collected from classmates. These toothbrushes had been used on a daily basis for at least 3 or more weeks and maintained in a normal manner, that is, rinsed off after use and placed in a glass, bristles up. The toothbrushes were numbered from 1 to 12 and individually tested for the presence of bacteria in the bristles by using standard culturing techniques and nutrient agar plates. Bacteria colony counts (control) were taken after 7 days of incubation. Once it was confirmed that the toothbrushes were contaminated with bacteria, they were separated into 4 test groups: normal care (another control), Listerine Antiseptic soak, UV sterilization and steam sterilization. After adequate exposure to the method of treatment, toothbrushes #1-12 were tested again for the presence of bacteria in the bristles. Bacteria colony counts were taken after 7 days of incubation and compared with the original control group results.

Results
The steam sterilization method was the most consistent and effective. It eliminated 100% of the microorganisms on the toothbrushes. The method using Listerine Antiseptic Rinse to soak the toothbrush bristles noticeably decreased the bacteria levels on the toothbrushes. Finally, the UV sterilization method was inconsistent and displayed a great variation in effectiveness.

Conclusions/Discussion
The steam sterilizer totally eliminated microorganisms on the toothbrushes. The Listerine Antiseptic soak method only lowered the amount of bacteria on the toothbrushes. Different antiseptic mouthrinses could be tested for their effectiveness for this purpose. The UV sterilizer was not consistent and mostly ineffective. The UV unit that was used here may be defective, therefore, other UV units should be tested. Once people become aware of the potential health risks involved with having microorganisms growing on their toothbrushes, they will treat their toothbrushes with much more care. This simple change in habit may help many people live longer and healthier lives.

Summary Statement

The purpose of this experiment is to find the most simple and effective at home method to make a toothbrush germ-free before every use, so that it can be eliminated as a potential vector for the spread of illness and disease.

Help Received

Mrs. Heather Miller, my science teacher, helped guide me through the experiment process. Mrs. Sally Hoffman, my English teacher, helped guide me through the writing process. My father's help guided me through this experiment that was done all at home. My mother helped me arrange the display board.

Name(s)	Project Number
Lisa A. Tripp	**J1334**

Project Title

Eliminating Microorganisms through Handwashing

Abstract

Objectives/Goals
   To test the effectiveness of different hand cleaning products to reduce micro-organisms on hands.
Methods/Materials
   Every day for 5 days, shower at 11:00 A.M. At 2:30 P.M. use the following methods for each product:
   Day 1 - no hand washing, day 2 - water only, day 3 - plain soap, day 4 - anti-bacterial soap, day 5 -
   alcohol hand cleaner. Use a sterile saline soaked cotton-tipped applicator to harvest micro-organisms off
   of each hand. Dip applicator into saline filled test tubes for each hand. Dip inoculating loop into each test
   tube. Swipe inoculating loop across blood agar plates in 3 directions. Put lid on plates and label each
   with day and method. Place in 37 degree celcius non-CO2 incubator. Make colony counts after 48 hours.
Results
   Day 1 - No hand washing   48 normal skin flora, 7 bacillus species
   Day 2 - Water only   19 normal skin flora
   Day 3 - Plain soap   11 normal skin flora
   Day 4 - Anti-bacterial soap   48 normal skin flora
   Day 5 - Alcohol hand cleaner   5 normal skin flora
   The alcohol hand cleaner had the least number of micro-organisms, followed by anti-bacterial soap, water
   only, plain soap, and finally no hand washing.
Conclusions/Discussion
   The alcohol hand cleaner was most effective in eliminating the highest number of micro-organisms and
   incubated the least number of micro-organisms. My hypothesis was correct. The alcohol hand cleaner
   had the least number of micro-organisms, followed by anti-bacterial soap, water only, plain soap, and
   finally no hand washing. I believe I obtained these results due to the effect of the active ingredients in the
   products being used. From this project, I have learned about micro-organisms that are common to the skin
   and the effect of hand cleaning techniques and products on removing them.

Summary Statement

   The purpose of my project ws to test the effectiveness of different hand cleaning products to reduce
   micro-organisms on my hands.

Help Received

   I received help from my mother in conducting research, my science teacher instructed me on the report
   format, and the microbiology technician at Bakersfield Heart Hospital instructed/supervised me in
   conducting the experiment. I received supplies from the Bakersfield Heart Hospital.

Name(s)	Project Number
Isabella Tromba; Lara Tromba	**J1335**

Project Title

Chlorella Algae and the Attack of the Fertilizers

Abstract

Objectives/Goals
The purpose of this experiment is to determine the effect of different fertilizers on algae growth.

We hypothesize that a higher concentration of fertilizers will lead to more algae growth. At a certain point, the algae growth will start to decrease as the fertilizer concentration increases. We also hypothesize that the Phosphate/Nitrate fertilizer will promote the most algae growth, Phosphate fertilizer the second most, and Nitrate will help grow the algae the least.

Methods/Materials
Pipettes, spectrophotometer, chlorella algae, Alga-Gro freshwater medium, florescent light, grow box, Chemicals: Phosphate, Nitrate and Phosphate/Nitrate fertilizers

Label your test tubes. Make the dilution series: add 8ml of Alga Grow Freshwater Medium to each sample; add 1ml of phosphate/nitrate fertilizer to the container you labeled .3% solution; to make the .03% solution, take 1 ml of the .3% solution and add it to the container you labeled .03%; to make the .003% solution, take 1ml of the .03% solution; to make the .0003% solution, take 1ml of the .003% solution. Then take 1ml of the .0003% and dispose of it to make all test tubes equal (at 8 ml). Repeat this process for the rest of the P/N dilution series and then for the remaining fertilizer dilution series (Phosphate and Nitrate). Also, shake the test tubes an equal amount of times before transferring the 1ml solution to mix it. Now, add 1ml of Chlorella algae to each sample. Control set #1: take 8ml of Alga-Gro and add 1 ml of phosphate fertilizer; repeat for each fertilizer (Phosphate/Nitrate and Nitrite). Now, test all of your samples using the spectrophotometer. Set up the Grow-box by attaching the light fixture then placing all of the samples inside. At day 7 test your samples again using the spectrophotometer.

Results
The Phosphate/Nitrate fertilizer and Phosphate fertilizers had equal toxicity. The Nitrate fertilizer was the least toxic. By toxic we mean the sample promoted less algae growth than the control.

Conclusions/Discussion
Not all fertilizer concentrations increase algae growth, some as we found kill algae.

Summary Statement

The effects of different Nitrate and Phosphate fertilizer concentrations on Chlorella algae

Help Received

Mr. Darrell Steely supervised us when using the equipment in his classroom.

Name(s)	Project Number
Robert C.S. Wight, II	**J1337**

Project Title

Bacterial Activity in Fresh and Frozen Human Milk as Compared to Cow's Milk and Baby Formula

Abstract

Objectives/Goals
Human milk is the best food for human infants, but many women work and must store their milk for later use. The objective of my project was to measure the bacterial activity in human milk compared to cow's milk and formula, both fresh and after freezing for different periods of time.

Methods/Materials
The Methylene Blue dye test was used to measure the relative aerobic bacterial content of various milks (fresh and pasteurized human milk, fresh and pasteurized cow's milk, and infant formula) tested fresh and after freezing for 3, 10 and 26 days in a household freezer at approximately 17.5°C. Each sample had a control. In this test, the more rapid the color change, the more bacterial growth. Color change was recorded by time and photographically up to 72 hrs at body temperature. The results of the experiment were compared to the bacterial count and graded milks standard charts. In Phase II additional samples frozen 4-5 months were tested and a simple home test kit was designed.

Results
All milks tested exceeded the highest commercial standards for cow's milk. Human milk had the greatest resistance to aerobic bacterial growth with no color change, except for 1 sample, for more than 72 hrs. Raw cow's milk had the greatest aerobic bacterial activity. Freezing had no effect on the bacterial activity of the milks, with the exception of pasteurized cow's milk that increased in bacterial activity with the length of time frozen.

Conclusions/Discussion
Human milk is the best food for human infants, but many women work and must store their milk for later use. One of the human milk samples (frozen 10 days) changed color after only 10 hrs, indicating increased bacterial activity, possibly due to illness in the donor or contamination during collection or processing. A simple home test kit was designed and tested to help mothers who may be concerned about the quality of their milk. Human milk is the safest, best food for human infants, even when frozen for extended periods of time.

Summary Statement

Human milk inhibits bacterial growth more than cow's milk or formulas, even after extended frozen storage, making it safest for infants whose mothers need to express and store milk for later use.

Help Received

My mother obtained human milk samples and helped with the graphs. My father helped me set up my experiment and helped organize the poster board. Both parents helped edit my report.

Name(s)	Project Number
Audrey L. Witt	**J1338**

Project Title

The Effect of Lalvin Champagne Yeast on Carbonation and Taste of Home-Brewed Root Beer

Abstract

Objectives/Goals
Because the yeast greatly affects the taste of home-brewed root beer, I wanted to determine what was the smallest amount of Lalvin Champagne Yeast that would produce an acceptable amount of carbonation and a pleasing taste. I chose to use Lalvin Champagne Yeast after taste testing two ale yeasts and the Lalvin Champagne Yeast.

Methods/Materials
To test the effect of the Lalvin Champagne yeast on the carbonation and taste of home-brewed root beer, I made four different batches of root beer: 0 tsp. yeast, 1/32 tsp. yeast, 1/16 tsp. yeast, and 1/8 tsp. yeast. All of the proportions of the ingredients remained constant, as well as the methodology: temperature of water, type of water, sanitizing procedure, type of bottles, and amount of time they fermented.

Results
I found that as I increased the amount of Lalvin Champagne Yeast the carbonation increased, but so did the distinctive taste of the yeast. 1/32 tsp. yeast batch was, by far, the best tasting and it had an acceptable amount of carbonation. On the other hand, the 0 tsp. yeast batch had no carbonation and a horribly foul smell!

Conclusions/Discussion
Yes, I was able to produce a good tasting home-brewed root beer with an acceptable amount of carbonation with only 1/32 tsp. of Lalvin Champagne Yeast. It was amazing that such a tiny amount of yeast would produce a pleasing amount of carbonation in a 1.89265 liter(½ gallon) batch of root beer!!!

Summary Statement

I made home-brewed root beer with varying amounts of Lalvin Champagne Yeast to determine what was the smallest amount of yeast that would produce an acceptable amount of carbonation and a pleasing taste.

Help Received

Leener#s Brew Works for giving me the plastic bottles and answering my questions; my mom for taking pictures and helping me with the things that took more than my two hands.

Name(s)	Project Number
Adam L. Wolf	**J1339**

Project Title

Living in a Martian Atmosphere: First Steps towards the Terraforming of Mars

Abstract

Objectives/Goals

The objective was to deterine if specific microorganisms could meet two of the criteria (ability to survive in the Martian atmospheric mixture of gases, and the near vacuum atmospheric density) required to terraform Mars.

Methods/Materials

Four sets of each type of microorganism (a strict aerobe, a strict anaerobe, a facultative anaerobe, and yeast) were grown. Each set of four was placed in a different atmospheric condition, including the Martian atmospheric gas mixture,the Earth's atmosphere, a mixed atmosphere (which included proportions of O_2 and CO_2 between that of Earth and Mars), and a near vacuum that was comprised of the Martian atmosphere. After 72 hours in each atmospheric condition, the microorganisms were removed, and samples were plated and incubated to assess for growth. Any such growth was taken as evidence of survival.

Results

The anaerobic bacterium (Clostidium sporagenes) and the yeast (Saccharomyces cerevisiae) survived both in the Martian atmospheric gas mixture and in the near vacuum, as was evidenced by growth when they were replated on new agar and incubated in optimal conditions. In addition, it was noted that moisture and gas formation occurred while the microorganisms were maintained in the vacuum.

Conclusions/Discussion

Both yeast and strict anaerobes are candidates for survival on Mars since they demonstrated the potential for survival. Aside from their capacity to survive without O_2, their survivability is probably also due to their capacity to sustain themselves in harsh environments as spores and endospores respectively. Moreover, both are capable of releasing CO_2 as a function of their metabolism, which might result in the thickening of the Martian atmosphere, and hence the warming of surface temperatures and the melting of any ice that might exist.

Summary Statement

This project investigates the capacity of four microorganisms to survive in a Martian atmosphere in order to assist in the terraforming of Mars.

Help Received

Dr. David Newcombe, and Dr, Karen Buxbaum both from the JPL confirmed that my choice of microorganisms was reasonable. Daniel Schoenholz, a research chemist confirmed that my design for the injection of gases was sound, and my mother helped obtain the apparatus and oversaw safety issues, and

Name(s)	Project Number
Jonathan E. Wosen	**J1340**

Project Title

Bandages and Bacteria

Abstract

Objectives/Goals

The objective of this experiment was to learn what components on an anti-bacterial bandage's pad are most effective in removing bacteria from the human hand.

Methods/Materials

To complete this experiment numerous scientific devices were required. Although the two most notable tools were the Petri Films and a Bacterial Incubator. . With these tools bacteria could be placed somewhere and grown at an optimum temperature. To complete the objective of this experiment the percentage of bacterial culture removal was calculated. This was done by taking the amount of bacterial cultures on a two square are on the film before the bandages were appplied. Then the bandages were applied onto the films and the remaining cultures were counted. The percentage of reduction from before to after the films were applied was the quantitative measurement needed to answer the experimental question.

Results

The percentage of bacterial culture reduction in the Johnson and Johnson bandage, which utilized a combination of Polymyxin B Sulfate and Bacitracin Zinc, was approximately 97.78% with a best value of 3.89%. For the Curad bandage, which contained silver as an active ingredient, the percentage of bacterial culture removal wdas 78.23% with a best value of 10.00%. And finally the Coralite bandage, whose pad contains Benzethonium Chloride, removed 12.12% of all bacteria and had a best value of 12.12%. These results are the product of numerous trials and therefore are reliable. The best values indicate how much the given values can deviate from the "true" value, which itself is unatainable.

Conclusions/Discussion

The experiment's results agreed with the hypothesis. The hypothesis was that the Johnson and Johnson bandage would be most effective in killing bacterial cultures. The experiment's results could be reworded to say that the Polymyxin B Sulfate and Bacitracin Zinc are more effective than either Benzethonium Chloride of Silver in removing bacteria from the human hand. The main reason that explains why these results were as they were is ingredients. Johson and Johnson's bandage pad contained Bacitracin Zinc, which is effective in destroying gram positive bacteria. The other ingredient on the pad, Polymyxin B Sulfate, is able to destroy gram negative bacteria. And because all bacteria in the world is either gram negative or positive very few bacteriums will be able to survive the pad of the Johnson and Johnson bandage.

Summary Statement

The focus of this project is to learn what ingredients on an anti-bacterial bandage pad are most effective in removing bacteria from the the human hand.

Help Received

A biology teacher at The Preuss School UCSD named Ms. Mussey provided materials for the experiment. Mother also provided assistance with science board layout suggestions.

Name(s)	Project Number
Hannah N. Zimmerman	**J1341**

Project Title

The Effect of Non-Antibacterial and Antibacterial Cleansers on E. coli, P. aeruginosa, and S. aureus Growth

Abstract

Objectives/Goals

The objective is to determine which of the eight types of disinfectant products is most effective in limiting the growth of bacteria strains of E. coli, P. aeruginosa and S. aureus.

Methods/Materials

The experiment was conducted in a sterile microbiology lab. Three large Petri dishes with nutrient agar were swabbed with a different bacterial broth. Filter paper discs were dipped into the eight numbered products (antibacterial and non- antibacterial: liquid soap, hand gel, and mouthwash, as well as bleach and alcohol). After 24 hours, the dishes were removed from the incubator and transferred to the experiment room. A millimeter ruler was used to measure the diameter of the circle of non-growth to show how much each product limited that type of bacteria growth.

Results

Purell antibacterial hand gel and 20% Bleach were the only products that killed some of every type of organism. Dial Antibacterial hand soap killed an extreme amount of both E. coli and S. aureus. Although these products had the best results, the other products had an effect as well. Overall, P. aeruginosa was the hardest bacterium for the liquid hand soaps and mouthwashes to kill, even if they were labeled antibacterial

Conclusions/Discussion

Dial antibacterial hand soap and Purell antibacterial hand gel are the most effective products tested at inhibiting E. coli and S. aureus. Dial antibacterial hand soap greatly limited the growth of E. coli and the S. aureus compared to all the other products. E. coli and S. aureus are found either on or in the skin and Dial is a antibacterial hand soap. Overall, P. aeruginosa was the hardest bacterium for the liquid hand soaps and mouthwashes to kill, even if they were labeled antibacterial. P. aeruginosa is found in distilled water and in hospitals, which means P. aeruginosa has very simple nutritional habits. Although Dial and Purell had the best results, the other products had an effect as well. From these results, it is recommended to wash your hands with Dial antibacterial hand soap instead of a nonantibacterial soap, and if using a hand gel, Purell is an effective antibacterial cleanser.

Summary Statement

I tested eight products, antibacterial and nonantibacterial on three different organisms to determine which product was most effective in killing the bacteria.

Help Received

I recieved help from my mentor Mrs. Herbst with checking the scientific accuracy on my report; I conducted my experiment at Santa Barbara City College under the supervision of Lab tec. Brett Dicks