CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Talar A. Alexanian

Project Number
J1301

Project Title
Do Different Amounts of Aloe Vera Have an Effect on Bacterial Inhibition?

Abstract

Objectives/Goals
The purpose of this project is to determine if different amounts of Aloe Vera have an effect on bacterial inhibition. My hypothesis is that as the amount of Aloe Vera increases, zones of inhibition will increase.

Methods/Materials
Inoculum of Bacillus Atrophaeus Tryptic Soy Broth culture was prepared for incubation. Bacteria was spread on five Tryptic Soy Agar petri dishes to ensure a confluent lawn of growth. .02, .12, and .22 grams of Aloe Vera were applied to petri dishes B, C, and D respectively. Five other petri dishes became control groups. After incubation, zones of inhibition were recorded.

Results
No distinct zones of inhibition were observed throughout all experimental trials. Bacterial growth appeared on Aloe Vera control and Aloe Vera with distilled water groups. Data did not support hypothesis.

Conclusions/Discussion
Repeating experiment by using a different bacterium, another method of aseptically extracting Aloe Vera gel, and utilizing the viable bacterial cell count method can establish more results.

Summary Statement
The objective of this project is to determine if different amounts of Aloe Vera have an effect on bacterial inhibition.

Help Received
Ms. Anahid Kazarians, my advisor provided me with the Bacillus Atrophaeus bacteria, inoculating loops, TSB broth, and centrifuge tubes. Mother drove me to different libraries for research. My Dad helped me with my tables and graphs.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Sudarshan (Sudi) R. Bhat

Project Number
J1302

Project Title
Do Not Drink That Water

Abstract

Objectives/Goals
The objective of this experiment was to explore bacterial content in water we come in close contact with every day. I chose a total of six sources of water within a 2 mile radius of my house. These waters include bottled water, tap water, drinking fountain water, pool water, and water from the Saratoga Creek. Distilled water was used as a control in this experiment.

Methods/Materials
I used 2.5 oz. glass bottles to collect my water samples. These bottles were boiled in hot water for 15 minutes to be sterilized. I used sterilized pipettes to pipette 1ml of each sample into three Petri dishes. I then poured a generous amount of agar into each Petri dish. I closed the Petri dish immediately to prevent airborne microbes from getting into the agar and sealed them with masking tape to prevent leakage of these potentially pathogenic microorganisms. I then placed these eighteen dishes (three tests per sample) up-side-down into an incubator at 37°C. Three days later, I checked the dishes for bacterial count. I also took pictures of all the dishes. All previous steps were repeated three times to ensure stability and repeatability of the experiment.

Results
I finally came to following conclusions. Distilled water, as a control, had no visible growth whatsoever. Tap water had a total average of 1.66 bacterial colonies, swimming pool water had 2.22 colonies, bottled water had a total average of 2.99 colonies, drinking fountain water had 9.44 colonies and the dirtiest of them all, creek water, had a total average of 22.66 bacterial colonies. Bottled water was more contaminated than tap water due to its packaging and sealing. I believe I know the answer as to why there was such a great difference between tap water and drinking fountain water. Water in the fountain may not be used for long periods of time. Colonies were found to be punctiform, circular, irregular, and filamentous.

Conclusions/Discussion
I am happy to note that the water supplied by Santa Clara County is one of the cleanest in the water samples I chose to do my research. I have influenced several of my friends to let the fountain water run for couple of minutes before drinking. Bottled water manufactures may want to add a vacuum seal to their bottles to avoid contaminants seeping in during handling and storage of these bottles. Small creeks are great for wading and watching small fishes and tadpoles but DO NOT DRINK THAT WATER.

Summary Statement
A population study of bacterial content in water within a two mile radius of my residence.

Help Received
Parents drove to gather samples; Miller Middle School and Mrs. Bixby for a lab, equipment, and supervision.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Paige L. Binsley

Project Number
J1303

Project Title
Could Spicy Food Be Safer to Eat?

Abstract

Objectives/Goals
Throughout the centuries, people have used spices for preserving food. The objective of this project was to observe how microbes react to spices. The goal of this project was to see if spices can control the growth of a microbe that causes food poisoning, bacillus cereus. Perhaps an ancient method can prevent food poisoning.

Methods/Materials
This experiment was performed twice with petri dishes with agar and bacillus cereus swabbed on the agar. The following spices were sprinkled on the surface of each agar plate: garlic, oregano, rosemary, sage, onion, and thyme. The independent variable was the type of spice, and the dependent variable was the amount of microbal growth. The petri dishes were placed in an oven with the oven light on, which served as an incubator for three 24-hour periods of time. The type of microbe and temperature were kept constant.

Results
Garlic and sage were found to be the best inhibitors of microbial growth. Onion powder and oregano were also good inhibitors. Thyme and rosemary had little effect on the microbial growth.

Conclusions/Discussion
The hypothesis for this project was that garlic and oregano would be some of the best inhibitors of microbial growth. Overall, the hypothesis was correct. However, the hypothesis did not predict that sage would be nearly the best inhibitor. According to this experiment, foods with garlic, sage, or oregano would be safer from bacillus cereus food poisoning than foods without these spices. Therefore, spicy food could be safer to eat. Several questions have arisen after the execution of this experiment. One example is Could different foods be more susceptible to bacillus cereus food poisoning? Another possible question is Could food that is kept at different temperatures be safer? For example, Is food that is kept warm less likely to have food poisoning toxins? The limits of this study include the small number of trials. This experiment should have had more than two trials for optimum results and reliable information. In addition, if this experiment were performed in a lab that had proper equipment, the results might have been more accurate.

Summary Statement
The focus of this project was to test the ability of commonly used spices to inhibit the growth of the bacillus cereus microbe.

Help Received
Teacher, Mrs. Armstrong, guided project deisgn; Father aided in the execution of the experiment; Mother helped with board and report.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Gregory J.C. Brostek

Project Number
J1304

Project Title
Natural or Pharmaceutical: Which Works Best?

Abstract

Objectives/Goals
The object of my project was to determine if natural antibiotics such as garlic and tea tree oil, work as effectively in killing bacteria as the pharmaceutical prescription antibiotic amoxicillin. My hypothesis was that amoxicillin would be most effective.

Methods/Materials
Four nutrient agar petri dishes were inoculated with Serratia marcescens bacteria. Dish # 1 was treated with Garlic, # 2 Tea Tree Oil, #3 Amoxicillin, #4 control distilled water. The area where bacteria was killed was measured until results stopped to progress to determine which agent was the most effective in killing bacteria.

Results
The most effective anti-bacterial agent was tea tree oil with an effective rate of 91%. Amoxicillin was 81% effective. Garlic was 80% effective, the Control 0% effective. Based on the results, the tea tree oil was 12-14% more effective than amoxicillin and garlic respectively. Initial results seemed to show that my hypothesis was wrong. Additional observations three months after entering my project in the County Fair show that amoxicillin and tea tree oil have both continued to keep a barrier around the treated disc to keep the bacteria from re-growing. The effectiveness of tea tree oil has dropped from 91% to 70% with the bacteria growing slightly in towards the teated disc. The effectiveness of the amoxicillin dropped from 81% to 79%. Garlic was effective in killing the bacteria in the beginning, over time it has lost all of its effectiveness and the bacteria have over-grown the treated disc. The results show amoxicillin was most effective.

Conclusions/Discussion
Scientists have found that bacteria are more sensitive to specific antibiotics than others. Research shows bacteria are becoming resistant to antibiotics. The natural antibiotics had a more immediate effect but I believe this was due to the fact that they were oils and could spread out more than the amoxicillin mixed in distilled water. After additional time to observe the treated bacteria, the pharmaceutical antibiotic has had a longer lasting result for killing the bacteria but the tea tree oil was effective as well. A more precise method to compare strengths and concentrations of the agents should be done. It is interesting to find that natural antibiotics did work to kill bacteria and have valuable health benefits. Because of my experiment I can see that natural antibiotics definitely have real medical benefits.

Summary Statement
My project is about the effects of the natural anti-bacterial abilities of garlic and tea tree oil compared to the anti-bacterial effectivness of the pharmeceutical drug amoxicillin.

Help Received
Mother took pictures of me working on my project. Parents paid for all materials. Customer service person at Carolina Scientific named Laura gave me a suggestion to use the serratia marcescens bacteria after my first selection of Micrococcus luteus bacteria did not work well.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Nathaniel S. Carson

Project Number
J1305

Project Title
How Much Longer Does It Take Bread with Preservatives to Grow Mold Than It Takes Bread without Preservatives?

Abstract

Objectives/Goals
The purpose of my project is to find out how much longer it takes bread with preservatives to grow mold than it takes bread without preservatives. By working on this project, I hoped to learn more about preservatives and different types of mold. My hypothesis is that it will take bread with preservatives at least a month longer to grow mold than it takes bread without preservatives to grow mold.

Methods/Materials
Methods: 1.Buy bread with and without preservatives. 2.Place slices in sealed, labelled Ziploc bags. 3.Observe bread. 4.Document when, where, and what color mold is growing on the bread.

Materials: 4 loaves of bread: whole wheat bread with and without preservatives, white bread with and without preservatives; Ziploc bags; Sharpie pen; Magnifying glass

Results
Mold started growing on the honey white bread without preservatives after 6 days. After 27 days, the bread was 100% covered with mold or other organisms.
Mold started growing on the honey whole wheat bread without preservatives after 12 days of observations. After 27 days, the bread was 33.7% covered with mold. I calculated the percentages by tracing my observations onto graph paper, counting the total number of squares, counting the number of squares for each color of mold, and dividing that into the total number of squares. Mold has not yet grown on either piece of bread that contains the preservative calcium propionate after 27 days.

Conclusions/Discussion
My conclusion is that it took more than 27 days longer for bread with preservatives to grow mold than it took bread without preservatives to grow mold. A lot of the bread at our house gets moldy before we have a chance to eat it, so we end up wasting a lot of bread. My results indicate that my family should buy bread with preservatives to fix this problem. Because my family prefers to eat bread without preservatives, I would like to continue this study by studying how to keep mold from growing on the bread. Some suggestions that I have seen are to put the bread in a cool, dry place like the refrigerator or in a cupboard, and to clean the area where bread is stored with Lysol to keep the mold and bacteria from spreading to new loaves of bread.

Summary Statement
The purpose of my project is to find out how much longer it takes bread with preservatives to grow mold than it takes bread without preservatives to grow mold.

Help Received
Mom helped me get ideas and showed me how to make graphs. Dad helped me analyze my results. My teacher, Ms. West helped me with the scientific method. Mrs. Eleanor, our librarian, helped me find books about mold. Melisa Walker reviewed this report with me.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Michael M. Case

Project Number
J1306

Project Title
Determining the Development and Transferability of Bacteria from One Piece of Athletic Equipment to Another

Abstract

Objectives/Goals
My objective was to find out how much bacteria accumulated/developed on a baseball bat, and basketball under normal use. I then used that data as my baseline for the tests I conducted determining how much bacteria transferred from the ball to the bat, and vice versa.

Methods/Materials
The way I completed my project was first I checked how much bacteria was on a basketball, and a baseball bat grip after using each for a 2 hour practice period. I checked the amount of bacteria present by swabbing each piece of equipment with a sterile cotton swab, and then #S# streaked an agar treated petri dish. I let the dish culturate for 48 hours, and then counted the number of bacterial cultures present in the dish. I completed 5 of each of these pre-tests, so that I#d have a good idea how much bacteria typically exists on these surfaces.

I then wanted to see how much bacteria could be transferred from one surface to another. I put on two sets of sterile latex gloves, so that no bacteria could or would come into contact with my skin. I cleaned the basketball with two alcohol/antibacterial wipes. I swung the bat for two minutes (about 25 pitches), so that the bacteria might possibly transfer onto my glove covered hands. I then handled the ball for two minutes, without letting it touch the ground. I then tested the basketball for transferred bacteria. I also did the test in the reverse order of ball to bat. I made certain that I changed gloves after every test so that I wouldn#t contaminate any of the results. I did each type of transferability test five times so that I would get conclusive results.

Results
I thought that the bacteria would be passed most easily from the ball to the bat. I was wrong, because more than double the amount of bacteria was transferred from the bat to the ball, than from the ball to the bat.

Conclusions/Discussion
What I learned from my investigation is that it is much more safe to handle a basketball, than it is a baseball bat. The bat#s pre-tests had more than double the bacterial amounts than the basketball#s pre-tests. Also, I learned it is much safer to play with the basketball, and then the baseball bat, and not vice-versa. The bat to the ball transferability tests had more than double the bacteria than the ball to the bat tests.

Summary Statement
Discovering if bacteria can be transferred from a basketball to a bat, and vice versa

Help Received
My advisor helped me with my procedural steps, and the actual testing, my mom helped with my project board assembly.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Gustavo A. Chavez

Project Number
J1307

Project Title
What Are the Effects of Different Humidity Levels on Mold Growth?

Abstract

Objectives/Goals
My objective is to prove if humidity really effects mold growth and how it effects it. If it's by making the mold grow faster of making it grow sooner.
Hypothesis
The higher the humidity the faster the mold will grow will grow to a certain level. Once it has reached a humidity point it will not grow as fast.

Methods/Materials
1. Fill pot with water halfway of height of agar containers; 2. Put pot on range and put on medium heat wait until it is boiling; 3. Put Agar containers in with caps off and wait until it is melted; 4. When agar is melted gets your Petri dishes and pours evenly into the dishes; 5. Wait until agar has hardened and when ready get your cotton swabs and you test tubes filled with rhizopus; 6. innoculate the dishes; 7. When you finish with all thirty-six put them in their corresponding boxes. Six to each box and close the boxes; 8. Quickly grab the towels and soak them thoroughly. Pick towels that soak approximately 400 ml; 9. Put towels in each of the boxes except for one; 10. In each box put a thermometer and a hot pad; 11.Each 12 hours record mold growth, temperature, and humidity with hygrometer; 12. After growth dispose dishes.

Results
The box with an average humidity of 97% started growing at 48 hours and at 108 hours all specimens reached 100% coverage. The box with and average humidity 88% specimens started growing 60 hours and at 132 hours all the specimens reached 100% . The box with an average humidity of 80% started growing 84 hours and at 156 hours the specimens all reached 100 % coverage. The box with an average humidity of 68% the specimens started growing at 84 hours and at 168 hours the specimens reached 100% coverage.the box with an average humidity of 55% the specimens started growing at 96 hours and reached 100% coverage at 180 hours. The box with an average humidity of 38% the specimens started growing at 108 hours and reached 100% coverage at 192 hours.

Conclusions/Discussion
Knowing information about mold can be useful because there is wide variety of mold species that can be dangerous to a human being. If you know how it grows you can prevent it.
Humidity was the variable that I was testing and plays a major growth in mold growth. The higher the humidity the faster the mold grows which was my hypothesis. But it really effects how soon it#s starts to grow rather than how fast the mold grows.

Summary Statement
Growing mold in different humidity levels and charting their growth rates and patterns.

Help Received
Teacher ordered Rhizopus, Agar and sterile petri dishes.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Gordon Cheung; Erik Huynh; Jimmy Lin

Project Number
J1308

Project Title
Brushing with Bacteria

Abstract

Objectives/Goals
The objective of this project was to find out the least costly and easiest way to disinfect toothbrushes of common mouth microorganisms. The results of this experiment can help us decide on healthier practices for dental hygiene. We tested the following rinses: hydrogen peroxide, hot water and salt water. We believe that the hydrogen peroxide would disinfect the most bacteria on the toothbrushes.

Methods/Materials
Materials, including labeled toothbrushes, were given to each subject. Each subject brushed with 3 brushes (1-morning; 2-after school; 3-bedtime) for 1 week. Then each subject brought toothbrushes to middle school lab. Next, we labeled and prepared agar Petri dishes; we swabbed brushes to Petri dishes; treated toothbrushes with liquid rinses (hydrogen peroxide, hot water and salt water) for 1 hr.; and swabbed brushes onto Petri Dishes. We then placed Petri dishes into incubator at 37.5 Celsius for 24 hrs. Record observations and measurements after 24 hrs of incubation. Material used were 20 prepared Petri Plates, Stirring Rod, beaker, toothbrushes, toothpaste, hydrogen peroxide, table salt, and 1 incubator model 10-140.

Results
According to our data, Hydrogen Peroxide had killed the most bacteria on the toothbrushes. The hydrogen peroxide killed an average of 93% of the bacteria on the toothbrushes. The hot water killed an average of 71% of the bacteria on the toothbrushes. The salt water had increased the amount of bacteria on the toothbrushes by 4 times.

Conclusions/Discussion
We accept our hypothesis because the hydrogen peroxide had killed the most bacteria on the toothbrushes. We were very surprised when the salt water had increased the amount of bacteria on the toothbrushes by about 4 times the amount of bacteria on the toothbrush. We think the bacteria in the tap water had over powered the salt. The salt could not kill all the bacteria in the tap water, so we ended up putting more bacteria on our toothbrushes.

Summary Statement
This project is about finding the least costly and easiest way to disinfect microorganisms on toothbrushes.

Help Received
Teacher gave technical advice and supervised experiment; Parents drove us to stores and our homes.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Taya S. Crayk-Bonde

Project Number
J1309

Project Title
Will the Growth of the Microorganisms Bacteria and Mold Be Inhibited by Various Sources of Illumination?

Abstract

Objectives/Goals
The purpose of this experiment is to find out if the microorganisms bacteria and mold would be inhibited when they are exposed to different illuminations sources that included different types, colors, and strengths of light. I thought that the bacteria samples that would be exposed to the illumination of the 25 watt ultraviolet light would inhibit the bacterial colonies growth. Also, the mold samples growth would be inhibited by the 25 watt blue illumination.

Methods/Materials
I will make nutrient agar to grow bacteria on by taking 4 Knox gelatin packages, 4 bouillon cubes, and 2 cups of distilled water and bringing it to a boil. I will pour this mixture into 20 sterile petri dishes, swipe the inside of my cats mouth to retrieve 20 saliva samples with sterile Q-tips and then inoculate the prepared agar dishes. For the next phase of this experiment, mold will be grown by collecting household dust and and placing it on prepared lemon wedge rinds. These will be placed into baggies with 20 drops of water and sealed. There will be an #A# and a #B# sample for each experiment to double check results, plus two controls. All of the samples will be placed into 10 separate prepared enclosures with the various light illuminations: 15 watt each of red, clear, green and fluorescent bulbs, 25 watt blue, ultraviolet and yellow lights and 40 and 60 watt incandescent bulbs. Data war recorded every 24 hours for 7 days. Photos were taken.

Results
The illumination that inhibited the bacterial colony growth the best was the 25 watt green light, with (2,1). The 25 watt U.V. light was the second best, but had excessive mold infiltration. Bacterial overgrowth was caused by the 60 watt incandescent. The blue 25 watt light was the best illumination to inhibit mold growth. The lights that caused mold overgrowth were the 15 watt red and the 25 watt yellow.

Conclusions/Discussion
What I discovered overall was that the microbes are sensitive to the effects of light or light wavelengths. Some light illuminations might cause a more perfect temperature or environment for microbes to reproduce or even overgrow. Some other light sources micht have just the right amount of energy to separate organic molecular bonds. This breakage could cause genetic or cellular damage to the microorganisms, killing them or limiting their growth.

Summary Statement
My experiment is about finding out if the growth of microorganisms bacteria and mold would be inhibited by exposure to various sources of illuminations.

Help Received
My mother took the photographs of me while I did my experiment, I took all of the other photos.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Ashley A. Elder

Project Number
J1310

Project Title
Electromagnetic Radiation on Saccharomyces: Do EMF's Affect Yeast Growth?

Abstract

Objectives/Goals
Electromagnetic fields {EMF#s) are common in our everyday lives. Whether or not EMF#s pose a negative health effect is an ongoing controversy. The purpose of the project is to determine if electromagnetic field radiation (EMR), produced by an AC or DC device, causes an increase in the growth of Saccharomyces cerevisiae .

Methods/Materials
The testing location was chosen after taking readings with an AC EMF meter (0.1 mG-199.9mG) and a DC Gaussmeter (0.1mG-19,999.9mG). Yeast of the species Saccharomyces cerevisiae was used as a test subject. Three groups were exposed to an electrical device of an alternating current or a direct current or a control environment. The duration of exposure lasted 45 minutes. The irradiated and unradiated yeast were placed in a lower EMF location for a 10 minute proof and a measurement of the volume was taken in milliliters. One hundred eight trials were tested in an ambient temperature of 70°F.

Results
Through the testing described above, electromagnetic field radiation influenced the function or life cycle of the AC and DC test subjects. Yeast cultures exposed to the AC environment (200+mG) grew an average 30.7% greater than the control group. The AC group had a mean volume of 15.65 mL. Yeast cultures exposed to the DC environment (2,500 mG) grew an average 15.7% greater than the control group. The DC group had a mean volume of 14.18 mL.

Conclusions/Discussion
Contradicting the hypothesis of the experimenter, the DC did positively affect the yeast growth. Bearing in mind that DC has 0 hertz and is near the bottom of the electromagnetic energy spectrum, the experimenter thought the DC group would have equivalent growth to the control group. The yeast cultures may have gained more volume due to abnormal water retention resulting from stress within the cell structure caused by EMR. Electrons in the current of the electric devices emit fields which ionized the yeast cultures. This data shows that EMF#s do have biological effects.

Summary Statement
When exposed to electromagnetic fields of AC devices, the yeasts significantly gained volume.

Help Received
Thank you to my mother for edit of report. Thank you to Alpha Lab, Inc. for providing field tester.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Aubrey L. Faust

Project Number
J1311

Project Title
Moonmilk: The Next Miracle Cure?

Abstract

Objectives/Goals
Moonmilk is a pasty accretion of minerals and microbes found in caves. European peasants used moonmilk to treat infected wounds. Fresh moonmilk deposits in the caves at Oregon Caves National Monument contain the bacteria Actinomycetes, which is the source of most antibiotics. I wanted to test the moonmilk from the Oregon Caves to see if it had the antibacterial properties suggested by folklore.

Methods/Materials
I tested four different samples of the moonmilk against two pure strains of bacteria, Rhodospirillum rubrum and Micrococcus luteus, and compared the results with those of Neosporin and a bacteria-only control. I used Petri dishes and measured any bacterial inhibition zones that developed.

Results
One Petri dish inoculated with moonmilk showed a narrow inhibition ring (radius of about 0.3 cm). No other moonmilk dishes showed inhibition rings. The Petri dishes containing Neosporin all showed comparatively large inhibition rings (average radius of about 4 cm). Colonies of bacteria covered the control Petri dishes.

Conclusions/Discussion
My experiment showed that the fresh moonmilk might have antibacterial properties. The effect was not strong enough to demonstrate antibacterial properties conclusively. The Neosporin, by contrast, showed distinct antibacterial properties. An unavoidable delay of eight days between collecting the moonmilk samples and inoculating the Petri dishes may have reduced the viability of the moonmilk samples, despite storage approximately at cave temperature. I predicted that the hardened moonmilk samples would have lesser or no antibacterial properties compared with the freshly formed moonmilk. The results were consistent with this prediction, as confirmed by the absence of inhibition rings around all of the rock moonmilk samples.

Summary Statement
I tested a cave deposit called moonmilk, once used by European peasants to treat infected wounds, to see if it would inhibit the growth of bacteria.

Help Received
John Roth, the Chief of Resource Management at Oregon Caves, authorized and supervised the collection of the moonmilk samples. Ms. Diana Skiles, my science teacher, helped me to select the strains of bacteria and obtain supplies. My parents drove me to the Oregon Caves.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Leanne T. Fretz

Project Number
J1312

Project Title
Ailing Roses

Abstract

Objectives/Goals
The purpose of this experiment is to see if a garlic extract can prevent Crown Gall in rose plants. This experiment is important to me because if garlic can reduce the symptoms of Crown Gall in rose plants, then scientists can further develop it into medicine for other types of cancers and bacterial diseases for humans. I hypothesized that if garlic oil is mixed with the watering of the roses daily of three of the Crown Gall-diseased rose plants, then the Crown Gall tumor at the base of the garlic treated plants will end up smaller and healthier than the tumors of the regular treated plants.

Methods/Materials
Materials:1 apple tree already infected with Crown Gall, 7 rose plants, 7 plots for the rose plants to grow in, garlic oil. Procedures:Buy 7 rose plants at nursery, obtain Crown Gall infested apple tree from nursery, have 6 rose plant#s roots grow with the roots of the Crown Gall infected apple tree for 1 week, take apple tree out and observe symptoms of roses, daily water all 7 plants and in addition, water three rose plants with the garlic oil, record each day what each plant is on the health scale on data table, record each day how big each tumor is in each data table, after twenty-one days, graph data on fours graphs.

Results
My hypothesis proved true. In group one (infected with garlic), plant#1 got to one on the health scale, plant#2 got to two, and plant#3 got to two. In group two (without garlic treatment), plant#1 got to six on the health scale, plant#2 got to six, and plant#3 got to five. In group one, plant#1#s tumor went away, plant#2#s tumor got to .5 cm, and plant#3#s tumor got to .5 cm. In group two, plant#1#s tumor got to 2.5 cm, plant#2#s tumor got to 2.5 cm, and plant#3#s got to 2 cm. Group one was overall lower on the health scale and had smaller tumors that would eventually go away.

Conclusions/Discussion
The reason garlic diminished the Crown Gall was because it has a cancer-fighting substance named allyl sulfide. It also contains allicin and its antioxidant properties can inactivate cell-destructive free radicals and help the immune system in wiping out premature cancer cells. Garlic is also useful in preventing digestive cancers, and it may act against breast and prostate cancer as well. Crown Gall is also a bacterial disease and one of garlic#s constituents, allicin, blocks key enzymes that assist bacteria and viruses in their attempt to occupy and harm tissues.

Summary Statement
Ailing Roses is about garlic extract healing Crown Gall disease (a bacterial cancer on plants) on rose plants.

Help Received
My mentor Frank Kinnaman advised me about the measurment of garlic oil to use, he also helped me locate the apple tree with the crown gall.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Jeremy A. Fuster

Project Number
J1313

Project Title
GSI: Bacteria A Gram Stain Investigation: The Number and Type of Bacteria on Frequently Touched Surfaces at School

Abstract

Objectives/Goals
My objective was to see which of six commonly touched surfaces found at school had the most bacteria, to identify them, and to see if an antibacterial wipe was effective in eliminating them. My hypothesis is that the locker knob and toilet handle will have the most bacteria, and that the wipe will eliminate them.

Methods/Materials
First, the six surfaces were swabbed with sterile swabs and smeared on agar plates. Next, each surface was cleaned with a Clorox wipe. The surfaces were then swabbed and smeared on agar plates. The plates were placed in an incubator at about 38 degrees Celsius for 2 days. The bacterial colonies that grew on the plates were observed. Their number and appearance were recorded. One colony of each appearance type was swabbed and heat-fixed onto a glass microscope slide. Next, the slides were Gram-stained. The slides were placed under a compound microscope and the shape and staining of the bacteria were recorded. The shape was recorded as cocci, bacilli, or cocco-bacilli. Gram positive bacteria stained blue; gram negative pink.

Results
The toilet handle had the most bacteria which were mostly Gram positive cocci. Gram positive cocci was the most common bacteria on dry surfaces. Gram negative bacilli were found on the water fountain (wet surface). The Clorox wipes eliminated many but not all bacteria on all the surfaces, but was least effective on the water fountain.

Conclusions/Discussion
Most of the Gram positive bacteria found on the dry surfaces probably were harmless skin bacteria, but there is a chance that they could have been harmful bacteria. Additional tests such as catalase and coagulase tests could help determine whether they were harmful or harmless. My hypothesis, that the locker door and toilet handle would have the most bacteria, was partially correct. The toilet came in first place, but the fountain, not the locker, came in second. The Clorox wipes eliminated most, but not all bacteria. The total number of colonies before wiping was 361, after wiping, 80. The wipes did not eliminate 99.9% of bacteria as claimed. The wipes were least effective on the water fountain mouthpiece. This may be because the disinfectant was diluted by the water. Based on my experiment, I would give others these words of advice: wash your hands and drink bottled water!

Summary Statement
My project is about discovering what types of bacteria can be found on commonly touched school surfaces, typing bacteria using Gram stain, and determining if disinfectant wipes eliminate these bacteria.

Help Received
Father taught me how to Gram-stain, count bacterial colonies, identify different bacteria; once I learned methods, did project on my own. Dad helped take pictures; mother helped with paper cutter for board.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Demetra H. Hufnagel

Project Number
J1314

Project Title
The Effect of Far Infrared on the Growth of Mold

Abstract

Objectives/Goals
The purpose was to discover far infrared's effect on the growth of common bread mold. The expectation was that the far infrared would act as a fungicide on the mold, therefore killing it. This hypothesis was based on my previous work with far infrared and its effects on bacteria, its ability to create extreme heat, in addition to its capability of isolating toxins from cells, and destroying them.

Methods/Materials
- Allow common bread mold to grow on a loaf of bread.
- Label the Petri dishes for identification with the sharpie.
- Heat the inoculating loop with the candle flame in order to sterilize it.
- Place the head of the loop into the agar, on the side of a Petri dish to cool it.
- Place the loop onto one of the colonies of mold and scrape gently.
- Apply the removed mold onto the agar in the Petri dish, in a zig zag fashion.
- Seal the Petri dish with the laboratory film.
- Repeat for all the Petri dishes.
- Take five Petri dishes that are already prepared with the mold and count the amount of colonies that are apparent, with the aid of the magnifying glass, then place them into the incubator. Make sure that the incubator is set at a constant temperature.
- Insert the remaining five Petri dishes under the far infrared pad, on top of a towel, for thirty-minute periods, four times a day. When the dishes are not in the machine, incubate them.
- During the testing period, record the amount of colony increase or decrease every other day using the magnifying glass.

Results
The data obtained displayed that far infrared treatment, through a far infrared pad, acts as a catalyst to mold growth. When plates of mold were exposed to the far infrared four times daily over the course of seven days, the number of fungal colonies increased.

Conclusions/Discussion
The far infrared pad treatment had a growth promoting affect on the mold. It also seemed to slow the growth down when compared to the incubated plates. It is possible for this information to be used in medicine and other fields where mold production is needed. Additionally, this data can contribute to the proper use of far infrared and far infrared pads. For example, if one were to have a fungal condition, placing a far infrared pad on it might not be the most beneficial course of action to take.

Summary Statement
This project explores the effects of far infrared on the growth of common bread mold.

Help Received
Mr. Brennan supplied the paper supplies, an incubator, and the backboard. MPS Global Inc. supplied the far infrared pad.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Gabrielle E. Jardini

Project Number
J1315

Project Title
Yeast: The Fungus Among Us

Abstract

Objectives/Goals
For my Science Project I am testing in what environment yeast will grow best in. Yeast creates alcohol (ethanol) by a process called fermentation. It takes one molecule of sugar and chemically changes it, into two molecules of ethanol and carbon dioxide. I will use four different test substances which are: baking soda, flour, sugar and vegetable oil.

Methods/Materials
I will measure the carbon dioxide generated through fermentation, by mixing water, yeast, and four different test substances into a bottle for each. Then a balloon will be placed on the opening of the bottle, and I will measure the carbon dioxide measuring the circumference of the balloon after thirty minutes.The materials used are:177mL baking soda, 12 round balloons, 177mL flour, 4 rubber bands, 177mL sugar, 1 measuring tape, 177mL vegetable oil, 1 timer, 60mL baking yeast, 1 funnel, 1772mL warm water, 2 cups, 4 empty water bottles, and 1 heater (optional).

Results
Of the four substaces used, flour produced the most ethanol and carbon dioxide.

Conclusions/Discussion
I think that flour produced the most ethanol and carbon dioxide because I used baking yeast. If I had used wine yeast, sugar might have made more ethanol and carbon dioxide. This information is useful because if you need to produce any kind of alcohol you know to use the substance that is most productive.

Summary Statement
I am testing what environment yeast grows in best.

Help Received
Mother helped fix procedures, and took pictures. Teacher corrected completed project.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Joyce D.H. Kim

Project Number

J1316

Project Title

Assessment of Bacteria Growth in Backwashed Open and Pop-Up Cap Bottles

Abstract

Objectives/Goals

The objective was to evaluate the bacteria growth in backwashed pop up and open cap bottles. My hypothesis was that the open cap bottles have a much higher amount of backwash than the pop up caps that introduce bacteria into the water bottles.

Methods/Materials

Eighteen students were participated and tested in a 50-minute period. They were noticed to take at least ten gulps, a rest in between each one, and to stop when they reached the line drawn at the bottom part of the label of a 251 mL water bottle. Then the water was left alone for seven or twenty-nine days, and then was put in the petri dishes with MacConkey agar for 3 days so that gram negative bacteria could grow in the MacConkey agar. Each day, the petri dishes were examined, taken pictures of, and the colonies were counted.

Results

For the results, the bacteria were divided into three categories: tiny (<1/16-inch), 1/16-inch, and 1/8-inch bacterium and the results were described in the average percentage of tiny colonies for covering per plate and the average number of 1/16-inch or 1/8-inch colonies per plate. On Day 2, there was a lot of colony growth. The first nine plates (open caps), the tiny bacteria covered 33% of the plate, while the back nine plates (pop up caps), the tiny bacteria covered only 20% of the whole plate. For the 1/16-inch category, there was an average number of 3.2 colonies in the first nine and none in the back nine. For the 1/8-inch category, the first nine had an average of 0.1 colony (1 of 9 plates with a single colony) but no colony was observed in the back nine. On Day 3, there was a bigger difference of colony appearance than Day 2. For the tiny category, the first nine had 45% of the plate covered by tiny colonies while the back had 29%. The 1/16-inch category had the average number of 86.9 colonies in the first nine, and the average number of 63 colonies in the back nine for the average. For the 1/8-inch category, the first nine had the average number of 0.2 colonies (2 of 9 plates with a single colony per plate) and the last nine had none.

Conclusions/Discussion

Collectively, the open caps had a much higher incidence of colony growth than the pop up caps indicating that open caps have a higher chance of introducing bacteria into the water bottle because of backwash.

Summary Statement

Assessment and comparison of bacteria growth in open cap and pop up cap water bottles after being drunken out of.

Help Received

Mrs. Culley at Santa Fe Christian Schools being my advisor/lab equipments and Dr.Tae-Won Kim at Isis Pharmaceuticals Inc. for lab equipments

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Sean J. Lee

Project Number
J1317

Project Title
Plants vs. Bacteria

Abstract

Objectives/Goals
To discover the effects various plants have on killing bacteria

Methods/Materials
Materials
Samples of the plants, Petri dishes with agar, magnifying lenses, science fair log, research materials, camera, food processor, Q-tips, clothing protection, safety goggles, measuring cups, a strainer, some containers, and a pen
Procedure
Collect samples of each plant and Petri dishes with agar. Each dish was infected with bacteria and let to culture. After the bacteria had grown, the plants were ground up using a food processor. The juices were strained out and poured over the bacteria, the other refuse was thrown away. The Petri dishes were locked and labeled

Results
I observed the plants every day for the next week. I checked each bacteria amount with a magnifying lens and found the dish with garlic had the least bacteria and most killed; only two colonies left and seven gone.

Conclusions/Discussion
I can say that garlic killed the most bacteria as it was the most acidic and after all, too much acid on bacteria really does not do it too good and its allicin content prevents the bacteria from growing or reproducing. So my hypothesis was proved right.

Summary Statement
My project is a study testing various plants' abilities to kill bacteria.

Help Received
Bought materials at Amico Scientific Inc., asked mentor Mr. Kaleikau for help on project, corresponded with Dr. Jennifer Thorsch at the UCSB for info on where to get plants in project

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Hannah E. Malone

Project Number
J1318

Project Title
The Life and Times of Red Algae

Abstract

Objectives/Goals
The goal of my project was to find out whether red algae would grow more quickly in warm or in cool temperatures. The purpose of this project is to help biologists find large populations of red algae. I thought that dinoflagellate red algae at a warmer temperature would grow more quickly than it would at a cooler temperature. I thought this because heat gives organisms energy and red algae need a lot of energy during the time they are growing and maturing.

Methods/Materials
I placed red algae in three flasks and put them in 50 ºF, 60º F and 70º F environments. I used a heating pad to warm the 70º flask. I tested for 39 days to determine which temperature the red algae would grow quickest. For testing I used a thermometer, a microscope, 3 flasks of red algael, a dropper, and a heating pad.

Results
After testing, I found that the dinoflagellate red algae in the cooler temperature grew more quickly than the red algae at the warmer temperature. The red algae at the cooler temperature took 35 Days to complete its growth cycle and the red algae at the cooler temperature took 39 days to fully mature. One interesting thing that I found when testing my experiment was that between 15 and 17 days, the individual algae cells attached themselves to each other and formed long chains that consist of many different cells.

Conclusions/Discussion
My hypothesis was incorrect. It turned out that the red algae in the cooler temperature grew more quickly than the red algae at the warm temperature. I found that between 15 and 17 days, the individual red algae cells came together and formed chains. Under a microscope these algae chains look like long hair-like structures.

Summary Statement
Finding out whether red algae grows more quickly in warm or cold water.

Help Received
Teacher helped edit report, UCSC lab gave red algae

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Alex P. Mandel

Project Number
J1319

Project Title
Using Solar Energy to Make Drinking Water Safe

Abstract

Objectives/Goals
My objective was to find a way to decrease the time it takes to use solar energy to inactivate pathogens in contaminated drinking water by raising the water's temperature using reflectors, insulation, and tea to darken the water.

Methods/Materials
I built a Plexiglas box to try to raise the temperature of bottles of water high enough to decrease the time it takes for the sun to inactivate pathogens in the water. First I placed two bottles of water (one clear and one with tea) in the Plexiglas set-up and two similar bottles outside and took the temperatures of the water at regular intervals on sunny days. For the second stage, I added E coli to the water and put .1 ml samples from each bottle on tryptic soy agar plates every hour. I incubated the plates and counted the colony forming units after 24 hours.

Results
I was able to raise the water temperature to 164 degrees Fahrenheit using the Plexiglas box and tea. In the second stage of the experiment, done on a cool, overcast day, the bottles without tea both inside and outside the box had more E coli inactivated than the bottles with tea, despite the higher temperatures with the tea. The bottle with tea inside the box had more bacteria inactivated than the bottle with tea outside the box. In my control bottle inside the house, the E coli increased during the experiment.

Conclusions/Discussion
Because I had to do the second state of my experiment on a cool, overcast day, the results did not show that heat affects the inactivation of bacteria by the sun. They do show that exposure to the UV radiation in sunlight inactivates bacteria in water. The water with tea may have had higher levels of bacteria at the end of the experiment because the tea may have blocked the UV radiation from penetrating the water as well, or the tea may have introduced another bacteria into the water.

Summary Statement
My project is about using solar energy to purifying contaminated drinking water.

Help Received
My mom helped by taking some of the temperature measurements during the first phase of the experiment on days when I had to be at school. Gary's Plastics Place cut Plexiglas for me and showed me how to make the box. Dr. Robert Metcalf answered many questions by email. My dad printed the photos.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Chiara Maruggi

Project Number
J1320

Project Title
Does the Sun Intensity Affect the pH in Water?

Abstract

Objectives/Goals
The objective of my project is to see if the sun intensity affects the pH of waters containing green algae. My hypothesis is that, due to the process of photosynthesis, the pH of such waters would be higher when the sun is shining then when it is not.

Methods/Materials
To collect the data used for my project, I utilized a pH meter, which recorded both the temperature and the pH. I conducted the sampling in a mudflat containing green algae, at different times and with different sun intensities. The data was then reported in a table and plotted on a graph.

Results
The values of the pH measured at different times and different sun exposures do not show a variation that correlates with the sun intensity. Therefore, the results are not supporting the hypothesis formulated for this research. During my experiment I have also monitored water temperature. The data collected, presented in the graph, does not show a clear relationship between temperature and pH that could support a new hypothesis.

Conclusions/Discussion
As mentioned in the analysis of the results, the experiment does not support the hypothesis for this research. Scientifically speaking this means that, under the broad assumptions of this research, the hypothesis is not true.
The possible causes for these different results are:

1.The chemical variations inducted by photosynthesis are very small, and therefore the effect on the pH is not measurable in a time interval as short as the one used for this experiment.
A possible suggestion for a follow up research is to increase the amount of time between each measurement to 30 minutes, and instead of making the measurements during a partially cloudy day, sample the pH during the day and the night. (For example start the sampling at 2.00 pm and continue to sample every 30 minutes until 12.00 am.)

2.The chemical variations inducted by photosynthesis could be offset by other chemical reactions that take place in a pond, therefore, the net result of the photosynthesis reaction on the pH would become null or not relevant. This second hypothesis needs to be further studied before another experiment takes place, due to the need of finding out the different reactions that happen in a pond of water.

Summary Statement
My project is about discovering the dependency of the pH in water on external factors such as the sun intensity.

Help Received
My Father helped me research about my topic and areas of study; my Mother helped me set up my board; Geo-chemist, Dr. Eleanora Robbins supervised me while I carried my experiments using her pH meter; Mrs. Hilde Van Den Bergh helped me find my mentor (Dr. Eleanora Robbins); my Brother took pictures

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Mary E. Medeiros

Project Number
J1321

Project Title
Will The 10-Second Rule Save Food in the Nick of Time?

Abstract

Objectives/Goals
Have you ever dropped your favorite treat on the ground and you and/or your friends cry out, "10-second rule!" making you feel not gross at all picking it up from the ground, blowing on it a little and eating the treat? My goal is to test a piece of ham that falls on the counter and ground for 10, 5, and 1 seconds. I want to see if it really will be clean enough to eat or if it will be crawling with germs.

Methods/Materials
1. I sterilized the knife and tongs in boiling water for 5 minutes. 2. I got the knife out of the boiling water and cut the ham in small pieces while it was still in the package. 3. I sanitized my hands with antibacterial waterless hand sanitizer. 4. I tested the piece of ham that I was going to use for my 10-second test as my control for the kitchen floor. 5. I got the tongs out of the boiling water and grabbed the piece of ham that I tested for my control and I put the ham on the kitchen floor for 10 seconds. 6. I picked the ham up and sampled the ham with a sanitized cotton swab rubbing it across the gelatin in the Petri dish. I repeated this process for the five second and one second samples. I also tested the kitchen counter before and after I wiped it down with a sanitized towel. When I finished the tests, I set the Petri dishes in a warm and moist environment. I observed them everyday and then at the end of seven days I counted the bacterial colonies in the Petri dishes.

Results
According to the swab samples from the dirty kitchen floor and dirty kitchen counter, the Petri dishes grew several colonies of bacteria. Even the clean counter test showed that the ham picked up bacteria. The kitchen counter was dirtier than the floor and the amount of time the ham was in contact with a contaminated surfaces did not matter. They were all full of germs.

Conclusions/Discussion
There are levels of bacteria on every surface and they are quite nasty. You can be pretty sure that if you drop food on the floor or counter for even the shortest period of time that it will pick up whatever bacteria are present.
My suggestion is to not eat food off the ground, let the vacuum get it or the dog.

Summary Statement
I wanted to test the 10-second rule to see if the myth was fact or fiction.

Help Received
No help

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Michael P. Melkonian

Project Number
J1322

Project Title
Testing Various Substances in Inhibiting Bacteria Growth

Abstract

Objectives/Goals
The purpose of my project is to test varoius susstances in inhibiting bacteria growth. I added substanes to the bacteria to see if it would have an effect on bacteria growth. The substances I used are salt,sugar,vinegar,and garlic.The machine I used is called a spectrophotometer.Its measures the amount of light that penetrates through the bacteria. No light passing though is 0%(bacteria filled) and 100% (clear).

Methods/Materials
1.spectrophotometer 2.test tubes with lids 3.5ml pipette 4.1ml pipette 5. inoculating loop 6.strainer/paper towels 7.gas stove 8.chicken broth 9.water 10.bacteria from mouth 11.white vinegar 12.garlic 13.salt 14.sugar 15.gloves 16.Q tips 17.goggles 18.lab apron

Results
There were 10 test done on each substance.Readings were recorded after 24hrs,48hrs,72hrs,96hrs.Sugar was the substance that had the most bacteria and vinegar had the least amount of bacteria.

Conclusions/Discussion
When I used the spectrophotometer, the substance that reduced bacteria the most was vinegar at 84.95%. The next highest was garlic at 69.8%.After garlic was salt at 67.05%. Then the lowest was sugar at 56.65%.In each group the control had the lowest average exept for the last group,96hrs.This meant that the control group had the most bacteria growth overal.These averages were taken over a 4 day period.

Summary Statement
The purpose of my project was to test various substances in inhibiting bacteria growth.

Help Received
Mother helped to do my report

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Rebecca D. Neilsen-Robbins

Project Number
J1323

Project Title
Which Building Materials Are Most Resistant to Mold Growth?

Abstract

Objectives/Goals
This experiment tested mold on various building materials in order to determine which substrates are least conducive to growth.

Methods/Materials
One of each of six building materials#brick, drywall, linoleum, masonite, tile, and wood#were placed in four large cardboard boxes. A different type of mold#Aspergillus, Penicillium, and Rhizopus#was applied to each substrate in its respective box, and one box, the control, had no mold applied. Each box was heated and kept moist with sponges. It was predicted that brick would have the least growth, due to the material#s low cellulose and moisture content, along with its high moisture storage capacity. Brick would be followed by linoleum, masonite, tile, wood, and finally, with the most growth, drywall.

Results
Over the next several days, the substrates were observed, with no growth present on the tops of the materials. But the bottoms of the drywall, masonite, and wood all showed progressive growth throughout the twelve days that the experiment was run.

Conclusions/Discussion
It was concluded that brick, linoleum, and tile were all free of mold, while drywall, wood, and finally masonite, with the most, had considerable growth. Therefore, the hypothesis is partially accepted, as the experiment determined which building materials are most resistant to mold growth.

Summary Statement
My experiment tested mold on various building materials in order to determine which substrates are most resistant to mold growth.

Help Received
Father helped tape pieces to board and provided project funding; Stephanie Wilkinson, mentor, provided advice and proofread report; Howard Berg, UCSB, devised heating device; Bruce Tiffany, UCSB, advised on project; Tim Cuellar, UCSB, supplied and cut materials

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Phoebe G. Ng

Project Number
J1324

Project Title
The Life Saver: The Easiest Way to Reduce Your Medical Bill

Abstract

Objectives/Goals
The objective of this project is to find out the most effective hand washing method(s) that will remove the most bacteria from our hands. Hence, it will prevent spreading and getting pathogenic bacteria. I strongly believe this project will demonstrate that proper hand washing, disregard the present/absent of soap, can eliminate most bacteria, including pathogenic bacteria.

Methods/Materials
Prepare nutrition agar with chicken broth and pour into sterile Petri dishes. Create a "bacteria bed" by using a lightly damp hand towel to rub lightly over the surface of common items/areas that our hands touch frequently to collect the maximum number of dirt and bacteria. Before the start of each hand washing trial, wash hands thoroughly with soap for 25 second and dry the hands. Wipe hands with the damp "bacteria bed" thoroughly for 15 seconds to ensure each trial starts with the same initial "settings." Eight hand washing methods were tested: not wash, randomly rinse, wash randomly and thoroughly without bar soap, wash randomly and thoroughly with soft soap, and wash randomly and thoroughly with antibacterial soap. After completing the hand washing method, swab fingers gently in a zigzag pattern across the surface of the agar. Place all dishes in room temperature and count the number of colony growth on the surface for the next seven days.

Results
The number of bacteria colonies grow for unwash versus rinse hands are almost the identical (7- days mean average 97 vs. 81). Washing hands with bar soap has more bacteria colonies grown among the three hand washing groups with soaps. Washing hands thoroughly with soap have much less bacteria colony growth than washing hand randomly for the same type of soap (mean average for bar, soft, and antibacterial soaps are 38 vs. 34 vs. 17) . Washing hands with antibacterial soap has the least number of bacteria grown.

Conclusions/Discussion
The result supports the hypothesis that thoroughness is the determining factor on how well hand washing can eliminate bacteria from our hand, disregard the present/absent of soap. Usages of different type of soaps can be marginally assist us to eliminate bacteria to a slightly lower level/number of bacteria. The result also provide evidence that rinse hand is no better than not washing at all.

Summary Statement
The purpose of this project is to find out the most effective hand washing method(s) that will remove most bacteria from our hands.

Help Received
Ms. Nazarro provided numerous technical advice. My parents and siblings provided me with unconditional assistance on the display and as well encouragement.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Sara L. Nishikawa

Project Number
J1325

Project Title
Bacteria Be Gone!

Abstract

Objectives/Goals
To determine the effectiveness of household substances in killing bacteria.

Methods/Materials
1.25 ml ea: -toothpaste in 1.25 ml water; -salt in 1.25 ml water; -chlorine bleach; -antibacterial liquid soap; -isopropyl alcohol; -hydrogen peroxide; -distilled vinegar; -baking soda dissolved in 1.25 ml water. 10 Petri dishes w/agar; heat lamp; measuring spoon; eye dropper; 10 cups; graduated cylinder; thermometer; gloves.
1)Wash hands; 2)Put 10 mm saliva in cylinder; 3)Put 1 mm saliva in each dish; 4)Put dishes/thermometer under lamp; 5)Turn on lamp and leave for 6 days; 6)Each day check that temp is 37 degrees C; 7)On day 6, after bacteria have grown, gather 1.25 ml of ea substance; 8)Stir 1.25 ml water & baking soda to dissolve; 9)Repeat step 8 for salt & toothpaste; 10)Put baking soda & toothpaste mixtures & salt water in separate dishes; 11)Put 1.25 ml each bleach, soap, alcohol, hydrogen peroxide & vinegar in separate dishes (use gloves with bleach); 12)Leave one dish without any substance; 13)Turn lamp off; 14)Each day for a week, check for decrease in bacteria; 15)Compare w/dish w/o substance.

Results
Percentage bacteria killed:
Soap 91%; Bleach 88%; Toothpaste 82%; Alcohol 81%; Hydrogen peroxide 68%; Salt 65%; Baking soda 52%; Vinegar 4%.

Conclusions/Discussion
No substance killed bacteria more quickly than others--some just killed more bacteria. Hydrogen peroxide didn't kill many bacteria because it's a weak acid--only 3% in solution. Alcohol killed many bacteria because it disrupts the function of the bacterial membrane. Once alcohol is in a cell, it causes proteins to stop functioning, which causes the cell to stops functioning. Vinegar didn't kill much bacteria because it is a weak 5% acid. Bleach killed many bacteria since chlorine inhibits bacterial growth by causing a chemical reaction. Toothpaste killed a lot of bacteria because of monofluorophosphate, which protects enamel from being attacked by cavity-causing bacteria. The soap killed many bacteria because of triclosan, which poisons an enzyme vital for survival of bacteria. Triclosan prevents the making of fatty acids (which bacteria need for cell structure), by disrupting production of enoyl-acyl carrier-protein reductase. Baking soda didn't kill many bacteria because it didn#t dissolve well in water. Although salt is 60% chlorine, there was not enough salt to kill the bacteria.

Summary Statement
In my experiment, I tested the effectiveness of different household substances in killing bacteria.

Help Received
Teacher ordered Petri dishes; parents contributed saliva; mother set up heat lamp.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Kylie B. Pace

Project Number
J1326

Project Title
A Real Mouthful

Abstract

Objectives/Goals
My project was to test and see if a dog's mouth is cleaner then a human's. My hypothesis for this project was that a dog's mouth would have more bacteria then that of a humans. I thought this because of some background research I found, remember a dog's tongue is both its wash cloth and toilet paper. I would think that this fact alone would increase the number of bacteria colonies found in the dog's mouth.

Methods/Materials
I had three different test groups, small, medium, and large for both dogs and humans. Each of the human groups consisted of three people and two people with braces. There was a total of nine dogs tested, three in each group. A cotton swab was used to gather bacterial samples from each of the twenty-four subjects. The bacteria was then transferred to a labeled petri dish and placed in an incubator. Over the next four days I counted and compared the colony growth averages between the dogs and the humans.

Results
The results showed the average amount of bacterial colonies for the dogs came out to be 1,807. The humans, on the other hand had an average of about 165 bacteria colonies. With these results that I have collected it shows that my hypothesis was correct. The dogs had more bacteria then that of the humans.

Conclusions/Discussion
My conclusion is that the dogs that I tested had more bacteria then the humans. This project did support my hypothesis, for I thought that the dogs would have more bacteria then the humans. The dogs had an average of 1,642 more colonies then that of the humans. Even the humans with braces had fewer colonies then the dogs and they grew at a much slower rate. The information that I have collected might also show that if you have been bitten by a dog, you should have a doctor cheek it out to make sure that the bacteria in a dog's mouth is not fatal to you. So next time my dog Taz, wants to lick me on the face or share my ice cream, I will be thinking twice.

Summary Statement
In this project I found the dog#s mouths to have more harmful bacterial colonies, that grew at a faster rate then the human subjects.

Help Received
Father helped cut plexi-glass for incubator.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Ashish B. Pamula

Project Number
J1327

Project Title
Herbs: Do They Prevent Periodontal Disease, or Do They Just Sound Healthy? Phase II

Abstract

Objectives/Goals
The objective of the project is to understand the role of the herbal products clove oil and neem extract in the prevention of periodontal disease. The goal of this project is to prove the anti-bacterial properties of herbal products on oral bacteria.

Methods/Materials
Material: Neem toothpaste, Neem extract, Clove oil, Promise toothpaste, Colgate, Aquafresh, Nutrient agar plates, Pipettes, Cotton swabs, bacteria from teeth and gums, sterile water, and sterial disks.

Procedure: Bacteria were collevted from teeth and gums and suspended in sterile water. 0.5mL of bacteria were spread on the plate. Toothpaste or herbal extracts were suspended in sterile water and disks soaked in the toothpastes or herbal products were put on the plate and observed for bacterial growth after 48 hours(2 days)

Results
In the control plates, there was no growth inhibition surrounding the disks.
In contrast, disks suspended in the toothpastes and herbal products showed growth inhibition aropund the disks.
Clove oil the best results of all.

Conclusions/Discussion
The herbal products Clove oil and Neem extract were shown to be better anti-bacterial agents than the chemical products found in Colgate, Aquafrsh, and many other toothpastes.

Summary Statement
To understand the role of the herbal products clove oil and neem extract in the prevention of periodontal disease.

Help Received
Mother helped supervise expirement, RCC provided the materials

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
George J. Saba

Project Number
J1328

Project Title
You Dropped It, Now What Do You Do? The Effectiveness of Common Cleaning Methods on the Reduction of E. coli

Abstract

Objectives/Goals
Who hasn't dropped food or seen a baby lose its pacifier and wondered "Now what do I do? Is there any way to save the food or the pacifier?" Since studies have disproved the "Five-Second Rule," I wanted to test the effectiveness of the different ways people use to "clean off" dropped objects. I hypothesized that these commonly used cleaning methods would reduce bacteria on contaminated objects. Testing this hypothesis could help us decide what to do when we have dropped something and still want to consume or reuse it.

Methods/Materials
I tested two experimental objects (M&Ms and pacifiers) for the presence of E. coli (control). I chose E. coli because it is frequently found inside and outside of our homes. I dropped each experimental object on a Petri dish containing E. coli for five seconds and tested to confirm contamination (control variable). Next, I exposed each object to E. coli for five seconds. I cleaned the M&M by: blowing on it or wiping it on a tee-shirt. I cleaned the pacifier by: blowing on it; wiping it on a tee-shirt; pouring water on it; wiping it with saliva; or spraying it with antibacterial hand sanitizer (experimental variables). Then, I exposed each object to a Levine agar Petri dish for five seconds. I streaked the dish and placed it in an incubator at 37.5° C for 48 hours. Bacteria were quantified using a grid. I tested each variable five times and repeated the entire experiment for accuracy.

Results
Blowing on both objects reduced 0% of the E. coli. To my surprise, wiping both objects on tee-shirts reduced bacteria by only 50%, and wiping the pacifier with saliva reduced it less than 50%. Pouring water on the pacifier reduced 25% of the E. coli. Only the antibacterial hand sanitizer reduced 100% of the bacteria.

Conclusions/Discussion
My hypothesis, that all methods tested would reduce E. coli, was only partially correct. Once food or a pacifier is dropped on the ground, we should assume it is contaminated, even if retrieved in less than five seconds. Because blowing or wiping did not reduce all of the bacteria, I recommend that we should not eat dropped food. Unless a dropped pacifier can be treated with antibacterial hand sanitizer, my data suggests that we should not put it back in a baby's mouth. In future research, I would explore combining methods, such as wiping and pouring water, to see if their effectiveness is increased.

Summary Statement
I tested five methods that people commonly use to clean off dropped objects in order to determine their effectiveness in reducing bacteria.

Help Received
My Mother supervised my experiment, and my Father helped edit my written report.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Lior I. Schenk

Project Number
J1329

Project Title
Save Your Teeth!

Abstract

Objectives/Goals
My objective is to determine how common foods affect the growth of oral bacteria; I want to discover which of those foods would be good for fighting against oral bacteria,and which ones could even treat oral diseases.

Methods/Materials
1 bottle of 70% alcohol; 20 agar plates; 1 alcohol lamp; 20+ cutips; 1 agar spreader; ginger, garlic, mint, cinnamon, lemons, curry, green tea, yogurt, and raisins were the materials. Extracts from one of the foods would be dripped onto an agar plate. The spreader would be dipped in alcohol and put through the flame of the alcohol lamp to sterilize it. The extract would be gently spread along the plate, and a saliva sample would be spread with a sterile cutip. A plate with more bacteria colonies than the control (a single plate with saliva only) would show increased bacteria growth; a plate with less bacteria would show decreased growth.

Results
Agar plates with ginger, mint, and curry extracts had the most bacteria growing; plates with yogurt, garlic, green tea, and lemon extracts had the least bacteria growing; plates with cinnamon and raisin extracts had about the same amount of bacteria as the control.

Conclusions/Discussion
Thus it can be determined that ginger, mint and curry are not good for fighting bacteria; yogurt, garlic, green tea, and lemons are ideal for protecting your teeth and mouth. By following this experiment, people can avoid many oral diseases, live a happy life, and stay out of the dentist's chair.

Summary Statement
My project is on how common foods fight against and affect the growth of oral bacteria.

Help Received
Mother bought supplies; uncle and aunt helped set up experiment and supervised experiment

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Sarine G. Shahmirian

Project Number
J1330

Project Title
Dandelions vs. Antibiotics

Abstract

Objectives/Goals
The purpose of my experiment was to determine if dandelion roots and dandelion capsules are as effective as certain antibiotics, such as Penicillin, Erythromycin, and Tetracycline in killing E. coli and Serratia marcescens.

Methods/Materials
E. coli and S. marcescens bacteria were cultured in six Petri dishes each, which contained tryptic soy agar with 5% sheep#s blood. The dishes were left in an incubator for 48 hours at 37 degrees C. In four different containers, 250 mg capsules of the three antibiotics and the dandelion were dissolved in distilled water. The dandelion roots were processed and mixed with an equal amount of distilled water in the fifth container. The sixth container of distilled water was used as the control. These six substances were applied to the 12 Petri dishes and left in the incubator for 48 hours. The area of inhibition in each dish was compared to that of the pre-treatment and estimated. This experiment had three trials.

Results
The average effectiveness of the Dandelion roots on the E. coli was 85 %, and on the S. marcescens, was 75 %. For the Dandelion capsule the average effectiveness on the E. coli was 95 %, and on the S. marcescens, it was 85 %, while the three antibiotics showed effectiveness that was less than or comparable to the dandelion roots and the dandelion capsule.

Conclusions/Discussion
The results showed that my hypothesis was correct, and dandelion roots are as effective as those antibiotics in killing the bacteria.

Summary Statement
My experiment was to determine if dandelion roots and dandelion capsules are as effective as certain antibiotics, such as Penicillin, Erythromycin, and Tetracycline in killing E. coli and Serratia marcescens.

Help Received
My parents helped me order materials and prepare the graphs.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Jessica S. Silvers

Project Number
J1331

Project Title
"Let Us" Find Out How Much Bacteria Is in Lettuce

Abstract

Objectives/Goals
My project was to determine which type of lettuce carried more bacteria, hand washed or pre-bagged, pre-washed lettuce.

Methods/Materials
I purchased Romaine and Iceberg lettuce samples in both pre-bagged, pre-washed form and hand washed form at Ralph#s Supermarket and Whole Foods. I tested both samples for bacteria content. In the course of the project, loose Romaine and Iceberg lettuce were cut in half. I washed (with glove-covered hands) one half of the loose lettuce and then compared it to the half that was not washed. Also, pre-bagged, pre-washed Romaine and Iceberg lettuce were tested for bacteria. The testing was done in two trials.

Results
My results showed that pre-bagged, pre-washed lettuce had a lower bacteria content compared to the hand washed lettuce. This may be due to the fact that aside from being washed in water there are also added chemicals on the pre-bagged, pre-washed lettuce that kill the bacteria before it is eaten.

Conclusions/Discussion
My testing concluded that pre-bagged, pre-washed Iceberg lettuce from Ralph#s had the least amount of bacteria.

Summary Statement
I tested for bacteria on hand washed and pre-bagged, pre-washed Romaine and Iceberg lettuce from Ralph's and Whole Foods.

Help Received
My Mother for driving me to the places I had to go; My Dad for helping me with my final drafts and my display board; Ms. Reynolds for helping me type, edit, and guide me through my project; Ms. Lerner for helping and guiding me through my project; Dr. Benjamin Cravatt for allowing me to use his equipment

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Kiana M. Strub

Project Number
J1332

Project Title
Bacillus cereus + Essential Oils = ???

Abstract

Objectives/Goals
The purpose of this project is to determine the effectiveness of different concentration levels of select essential oils on the growth of the bacteria, Bacillus Cereus.

Methods/Materials
40 petri dishes were placed into groups of 5. lst group: one drop of first essential oil added/mixed into nutrient agar, 2 drops added/mixed to each of 2nd group, 3 drops added/mixed into 3rd group, 4th group: no essential oil added (controlled variable). Repeated using second essential oil. Inoculated all petri dishes with Bacillus Cereus spores and incubated 56 hrs at 33 degrees Celcius. Colonies were then counted.

Results
Thyme oil (2nd essential oil) resisted the growth of the bacteria with only one drop, whereas the Peppermint oil (lst essential oil) could only inhibit the growth of the bacteria at the highest concentration.

Conclusions/Discussion
My hypothesis was correct. I concluded that the Thyme oil had great effectiveness against the bacteria, but at the highest concentration, Peppermint oil inhibited the growth of Bacillus Cereus just as well.

Summary Statement
My project is designed to test the effectiveness of different concentration levels of select essential oils on the growth of Bacillus Cereus.

Help Received
Mother helped find reference books and supervised my experiment.; D. Cornelius helped find reference books; B. Peterson loaned lab equipment to me.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
David K. Tang-Quan

Project Number
J1333

Project Title
The Effects of Sodium Nitrate on the Growth Rate of Microalgae

Abstract

Objectives/Goals
The objective of this project was to study the effects of sodium nitrate on the growth rate of microalgae. The specific question to be answered was what concentration of sodium nitrate would most increase the growth rate of nannochloropsis, a species of microalgae.

Methods/Materials
Nannochloropsis was mixed with 5 ml of different concentrations of sodium nitrate solution: 0% (control), 1%, 5%, 10%, 20%, and 30%. Growth rates were measured by means of (1) weight, and (2) cell counting. Three trials were conducted.

Results
My first trial generated results showing that the 10% concentration of sodium nitrate led to the greatest rate of growth. But the second trial produced data showing that the 30% concentration most increased the growth rate. The third trial reflected evidence of a crash, but cell counts still provided sufficient data to determine growth rates. This last trial, which used the method of cell counting under a microscope, provided confirming data that the 30% concentration most increased the growth rate of nannochloropsis microalgae.

Conclusions/Discussion
From the data obtained, I formed the conclusion that a 30% concentration of sodium nitrate most increases the growth rate of microalgae. This study on nannochloropsis growth provides a foundation for discovering new methods of increasing microalgae productivity. Since algae are at the start of many food chains, whatever affects algae's growth rate will eventually affect our food supply.

Summary Statement
The goal of my project was to determine the concentration of sodium nitrate that most increased the growth rate of nannochloropsis microalgae.

Help Received
Used Cabrillo Marine Aquarium research facilities and learned lab techniques under the tutelage of Dr. Kiersten Darrow and Mr. Mike Schaadt.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Miranda M. Weatherly

Project Number
J1334

Project Title
Bacteria in the Cafeteria

Abstract

Objectives/Goals
My objective was to determine which surface in my school cafeteria had the most bacteria.

Methods/Materials
I used sterile swabs to to take samples from the each of the various surfaces in the cafeteria and then rubbed each swab in a petri dish with agar and covered the dish and labeled it. I checked the samples for growth on a weekly basis. I then took the petri dishes to a lab to get help in determining what was growing in them.

Results
The results were that there was a lot of mold growth (acremonium and mucor) in the petri dishes and very little bacteria.

Conclusions/Discussion
My hypothesis was incorrect. There was very little bacteria growing in the petri dishes. Instead, mold was the most common growth found. There was very little bacteria growth on the surfaces because of the cleaning agents that are used in the cafeteria that contain alcohol and bleach. These agents do not kill molds. I learned that the janitors would have to use an antimicrobial cleaner to get rid of the mold.

Summary Statement
Is there bacteria growing on the surfaces of my school cafeteria?

Help Received
Used lab equipment at TEKnova, under the supervision of one of their scientists.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Michael T. Winslow

Project Number
J1335

Project Title
How Common Are Antibiotic-Resistant Bacteria?

Abstract

Objectives/Goals
The objective of my project was to test the occurrence of antibiotic resistance bacteria in my local environment. I hypothesized that bacteria sampled from locations or food in our house that may have been exposed to antibiotics or antimicrobial agents will be more resistant than non-exposed areas.

Methods/Materials
I selected 10 sample sites within my house, and collected samples from them twice to test for antibiotic resistance in 2 separate experiments. In both experiments, the samples were cultured in agar with 3 different antibiotic discs: penicillin, tetracycline, and chloramphenicol (Kirby-Bauer test). The bacteria growth around the discs was measured and compared to antibiotic-sensitive gram-negative and gram-positive control strains. In Exp.2, new samples were also diluted and a colony count plate assay was performed in the presence and absence of the 3 antibiotics to detect subpopulations of resistant bacteria.

Results
The majority of bacteria for all the samples are gram negative and insensitive to penicillin. Bacteria growth from 4 sites exhibited resistance to tetracycline and chloramphenicol, relative to the control stains, for 50-75% of the 6-8 growth tests performed. These were the kitchen sink/countertop, toilet, yard dirt, and some of the commercial chicken. The samples from yard dirt were not predicted to be resistant, but exhibited the most consistent pattern of resistance in the antibiotic disc tests. Bacterial growth from 6 sites exhibited resistance for 0-25% of the 6-8 growth tests.

Conclusions/Discussion
Bacterial resistant growth from 3 sites and low resistant growth from 5 sites were consistent with the hypothesis that bacterial resistance could correlate with sample sites exposed to antibiotics or antimicrobial agents. The samples from yard dirt were not predicted to be resistant, but exhibited the most consistent pattern of resistance. The observed resistance could be due to unusual bacteria strains selected for enzymes that neutralize antibiotics or for multidrug resistance transporter genes. Or, they can represent more common strains with resistance due to mutation or plasmid uptake.

Summary Statement
My project was to determine the prevalence of antibiotic resistance bacteria in my local environment.

Help Received
Use of incubators and a sterile culture hood at my father's work. My parents helped me with making some of the figures and the display.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Nicole Yeghiazarian; Anais Zarifian

Project Number
J1336

Project Title
What Lurks in the Lockers?

Abstract

Objectives/Goals
The objective of this experiment was to find out the relative amount of bacteria and the general type of bacteria found on commonly touched surfaces in our school. The hypothesis was that a computer room keyboard would have the most bacteria.

Methods/Materials
Ten sites were selected and numbered. Sterile swabs were used to transfer bacteria and the other microorganisms to the surface of nutrient agar plates. The plates were streaked and incubated for 72 hours. Plate observations were taken at 24, 48, and 72 hours. The colonies were counted. Gram stains were made of 10 different colonies.

Results
In two separate trials, it was found that the computer keyboard and the soap dispensers had the most bacteria. In both trials, the faculty room door handle had little growth. The gram stains showed gram positive cocci and rods. No gram negative organisms were seen, fortunately.

Conclusions/Discussion
The results supported the hypothesis in one trial, but not in the second. However, since the keyboard had the second highest colony count in the second trial, it was concluded that the computer keyboards are highly contaminated due to the frequent amount of touching. It was also concluded that the bacteria on the keyboards was normal flora from the skin and from dirt because it was gram positive.

Summary Statement
The objective of this experiment was to find out the relative amount of bacteria and the general type of bacteria found on commonly touched surfaces in our school.

Help Received
Ms Ohanessian lent her microscope, lab, and incubator; Mother helped with gram staining and streaking

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Noreen Zia

Project Number
J1337

Project Title
Revenge of the Microbes: How Bacterial Resistance Is Weakening the Antibiotic Miracle

Abstract

Objectives/Goals
The purpose of my project was to test different antibiotics, and how resistant bacteria are to them. In my experiment, I used E. Coli and Staphylococcus Epidermidis (bacterium) to check their resistance to penicillin, ampicillin, neomycin, tetracycline, erythromycin, streptomycin, and cefotaxime (antibiotics.) Based on my previous research, I hypothesized that both bacteria will be most resistant to penicillin, and least resistant to cefotaxime. But, since both bacteria are different, I believe that the results will vary, but the overall result will be similar.

Methods/Materials
The materials I needed were: 12 antibiotic discs each for penicillin, ampicillin, erythromycin, neomycin, streptomycin, tetracycline, and cefotaxime; E. Coli and Staphylococcus Epidermidis; 15 sterile swabs, broth, 1 incubator, 8 foceps, and 36 blank sterile discs.
In order to conduct my experiment, I spread the bacterium dipped in broth onto the Nutrient Agar Plates. Then, I put 3 antibiotic discs and 1 blank disc on top of the bacteria that had been spread, and then incubated the plates in order for the bacteria to grow. I then repeated my experiment.

Results
After conducting my experiment, I found that Staphylococcus Epidermidis was most resistant to Erythromycin. It was most sensitive Cefotaxime.
Based on the outcomes from the first trial, I found that E. Coli had similar results to Staphylococcus Epidermidis, but the growth rates were different. I found that E. Coli treated with Penicillin, Ampicillin, Erythromycin, Tetracycline, Neomycin and Streptomycin had a very low growth rate. The bacteria treated with Cefotaxime didn#t grow at all. This goes to show that E. Coli is a weaker and more resistant bacterium than Staphylococcus Epidermidis.

Conclusions/Discussion
The results show that the first part of my hypothesis was proven incorrect. At first, I thought that Penicillin was not a very strong antibiotic, but my results proved that Erythromycin was an even weaker antibiotic. That is why so much bacterium had grown. The second part of my hypothesis was proven correct; cefotaxime was the strongest antibioitc, and therefore, the bacteria weren't able to develop ways to become resistant to it. So, if a person has a severe bacterial infection, cefotaxime would be the best antibiotic to use.

Summary Statement
The purpose of my project is to test bacterial resistance to different antibiotics.

Help Received
I performed my experiment under the supervision of Dr. Nabila Patel