CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Paul A. Abdou

Project Number
J1701

Project Title
Can Ultraviolet Light Purify?

Abstract

Objectives/Goals
The objective of this project is to see if ultraviolet light will reduce the bacterial count in a useable water source making it acceptable to drink.

Methods/Materials
A sample of clear water was obtained from the Kern River. A portion of it was poured in a clear plastic PET bottle and placed under a 100 watt ultraviolet light for disinfection. Samples were taken for bacterial culture at 24, 48, 72, and 96 hours. Controls of boiled Kern River water, Arrowhead bottled water, tap water, and untreated Kern River water were also taken. They were checked for bacterial growth at 24, 48, 72, and 96 hours.

Results
The results showed that it took 72 hours under the 100 watt ultraviolet light to decrease the amount of bacteria in the useable water source to an acceptable level and 96 hours to reduce it further.

Conclusions/Discussion
The bacterial count in the water source was reduced over seventy-two hours of exposure to the ultraviolet light. The amount of time required in the lab setting is prolonged due to the limits of the 100-watt ultraviolet light bulb and the limited heat that it produced. This shows that sun light would reduce the bacterial count in the useable water source at a faster rate because both the higher intensity ultraviolet light and the heat produced by the sun would increase the rate of bacterial death.

Summary Statement
Ultraviolet light can disinfect useable untreated river water and render it drinkable.

Help Received
Dr. Martha Madrid, MD supervised my project in the lab. My mom helped type my project, shop for supplies, and with my display board. My dad helped me with the review and interpretation of the data and helped me write the abstract. Mrs. Melby, my computer teacher helped me with my charts.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Riley K. Adams

Project Number

J1702

Project Title

Seeking the Green Gold: Optimizing Growth Parameters for Algae Biofuels

Abstract

Objectives/Goals

With a price over $8 per gallon for algae biofuels, companies across America are seeking to reduce the costs. Knowing the best conditions for growing algae may help make algae a viable option. My objective was to investigate which combination of light and nutrients would produce the fastest growth rate and highest yield of algae. My hypothesis was that algae grown in the standard enriched seawater f/2 Media would grow faster than algae in other nutrient sources. The test solutions included wastewater, recycled water and ocean water alone. I also believed the algae would grow fastest under the highest light conditions.

Methods/Materials

The algae I tested was Nannochloris oculata, a salt water strain of microalgae known for its high lipid content (up to 60%) and recommended for biofuel. I tested more than 600 samples, over 34 days in two separate trials. The first nutrient I tested was f/2 Media, the standard media used in laboratories to grow algae. It served as my control. I also tested wastewater mixed with 3% NaCl. I tested recycled water from a municipal water district also mixed with 3% salt and I tested ocean water alone. The 3 experimental light levels were: high (381.05 micromol Quanta/ 31.75 k Lux), medium (211.96 micromol Quanta/ 17.66 k Lux), and low light (127.01 micromol Quanta/ 10.58 k Lux) representing varying light levels during different seasons of the year. I constructed a shelving apparatus, placing light sources at each shelf with screens to alter light levels. To monitor algae growth, I measured the fluorescence of chlorophyll a, the primary photosynthetic pigment present in all forms of algae.

Results

To my surprise, I found that algae grown in wastewater or in recycled water at medium light levels had the fastest growth rates. The f/2 Media samples grew best under 'high' light conditions, but showed far less growth than waste or recycled water under medium light conditions. Wastewater nutrient samples exhibited 56% more algal growth than was seen in the f/2 media samples while recycled water algae exhibited 45% more growth.

Conclusions/Discussion

Based upon my findings, using wastewater or recycled water may be a cheaper and more effective option for growing algae cultures. It would eliminate the cost of raw material and time to formulate f/2 nutrient media. My experiment showed we could make positive use of waste nutrients as we produce algae biomass for renewable biofuel.

Summary Statement

My objective was to investigate which combination of light and nutrients would promote the greatest growth and highest yield of algae biomass for Nannochloris oculata, a microalgae recommended for biofuel production.

Help Received

I received the fluorometer and miscellaneous lab supplies including the algae strain and f/2 Media to be able to set up and run the experiment in my garage from the Scripps Institute of Oceanography Photobiology Lab, Dr. Greg Mitchell. My dad helped me build the shelves. Teacher reviewed my report.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Beatriz Antonio; Edgar Rua

Project Number
J1703

Project Title
Clean Cow Cribs

Abstract

Objectives/Goals
The objective for our project was to determine the most sanitary cow bedding that dairymen should use to reduce the chances of mastitis and contaminated milk. We believe that the almond shell will be the most sanitary bedding because it didn't create a flat surface and we thought the manure would seep through and not build up on the top of the surface.

Methods/Materials
A control and four of the commonly used products for cow bedding and manure were tested for bacteria over an eight day period. We tested sawdust, straw, gin trash and almond shell. There were three samples of each bedding and they were measured under a microscope and also with the naked eye and documented on an observation sheet. Every precaution was taken to ensure cleanliness from using alcohol swabs on tools to timing the Petri dish exposure time.

Results
The data that we gathered informed us that the sawdust had the least bacteria growth over the eight day period. There was very little bacteria on the sample. Straw is a good second choice as it appeared to have only slightly more bacteria under the microscope. The gin trash sample was full of bacteria and the almond shell was too.

Conclusions/Discussion
Keeping the cows teats clean is critical to the success of any dairy operation. If the bedding is sanitary and the cows do not get any diseases, then the milk will be accepted at the creamery and the dairymen will get paid for their milk. This helps them be more profitable. We also checked the pricing for all of the products that we tested. It turns out that the sawdust is the best priced product, and a dairyman could save money purchasing sawdust. Our recommendation for a clean cow crib is sawdust.

Summary Statement
Our project is about which cow bedding is the most sanitary for cow health and dairyman's profitability.

Help Received
Our teacher drove us to two different dairies.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Madeleine S. Appelmans

Project Number
J1704

Project Title
Micro-Algal Growth in Cow Manure

Abstract

Objectives/Goals
The objective of my project is to determine whether micro-algae grown with cow manure will grow at the same rate as micro-algae grown with commercial algae food.

Methods/Materials
First, I mixed distilled water and aquarium salt and then created two dilution series; one with five concentrations of commercial algae food (trademarked as "Algae Grow") and one with six concentrations of cow manure extract. I got the cow manure from the manure retention pond at a local dairy farm owned by Tim Jones in Humboldt County. This composted manure is used to fertilize fields in the late spring and summer. To process the cow manure, I strained it in a coffee strainer, put it in a table top centerfuge for 10 minutes at maximum speed and collected the clear supernatant. The manure extract was then frozen until needed. I next added 0.1ml of Nannochloropsis (a micro-algae) to each jar, then randomized the position of the jars on a Sunray Happy Lamp and the temperature was maintained at 24 degrees Celsius. The photoperiod was 12 hours light/12 hours dark. I let the algae grow for four days. On the fifth day, I counted the number of algae cells using a hemocytometer under a compound microscope at 100x magnification. I repeated my entire experiment again several weeks later.

Results
The micro-algae that were grown with the highest concentration of cow manure grew as well as the algae grown with the commercial food, Algae Grow. The results from the combined Algae Grow and cow manure extract suggest that adding cow manure extract to lower-than-recommended concentrations of Algae Grow helps to maintain higher growth rates.

Conclusions/Discussion
My conclusion is that you can grow micro-algae with cow manure as well as the commercial food, Algae Grow, but with a higher concentration of cow manure. Cow manure extract at a concentration of 100x was better than Algae Grow at a concentration of 1x. Micro-algae are a very good candidate for an alternative energy source because they have a rapid growth rate, are easy to grow, and have been shown to produce 1,850 gallons of oil/acre/year. Using cow manure to grow micro-algae instead of commercial algae food would reduce the cost of purchasing the more expensive commercial food by reducing the concentration needed. My results could help dairy farmers in Humboldt County by providing them with another way to recycle manure and another source of income.

Summary Statement
My project measured the growth rate differences of growing micro-algae with commercial algae food compared to cow manure.

Help Received
My dad helped me develop my hypothesis and methods. Tim Jones helped me get the cow manure. A marine lab technician provided me with the micro-algae, commercial media, and hemocytometer.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Morgan M. Ard

Project Number
J1705

Project Title
Is a Dog's Mouth Really Cleaner Than a Human's?

Abstract

Objectives/Goals
The objective was to compare the bacteria from dog and human saliva. My hypothesis was that the dog saliva would have much more bacteria and a greater variety as well, despite the common belief that a dog's mouth is cleaner than a human's.

Methods/Materials
I took fifteen saliva samples from dogs, thirteen from humans, and twelve controls all within a one hour period. I then put the individual samples on Petri dishes with nutrient agar, sealed them, then stored them in a container kept at approximately seventy-two degries Fahrenheit with no light. every day for three days (on the fourth day the colony forming units got too large to count)I counted the colony forming units, observed the color and shape, and photographed each Petri dish (forty total).

Results
The dog saliva bacteria grew very fast with many colonies and colors such as pink, orange, white, gray, and black. The human saliva bacteria had few colonies and with fewer colors; those colors being orange, pink, and white. For some reason, while the dog and control samples continued to grow, the number of bacterial colonies in the human samples decreased after seventy-five hours. I can't explain why, but that was rather odd. The control samples in the end surprisingly had more colonies than the human samples. The only colors from the controls were gray and white, and the number of colonies was still much less than the dog samples.

Conclusions/Discussion
My results did support my hypothesis. There were many more bacterial colonies in the dog samples than there were in the control and human samples. I did this experiment because I never believed the common saying that a dog's mouth is cleaner than a human's. Dogs do pretty gross things with their mouths, like licking themselves clean, playing fetch with muddy tennis balls, and eating out of the garbage. Most people don't put potentially gross items in their mouths, and do brush their teeth every day. I'm not sure where people got the idea dog's mouths were cleaner but, I have heard it and read it repeatedly. It didn't sound right to me and I wanted to discover the truth for myself once and for all. I am glad my hypothesis was correct, now people can know that you can't believe every thing you hear; particularly about a dog's mouth being cleaner than a human's.

Summary Statement
My project compares the growth of bacteria from the saliva of dogs and humans.

Help Received
Mom drove me to the beach path where I took the samples, Dad helped me learn the graphs for the display and helped me order the Petri Dishes.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Gabriel M. Ares

Project Number
J1706

Project Title
Wolbachia vs. Spiroplasma

Abstract

Objectives/Goals
I did my research project on Wolbachia and Spiroplasma. These two Bacteria infect many insect species are and are passed down from generation to generation through ovaries. My investigative question was; does Wolbachia affect the infection rate of Spiroplasma?

Methods/Materials
I went to Big Sur and capture fruit flies from several locations. I established 38 inbred lines from individual females, and used polymerase chain reaction (PCR) to see whether each line was infected with Wolbachia or Spiroplasma or both.

Results
We found Spiroplasma infection = 0. Due to this, my hypothesis couldn't really be tested and my results are inconclusive. My data did show the approximate infection rate for Wolbachia and Spiroplasma when infection > 0. The infection rate for Wolbachia is around 62.5% and Spiroplasma is almost certainly less than 9% but more probably less than 2.5%.

Conclusions/Discussion
My Hypothesis stated that there would be a change in the rate of Spiroplasma if the flies carried Wolbachia. Unfortunately, my results said my Null, there would be no change, was supported.

Summary Statement
I was trying to see if the presence of Wolbachia affects the infection rate of spiroplasma (a mycoplasma, tiny bacteria that live in fruit fly blood

Help Received
Used lab equipment at UCSC under the supervision of doctors Sullivan and Ares, Justin Crest and Catharina Lindley helped with procedures, Haller ige helped glue the board

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Asia B. Black

Project Number
J1707

Project Title
Hey, I Did Not Order That!

Abstract

Objectives/Goals
The purpose of my project is to make people aware of the germs they might be ingesting if they dont clean the outside of the cups they receive at fast food restaurants. I wanted to investigate if a person could contract bacteria from the outside of a cup even if they were to wash or sanitize their hands first.
I conducted a survey of 240 people. From the 240 people, 164 of the ordered beverages while dining at a fast food My hypothesis was correct. Group B, which was the group with the cups received directly from the cashier had the highest average rate of bacteria. Group C came in second place. Since Group C was pretty high in bacterial containment this shows that a person can contract germs even if they do wash or sanitize their hands but don't wipe their cup. Group D was third and finally the control group was the cleanest. I believe with this project I have proven that people should always wipe their beverage cups 53% of them sanitized or washed their hands. Out of that, only 4% wiped or cleaned the outside of the cup therefore, 96% did not wipe the outside of the cup.

Methods/Materials
10 Fast Food restaurant locations, 40 Petri dishes (100x150mm), Beverage cups, Closet (80°F or incubation), Computer, Cotton swabs, Clay, foam and paint (for the models), Digital camera, Disinfecting wet wipes, Disposable gloves, Large sterile plastic container, Locations for conducting survey, Microscope 150X, 450X, 750X with a projector, Nutrient agar, Purified water, Spreadsheet, Survey (and survey takers 240 in total).

Results
I found significant differences between the wiping the cup and washing your hands and just washing your hands. Once all of the CFU numbers where entered into a spreadsheet I created some graphs to illustrate my results.

Conclusions/Discussion
My hypothesis was correct. My results proved that people should always wipe their beverage cups before they eat and after they sanitize their hands.

Summary Statement
Germs can be transmitted from the cashiers hands to the distributed cups onto your hands, even if you washed your hands.

Help Received
My mom helped me collect my tests specimens,surveys, and photography.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Chester H. Charlton

Project Number
J1708

Project Title
Bio-Hydrogen Project CC-125

Abstract

Objectives/Goals
This project seeks to demonstrate a non-wasteful method to produce hydrogen using Chlamydomonas Reinhardtii, strain CC-125. I will be using an algae, also known as a photosynthetic bacteria, or hydrogenase, which when deprived of sulfur, stops photosynthesis and produces hydrogen instead.

Methods/Materials
Assemble photo bioreactors; Measure and add ingredients for culture media to Bottle A and Bottle B. Record daily growth, swirling daily to activate. Monitor tempature to achieve avg. 20-25 Celsius. Observe evidence of bubbles, ie. Oxygen and Hydrogen. Remove photo bioreactors. Close spout, swirl, Secure balloons to capture Oxygen from Bottle A and Hydrogen from Bottle B,

Two 10 ml cultures CC-125, 25 ml complete salts solution, 25 ml sulfur free salts solution, 50 ml phosphate solution, 50 ml acetate solution, 5 ml trace elements solution, 5 ml sulfur free trace solution, Two pieces vinyl tubing, One piece latex tubing, Four 1 ml disposable pipettes, Five 5 ml disposable pipettes, One 50 ml plastic tube, Four balloons (to collect gas produced by cultures).

Results
The results of this project surprised me for this reason: The algae was touchy about its environmental needs. In my first experiment with CC-125, Bottle A produced a greater amount of oxygen than in my second experiment. Where as Bottle B produced a lesser amount of hydrogen in Trial 1 and a greater amount of hydrogen in Trial 2. In both trials the growth of CC-125 was observed over the course of 12 days and was ultimately successful, but was variable due to fluctuations in its temperature and growth medium.

Conclusions/Discussion
My hypothesis was correct. Bottle A produced oxygen and Bottle B produced hydrogen. I think further study is needed to improve biohydrogen production on a commercial level.
Chlamydomonas reinhardtii grew quickly in both Bottle A and B before losing energy at Day 6 (see graph). Bottle A then slowly tapered its growth. Bottle B quickly plummeted to a non-energy, (or non hydrogen-producing) state. The hydrogen producing phase was only 3-4 days. The scientific principle in this study is photosynthesis. This is the process that plants use to convert sunlight into energy. CC-125 performed regular, or aerobic, oxygen producing, photosynthesis in Bottle A.

Summary Statement
My project seekes to find a renewable way to create H2.

Help Received
parent helped type the report

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Ariana N. Dermand

Project Number
J1709

Project Title
Cooking Smart: The Use of Spices to Inhibit Microorganism Growth in Meat

Abstract

Objectives/Goals
Spices have been used around the world for centuries and have been believed to prevent microorganism growth in meat. The purpose of my experiment is to prove if such is true. If so, which spice is the best to use to prevent microorganism growth? After completing my experiment, I will know which spice tested, if any, inhibits the most growth from raw hamburger meat.

Methods/Materials
I streak-plated nutrient agar Petri dishes with raw hamburger meat using a loop and I applied a different spice to each dish, carefully ensuring each streak-plated section had a sample of spice applied. I also had a control dish that had only meat streaked on it. The following spices were used in the experiment: black pepper, cinnamon, clove, coriander, garlic, lemon juice, oregano, pepper, rosemary, and salt. The dishes were put under a Stryfoam incubator and kept at 34 degrees Celsius for three days and had two replicates.

Results
All of the Petri dishes showed growth on the nutrient agar. Most of the spices were surrounded by a yellowish/white mass. The control plate showed white dots in all sections of the streakplate. Most spices inhibited growth of the same white dots seen on the control plate fairly well. Only small white dots were found on some dishes containing spices similar to the ones found on the control plate. The spices that prevented growth listed from most prevention to least prevention were: lemon juice, salt, rosemary, clove, habanero pepper, coriander, oregano, cinnamon, garlic, and black pepper.

Conclusions/Discussion
I concluded that most spices tested were able to inhibit growth of microorganisms from the meat. I hypothesized that the chili peppers and the lemon juice would probably inhibit the growth best. It was surprising to find white masses that surrounded most of the spices in the dishes. I was not able to determine what type of growth grew out without access to a microscope, but I observed what surrounded the spices looked different to that on the control plate and that some spices had significantly less growth than seen on the control. Now with access to a microscope, I have decided to re-run the experiment so I may be able to classify if the growth was bacterial or fungal or possibly both.

Summary Statement
The purpose of this project is to determine if spices inhibit the growth of microorganisms in meat.

Help Received
My science teacher, Mrs. Vodraska, helped teach me how to prepare agar; my step father taught me about the importance of streakplating; my Girl Scout leader, Mrs. Winter, taught me how to use a microscope.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Rachel S. Dokko

Project Number
J1710

Project Title
A Shoe Cleaning Machine to Reduce the Levels of Bacteria on Footwear

Abstract

Objectives/Goals
How much bacteria are actually found on the bottoms of shoes, and if there is a significant amount, is there an effective way to get rid of them? If there is a great amount of bacteria found on the bottoms of shoes, then people who wear their shoes inside will spread more bacteria in their houses. This scientific experiment benefits all people who wear their shoes inside their houses. It also gives them the choice of keeping their shoes on, without worrying about the transfer of bacteria.

Methods/Materials
By culturing six pairs of shoes, this hypothesis was tested. The first of the three shoes were worn over a period of 15 days, while every 5th day, the bottom of each shoe was cultured. Then after the 15th day, each shoe was cleaned with the machine, which was built to try and reduce the amount of bacteria. The remaining three pairs of shoes were random samples that were already worn, and were only cultured before and after using the machine.

Results
After the data was collected, it showed that during the 15 days, the bacteria colonies increased 382.39 times, with the highest number of colonies counted being 1,317.5. But luckily, after using the machine, the bacteria diminished by 856.17 colonies, or a 92.59% decrease in bacteria.

Conclusions/Discussion
This proves that even though shoes are a place where many types of bacteria collect, they can easily be removed through a simple and effective cleaning that anyone can carry out in daily life.

Summary Statement
It is a practical way to recude bacteria on shoes, so they can be worn inside without spreading any illness.

Help Received
Father helped operate power tools and wire machine; Uncle taught how to culture bacteria effectively

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Asha N. Failor-Wass

Project Number
J1711

Project Title
Microbes in the Mouth

Abstract

Objectives/Goals
The objective of my project is to quantify and compare the number of bacterial colonies in the mouths of a dog, cat, rabbit and human.

Methods/Materials
To obtain my results I gathered two oral samples from one dog, cat, rabbit, and human with sterile swabs. The samples were then streaked on sterile agar plates in a zig-zag formation. All the bacterial samples were grown at room temperature in the same location. The bacterial colonies were then counted, averaged, and compared.

Results
The results of the study showed that the rabbit had the most bacteria in its mouth with 73 colonies. The dog followed with a colony count of 22.5, then the cat with a count of 7.5. The mammal with the least amount of bacteria in its mouth was the human, with a bacterial count of 1.5 colonies.

Conclusions/Discussion
My project compared the amount of bacteria in the mouth of a dog, cat, rabbit and human. My hypothesis was that the dog would have the most bacterial colonies in its mouth followed by the cat, then the human, and lastly the rabbit. My results indicated that I needed to reconsider my hypothesis.

The findings of this experiment expanded my knowledge in many different ways, and are important to the outside world because they have real life applications. For example, the bacterial colonies in an animals' mouth may pose a health threat to a human because of the probability of infection if bitten by the animal. These results may also change the way you treat your animal. One example is that you may never let your dog lick your face again. You may also brush your teeth more, and maybe your pets# teeth once in a while too.

Summary Statement
My project quantifies and compares the number of bacterial colonies in a dog, cat, rabbit, and human's mouths.

Help Received
Dad helped paste papers on board; science teacher advised and edited project: Mom and Dad helped with exparamentation

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Jeremy E. Fukushima

Project Number
J1712

Project Title
Is That Lemon Safe?

Abstract

Objectives/Goals
Does bacteria grow on a lemon wedge from different restaurants and what can effect the growth?

Methods/Materials
1.Take Blood Agar plates out of refrigerator and place in the open air
2.Keep the lids closed and let the plates come to room temperature for 10 to 15 minutes
3.Divide plate into fourths with a white crayon on back of the plates
4.Carefully swab the outside rind of the lemon and swipe the swab on one of the quarter sections of the plate
5.Use one quarter section of the plate for one sample therefore one plate will have four samples
6.Each lemon wedge was tested three times (three quarter sections)
7.Place the plate in an insulated container at room temperature to help ensure a stable environment
8.Check and record growth every 24 hours for a week
9.Repeat for other tests

Results
47.5% of the samples grew something by the end of the second day. By the end of the week 84.2% of the plates grew something. Almost all of the samples grew different kinds of bacteria and molds.

Conclusions/Discussion
My conclusion is that the restaurants that did not have tongs and lids grew more. In addition, the way the places washed their lemons had an effect n the amount of growth. Finally, improved restaurant hygienic standards need to be implemented for lemon wedges.

Summary Statement
My project is looking to see if and how much bacteria grow on lemons from different restaurants.

Help Received
Mother hepled cut and retrieve lemons and done under her supervision. My mom is a pharmacist at Hoag Hospital.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alexis A. Garcia

Project Number
J1713

Project Title
Caution! Water Hazard

Abstract

Objectives/Goals
The purpose of my project was to determine if there are any adverse effects to reusing a water bottle for at most one week without being washed. There are two types of bacteria, Mesophillic and Coliform bacteria, which were tested in my project. For Mesophilic bacteria I hypothesized that there will not be sufficient amount of build up in five days to cause adverse effects and cause the water to be non-potable. I also hypothesized that Coliform bacteria will not show those same effects before seven days.

Methods/Materials
I used seven reused plastic water bottles for at most one week, but also tested a new bottle that was never reused as my control. I used two methods to culture cells, petri dishes and test tube incubation to test for both the Mesophillic and Coliform bacteria. The petri dishes were incubated upside down for 24-48 hours. After 48 hours, I observed the quantity of Mesophilic and Coliform bacteria in the petri dishes by counting each of the bacteria's colonies. The test tubes were used for handling and culturing both bacteria. Test tubes were filled with both distilled water from the bottles and Lactose broth, then upturned into a water-filled beaker to capture any gases of either bacteria. These two methods were repeated for the remaining seven bottles.

Results
My data and results shows that after four days of reusing a water bottle it is non-potable and can contain adverse effects. Bottle number eight, which was reused seven days in a row, reached the highest number of Mesophilic bacteria found out of all eight bottles, while the bottle that was reused only one day reached the lowest amount of Mesophilic bacteria found. For both of these bottles, Coliform bacteria were not found in seven days.

Conclusions/Discussion
Based on my research and results, I must reject both of my hypotheses because my findings show that after four days it contained more than 500 CFU (Colony Forming Units) per milliter of the Mesophillic bacteria which does not satisfy the healthy drinking water criteria. I had hypothesized that there would be no adverse effects in five days. For the Coliform bacteria there were no colonies found in the seven days in which I tested.

Summary Statement
The purpose of my experiment was to test to see if any adverse effects resulted from reusing a water bottle for at most one week.

Help Received
Used lab equipment at Rodriguez's Laboratory under the supervision of Mr. Rodriguez; friends and family for their contribution; mother helped construct the board; Mariela accompanied me in searching for a laboratory.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Eva M. Gleizer

Project Number
J1714

Project Title
Eliminating E. coli: How Hard Can It Be?

Abstract

Objectives/Goals
My objective was to determine which condition would eradicate the most E.coli when applied to ground beef.

Methods/Materials
The materials I used were cotton swabs, test tubes, distilled water, auger plates, surgical style gloves, a harmless strain of E.coli, a dark colored Sharpie, a glass spreader, Methanol, sterile costar STRIPETTE, a test tube rack, a graduated cylinder, a small glass bowl, ground beef, bleach solution, cheese cloth, a kitchen scale, a lighter, and a pair of kitchen scissors. I 'infected' distilled water with E.coli (10 milliliters) before mixing it in with the bowl of ground beef. After that I added whatever condition I was testing, and the froze the meat. When the meat had frozen I tested one gram pieces by mixing them into 10 more milliliters of distilled water before I spread the water onto auger plates. The plates incubated for 3 days, and then the colonies were counted manually by myself.

Results
After my experimentation, I discovered that chili powder grew the least amount of colonies with an average of 46 'regular' sized colonies. There was also an average of 4 colonies which were abnormally sized, i.e. they were larger or discolored in comparison to the majority of the bacterium. Cinnamon grew the most colonies with an average of 69 regular and 9 abnormally sized colonies of E.coli. Lime juice had an average of 57 regular colonies and 8 abnormal colonies, whilst the control group had 113 regular colonies and 8 abnormal colonies.
However, currently I am not yet finished with my testing. There are still two more variables that have not been factored in.

Conclusions/Discussion
After completing my project, I came to the conclusion that chili powder was the most effective at eliminating the E.coli bacterium. This contradicted my hypothesis, as I had predicted that lime juice would be the most effective. I did, however, obtain my objective successfully. Due to this project, I have learned when consuming raw meat which is safer to add out of the three candidates, and I also have a better knowledge of ground beef, specifically how it is manufactured, as a whole.

Summary Statement
My project is about finding which condition (cinnamon, lime juice, or chili powder) will hinder the growth of the E.coli bacterium the most.

Help Received
Parents provided materials for project in addition to support; Teachers helped by providing information and helpful resources; Other Teacher in the district assisted in both ideas and materials, he provided the testing space and supervision required.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Austin K. Ha

Project Number
J1715

Project Title
Are You Anti-Antibiotic?

Abstract

Objectives/Goals
The objective of this experiment was to find what types of antibiotics E. coli, bacteria commonly found in raw or undercooked meat and produces, can grow resistant to. My hypothesis was that the E. coli could grow resistant to Penicillin and Erythromycin, but could not grow resistant to Ampicillin, Amoxicillin, and Kanamycin.

Methods/Materials
A mixture of distilled water and agar powder was boiled, then poured into Petri dishes to form the living surface for the bacteria. Sterile swabs were used to transfer E. coli from a tube slant onto the agar in the Petri dishes. A penicillin dish was placed one in each of 16 dishes. The same went for Ampicillin, Amoxicillin, Erythromycin, and Kanamycin. The dishes were incubated and the growth of the bacteria was measured and recorded every other day for 21 days.

Results
In the resulting averages, E. coli from inside the dishes containing Penicillin, Ampicillin, and Amoxicillin was able to grow resistant (within 5 mm of) to the antibiotic. The bacteria was able to grow as close as 1.9375 mm to the Penicillin discs, as close as 2.0625 to the Ampicillin discs, and as close as 2.125 mm to the Amoxicillin discs. In contrast, the E. coli was only able to grow up to 9.5 mm to the Erythromycin discs and only up to 10.125 mm to the Kanamycin discs.

Conclusions/Discussion
The main hypothesis was that the E. coli could grow resistant to Penicillin and Erythromycin, but could not grow resistant to Ampicillin, Amoxicillin, and Kanamycin. The bacteria was able to grow resistant to Penicillin, Ampicillin, and Amoxicillin, but not able to grow resistant to Erythromycin and Kanamycin, refuting most of my hypothesis. My experiment shows how dangerous E. coli can be to humans and animals since it can grow resistant to different types of antibiotics, and also how antibiotic resistance can become dangerous.

Summary Statement
In my project, I tested whether or not E. coli would be able to grow resistant to different types of antibiotics, including gram negative, gram positive, and broad spectrum antibiotics.

Help Received
Father helped me to buy all of my supplies, to create an incubator for the bacteria to live in, and to properly dispose of the Petri dishes; Mother helped me boil and prepare all of the agar plates; my science teacher and advisor, Ms. Fisher, helped in all aspects of my project and guided me throughout the project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Maya A. Hotz

Project Number
J1716

Project Title
What Starter with Which Milk Makes the Creamiest Yogurt?

Abstract

Objectives/Goals
The problem I am trying to solve with my project is to find out how to make really creamy yogurt. I learned from my research about different ingredients that could be used to prepare yogurt. This gave me an idea for my hypothesis. Since some yogurts are creamier than others, I decided the differences must come from the ingredients used. Therefore, I hypothesized that the ingredients highest in fat content would make the creamiest yogurt. I experimented with three milks with varying fat contents and two yogurt starters, also with different fat contents.

Methods/Materials
Experiment Design: To test my hypothesis I performed 6 experiments using 2 different starters* and 3 types of milk with varying fat contents. My constants are the: amount of milks, amount of starters, amount of time the milks were boiled (2 minutes), all milks were cooled to 110 degrees F. and all the recipes were warmed for 10 hours. My variables were: the types of milk used, 2% cow's milk, 1% goat's milk, and soymilk and the yogurt starters: Fage brand Greek non-fat yogurt and Brown Cow whole milk yogurt. The variables changed the creaminess of the experiments. To measure the variables I had people do a blind taste test and rate the different yogurts for creaminess. *To make yogurt at home an active (living) culture is necessary as a "starter." Active living cultures refer to the living organisims found in some yogurts such as lactobacillus bulgaricus.

Results
My data showed the high fat content milk mixed with the non-fat yogurt starter was judged the creamiest. The yogurt made with the highest fat content did not turn out to be the creamiest, so I didn't prove my hypothesis.

Conclusions/Discussion
I have learned that ingredients with the most fat content do not necessarily make the creamiest yogurt. If I did this experiment again, I would try to find a better way to judge 'creaminess'.

Summary Statement
What starter with which milk makes the creamiest yogurt?

Help Received
Mother helped type report and individuals volunteered for blind taste testing.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Emily P. Imfeld

Project Number
J1717

Project Title
Investigating If Different Levels of UV Light Blockage in Glass Affect the Amount of Airborne Bacteria in Your House

Abstract

Objectives/Goals
Hypotheses-Clear glass will have the least amount of airborne bacteria. It has the lowest amount of UV light blockage, lets the most UV light in and kills the bacteria. Laminated glass will have the most airborne bacteria because it blocks the most amount of the UV light from the sun.

Methods/Materials
Materials*75 Nutrient Agar Petri dishes*Five 24x36inch wooden raisin trays*10 paper tray liners*50Tbsp of spoiled persimmon*50Cups of fresh potting soil*Five 32x40inch dual pane windows-one for each glass type*Commercial hot house*Fan*1x1 cm grid*Camera
Procedure 1.Put a 24x36inch raisin paper on top of 24x36inch wooden tray 2.Spread 10 Cups of top soil on raisin paper ½ inch thick. 3.(1)Tbsp of spoiled persimmon in 5 evenly spaced spots on top of soil 4.Cover w/glass type & set in sun for 12 days 5.Remove glass from tray 6.Put plastic sectioned container on soil 7.Put Petri-dish over container opening and let sit for 10 min 8.Remove and seal Petri-dish 9.Put sealed Petri-dish in dark warm area for 72 hrs then measure bacteria growth 10.Repeat Steps 1-9 for each glass type 11.Bleach, seal and dispose of Petri-dishes in hazardous waste receptacle

Results
I found that my hypotheses were incorrect. The Triple Layer Silver Low-E glass preformed best and averaged 13.67 colonies/Petri Dish. The reflective properties of the Silver Layer in the glass deterred more UV light than any other glass types.

The Double Layer Silver Low-E glass performed 2nd best and averaged 14.27 colonies/Petri Dish. It had one less layer of silver than the best performing glass and again the reflective properties of the Silver Layer in the glass helped prevent more UV light from penetrating than any of the lesser performing glass types.

The 3rd and 4th best performing glass types were the Laminated which averaged 21.60 colonies/Petri Dish and the Dual Pane Clear averaged 23.07 colonies/Petri Dish.

The glass type that let the most air borne bacteria growth was the Single Pane Clear glass that averaged 39.87 colonies/Petri Dish.

Conclusions/Discussion
I would suggest Triple or Double Layer Silver Low-E glass as the best window glass type for homes to reduce airborne bacteria. I found that visible light may help bacteria growth more willingly than UV light reduces the growth of the bacteria. My bacteria growth results were very similar to the visible light transmission of each glass type. This is what may have caused the results.

Summary Statement
My project is investigating if homes with energy efficient windows have more bacteria growth then homes with out energy efficient windows.

Help Received
Mom & Dad help proof read report. Dad help move the heavy windows and made sure I was safe when handling the bacteria.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Kaelene Jensen

Project Number
J1718

Project Title
How Do Changes in Light and Dark Affect the Bioluminescence of Pyrocystis noctiluca?

Abstract

Objectives/Goals
I wanted to learn if the bioluminescence of plankton could be increased by giving it more light.

Methods/Materials
I obtained living samples of plankton that I subjected to variuous amounts of lamp light over a three week period and measured their bioluminescence five times a day. One test group received no light, a second group received 12 hrs of light and 12 hrs of darkness, and the third group received continuous light. I measured each group over a three week testing period.

Results
When the data was averaged over the three week period the plankton reciving 12 hrs light and 12 hrs darkness recorded the brightest bioluminescence. Surprisingly, the plankton recieving light continuously had the lowest brightness scores.

Conclusions/Discussion
I was surprised that the plankton receiving the maximum amount of light produced the lowest brightness. This made me think, "why?" I did some more research after my experiment and found out that bioluminescence is actually a chemical reaction that is only partly dependent on sunlight. I would like to do an experiment on what this chemical is and how it works.

Summary Statement
How does darkness and sunlight affect bioluminescence in plankton?

Help Received
Parents helped get materials and with grammer, punctuation, and spelling.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Anjini Karthik

Project Number
J1719

Project Title
Green Pharmacy: The Antimicrobial Effect of Spices and Herbs

Abstract

Objectives/Goals
We are currently facing a major medical crisis: antibiotics are becoming less effective as bacteria are developing resistance to them. I wanted to find if natural alternatives like spices and herbs may help by killing food-borne pathogens. My project tested if spices and herbs had antimicrobial properties, and if they did, how effectively they "cleaned" our food. I hypothesized that each spice or herb would partially inhibit bacterial growth, and the amount of inhibition would depend on the spice or herb.

Methods/Materials
I had ten spices and herbs: garlic, turmeric, black pepper, red pepper, cinnamon, cumin, oregano, coriander, ginger, and onion; I had a positive control of ampicillin and a negative control of sterile distilled water. I used the Kirby-Bauer disk-diffusion method to test my hypothesis. I swabbed E. coli on nutrient agar and placed filter paper disks impregnated with the test agent on it. Then I incubated all the plates and measured any zones of inhibition the next day. On my third trial I also tested three different dilutions of garlic. For my fourth and fifth trials, I tested the following combinations: garlic and oregano; garlic and turmeric; and onion and ginger. I added plain garlic as an additional control.

Results
Individually tested, garlic had the highest amount of inhibition, even after dilutions. It was followed by oregano, then cinnamon. Turmeric, black pepper, cumin, coriander, onion, and ginger all exhibited average inhibition, and red pepper showed the least. Combined, garlic and oregano had higher inhibition compared to garlic alone, while garlic and turmeric's combination had less. Ginger and onion combined had the least inhibition. For all trials, sterile distilled water had no inhibition, while ampicillin had complete inhibition.

Conclusions/Discussion
Since spices and herbs are plants, which can be infected by microbes, they have antimicrobial compounds called phenols. Almost every plant contains these, and that's why they all exhibited some inhibition, though in different amounts. Garlic had the highest inhibition because it has the special antimicrobial compound allicin in addition to other common phenols. This can help us in the real world in two ways: by eating spices and herbs, we are reducing our chances of infection from food-borne pathogens. If we don't get sick so often, we can reduce our use of antibiotics, keeping them effective.

Summary Statement
My project intended to test if spices and herbs had antimicrobial properties, and if they did, then how effective they were, and to conclude if these could provide us the "green pharmacy", the natural alternative to antibiotics.

Help Received
I acknowledge my parents for driving me to the lab and my science teacher, Mrs. Nguyen, for her help and guidance throughout this project. I thank the Tech Museum for letting me use their Wet Lab, and lastly, a special thanks to Barry Starr, the microbiologist who supervised me in the lab.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Daniel Kuai

Project Number
J1720

Project Title
To Swish or Not to Swish? That Is the Question: The Effectiveness of Oral Hygiene in Reducing Bacteria in the Mouth

Abstract

Objectives/Goals
My project was to determine what method of cleaning: 1) toothbrushing, 2) toothbrushing and flossing, 3) toothbrushing and mouthwash rinsing would kill the most bacteria in my mouth. My hypothesis was that toothbrushing and mouthwash rinsing would kill the most bacteria.

Methods/Materials
I prepared petri dishes by heating a bottle of nutrient agar and filling 10 dishes at a time. I stored the unused petri dishes upside down in sandwich bags in the refrigerator. For the control, my dad poured distilled water over a sterile cotton swab and swiped one tooth in my uncleaned mouth. We then swabbed back and forth across the entire petri dish. We did this a total of three times. I then stored the petri dishes in my incubator at 30 degrees Celsius. The next day I counted the petri dishes for the number of bacterial colonies. There were a lot of very small colonies so I counted in groups of ten. I recorded the temperature, time, number of colonies, and observations in my journal. I repeated all these steps for the tooth brushing, toothbrushing and flossing, and toothbrushing and mouthwash rinsing trials. I did a total of 9 dishes for each. My constant factors were the same amount of mouthwash (10 ml.) and toothpaste (pea-size), the same amount of time brushing (2 min.), flossing (1 min.), and mouthwash rinsing (1 min.). I incubated the dishes at the same temperature (about 30 degrees Celsius) for the same amount of time (24 hours).

Results
After doing my experiment, the mouthwashing group had the least amount of bacteria colonies counted per plate with an average of 635. The toothbrushing group had an average count of 1,157 colonies per plate. The toothbrushing and flossing group had an average count of 956 colonies per plate. My control group had an average count of 1,742 colonies counted per plate. To make sure that the average numbers of the four groups were reliable, I found that the control group had the most bacteria colonies counted in 7 out of 9 trials. Also, the toothbrushing and mouthwash rinsing group had the least amount of bacteria colonies counted in 5 out of the 9 trials. This proved to me that the averages were reliable.

Conclusions/Discussion
My hypothesis was supported because toothbrushing and mouthwash rinsing had the smallest average amount of bacteria colonies compared to toothbrushing and toothbrushing and flossing.

Summary Statement
My project showed me how important toothbrushing, flossing and mouthwashing is in preventing diseases in my mouth.

Help Received
My mom helped with typing and matting. My dad took pictures and swabbed my tooth and helped me swab the dishes.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Kriti Lall

Project Number
J1721

Project Title
Environmentally-Friendly Algal Hydrogen

Abstract

Objectives/Goals

The purpose of my project is to test two different methods of producing environmentally friendly hydrogen using the green algae Chlamydomonas reinhardtii. Under certain conditions, the photosynthesis process occurring within this algae is known to produce hydrogen.

Although the use of hydrogen as a fuel is environmentally friendly, its production is not. Today, most of the hydrogen is produced from fossil fuels, emitting greenhouse gases. Hence, hydrogen as a fuel does not solve the greenhouse gas problem. On the other hand, producing hydrogen through algae promises reduction in air pollution and global warming.

Methods/Materials

I used five water bottles (with spouts), and labeled them as Control, Copper 1 ppm, Copper 1.6 ppm, Copper .8 ppm, and Sulfur Free. I added control, sulfur free and copper (0.8 ppm, 1ppm and 1.6 ppm) solutions to each bottle, along with equal amount of algae in each bottle. I assembled an airtight apparatus for each to make sure the algae environment would eventually become anaerobic. I left the apparatus assembled for four days.

On the fourth day, I took off the apparatus, and fitted balloons onto the spouts of the water bottles. These would be used to collect the gas that the algae produced. After 12 days, I observed the bottles again. The balloons were filling up with gas. Carefully pinching the balloons, I took them off of the water bottle spout. Then, I measured the amount and type of gas produced (oxygen/hydrogen) using a graduated cylinder and a burning splinter. I repeated this experiment two times to make sure my results were valid.

Results

The sulfur free environment for the Chlamydomonas reinhardtii was the most effective in producing hydrogen, followed by copper 0.8 ppm, copper 1 ppm, copper 1.6 ppm, and control. Control produced no hydrogen, but made 17.5 ml of oxygen.

Conclusions/Discussion

Both methods, sulfur deprivation and copper addition, produced hydrogen with Chlamydomonas reinhardtii. Control didn#t produce any hydrogen because it was not under any specific conditions. Sulfur free produced the most hydrogen, but it eventually killed the algae. This was due to the absence of proteins that were in the deprived sulfur. Due to the fact that copper is an algaecide, copper 1.6 ppm produced less hydrogen than copper 1 ppm and copper 0.8 ppm. In other words, as the copper amount increased, the hydrogen amount produced decreased.

Summary Statement

This project involves testing and comparing two methods of producing environmentally friendly hydrogen, copper enrichment and sulfur deprivation, using the green algae Chlamydomonas reinhardtii.

Help Received

Dad helped in procuring project materials and handling algae and chemicals.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Erin S. Lee

Project Number
J1722

Project Title
Powering Up Your Home with Green Energy

Abstract

Objectives/Goals
To see if green algae can be tricked into producing H(2) via photosynthesis and the optimal conditions for maximum production. I will also determine whether this H(2) can be a viable energy source.

Methods/Materials
Green algae kit (containing Chlamydomonas cultures) was ordered from the Chlamy Center (Duke University, Durham, NC) Algae was grown in 1 of 4 conditions, all under a 60 watt bulb 24/7: "Control" - left alone, "Variable 1" - "fed" CO(2) daily, "Variable 2" - spun constantly, and "Variable 3" - "fed" and spun. The algae was induced to produce H(2) by being put into anaerobic and sulfur-deficient conditions. The algae was centrifuged and washed in sulfur-deficient media. The volume of O(2) and H(2) produced was measured separately by recording the pressure increase in an airtight bio-reactor and converted to volume (ml) of H(2). Electricity from the H(2) produced by the algae was made using a fuel cell.

Results
The optical density of 4 bottles, or the amount of algae, was measured repeatedly during 3 months. The worst condition was the control, which was approx. 5 x 105 cells per ml. None of the other conditions reached Variable 3's peak density (approx. 5 x 106 cells per ml). O(2) production from algae was much more than H2 production (9 vs. 1.8 ml/day, respectively). Gas production was linear in increase (r2 of .94). The amount of electricity produced per ml of H(2) from both electrolysis and algae was recorded using an ammeter. H(2) produced from electrolysis produced almost six times more electricity per ml than H2 from algae. However, both methods produced very little electricity - electrolysis produced 1.7 mW and algae produced 0.3 mW. Lastly, the cost of 1 KWH of electricity from 4 different sources was calculated. One KWH from LA DWP costs $0.13; from electrolysis was $0.80; from algae ranged from $1.06 to $30.58 depending on how the H(2) was collected.

Conclusions/Discussion
The cost of making electricity from algae-generated H(2) is 6-8 times higher than electricity from fossil fuels. However, H(2) could be a valuable energy source in the future if the amount of H(2) produced from algae could be made more efficient, and/or the price of fossil fuel electricity goes way up. Since we have a limited source of fossil fuels, a home of the future would most likely be powered by a combination of renewable sources, including H(2) from algae.

Summary Statement
My study showed that green algae can be tricked into producing hydrogen and this hydrogen can be used to produce electricity using a fuel cell.

Help Received
Dad soldered wires for fuel cell, Chlamy Center advised on growing of algae

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Gabriela Levikow

Project Number
J1723

Project Title
Does the Emergency Ride Affect the Bacteria Inside?

Abstract

Objectives/Goals
Each year in the United States there are about 1 billion colds. Some of these are caused by emergency vehicles. I hypothesized that out of the ambulance, police car, and fire truck, the police cars would have the most bacteria inside. Many criminals go inside police cars and the officers most likely do not clean the inside as well as they could. Bacteria are important in determining how often people get sick. In emergency vehicles, bacteria could be everywhere because of the everyday situations the workers face.

Methods/Materials
I was very careful to make sure my experiment was as accurate as possible. I thought about how to control my test so that I could get the best possible results. I swabbed the vehicles in the same place every time, and I transferred the swabs into the agar plates the same way every time. I looped my agar plates the same way every time. I also made sure I wore gloves every time I dealt with the bacteria. The incubation period was the same for each plate, two days.

Results
I found that out of the three vehicles, the police cars had the most bacteria inside. On average, the police cars had about 917 bacteria spores in the four places I swabbed. The ambulances had 130 bacteria spores inside, and the fire trucks had about 221 bacteria spores present.

Conclusions/Discussion
As you can see, there was a big difference in the numbers.

Summary Statement
My science fair project determined which emergency vehicles tend to have the most bacteria spores inside; comparing ambulances, fire trucks, and police cars.

Help Received
Dad set up appointments to swab vehicles, also took pictures; mom helped type papers; teacher provided microbiology lab.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Lacey M. Lindsley

Project Number
J1724

Project Title
Which Antibiotic Most Effectively Reduces the Amount of Bacteria?

Abstract

Objectives/Goals
The purpose of this experiment is to determine which antibiotic most effectively reduces the growth of bacteria. The hypothesis was that ciprofloxacin would reduce bacteria growth most effectively than amoxicillin-clavulanic acid, tetracycline, or vancomycin.

Methods/Materials
To conduct this experiment, take antibiotic paper discs of amoxicillin-clavulanic acid, ciprofloxacin, tetracycline, and vancomycin and place them into agar plates inoculated with Bacillus cereus. Over a period of 12 hours, 24 hours, and 36 hours, measure and record the zone of inhibition around the antibiotic discs from all seven trials.

Results
The results of the experiment were the ciprofloxacin was the most effective on average to the growth of the bacteria while tetracycline had little effect, vancomycin was less effective, and amoxicillin-clavulanic acid was the least effective. The results indicate that the hypothesis should be accepted as the ciprofloxacin treated dishes showed more interference with the bacteria growth, leaving the bacterium unable to form new proteins vital to its growth with the largest zone of inhibition.

Conclusions/Discussion
Because of the results of this experiment, additional studies should be done to see if ciprofloxacin would still work most effectively if there were different types of bacteria used, and to treat bacteria with different antibiotics, as well as different substances like wine, cider, vinegar, or seaweed. Findings from this experiment could prove to be useful to those in the medical field, microbiologists, and other areas of work related to bacterial resistance and those having contact with bacteria.

Summary Statement
To determine which antibiotic most effectively reduces the growth rate of bacillus cereus.

Help Received
Qualified scientist inoculated the bacteria and disposed of the bacteria properly.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Olivia K. Maglieri

Project Number
J1725

Project Title
Investigating Bacteria Contamination Levels on Different Coins Exposed to Various Environments

Abstract

Objectives/Goals
The purpose of my project is to compare the effects of various environments on the contamination level of different coins. This is a second year study, I am furthering my investigation by including different coins and by placing the coins tested directly onto the petri dishes. The reason that I am doing this experiment is to determine whether the metal composition of coins is a factor in keeping bacteria from growing.

Methods/Materials
I conducted my experiment by using sterilized Q-tips, Petri dishes containing agar, pennies, dimes, nickels, quarters, silver dimes, gloves and subbing alcohol.
I gathered samples from a lake, soil, and placed coins in students hands. I placed 20 of each coin in the different environments for 24 hours. The coins tested on human hands, where handled by students for 10 minutes. I swabbed the coins onto a petri dish and place coins directly onto the agar. After 48 hours I counted the bacteria colonies using a grid and a mathematical formula. I completed 10 trials.

Results
The results of my investigation concluded that the average amount of bacteria counted on nickels in the lake water had an average of 1,416 bacteria colonies. Quarters in the lake water had an average of 1,150 bacteria colonies. Pennies tested in lake water and placed on top of agar had an average of 20.8 bacteria colonies. Silver dimes and quarters tested in lake water and placed on agar had an average of 11.1 bacteria colonies. Dimes tested in soil had an average count of 24 bacteria colonies. Pennies tested in soil and placed onto the agar had an average 2.4 bacteria colonies. The human hand environment tested with silver dimes had an average of 190 bacteria colonies while quarters had .8 average bacteria colonies. Pennies tested on human hands had an average of 23.2 bacteria colonies and quarter had 12.4 bacteria colonies placed onto agar.

Conclusions/Discussion
After completing my investigation I found that quarters tested on human hands and swabbed onto the agar had the least amount of bacteria colonies. I learned that the coins tested in the environments and then placed onto the agar had less bacteria growth than the coins that were swabbed.

Summary Statement
This project is about testing wheter or not metal in coins can block bacteria from growing.

Help Received
Carl Gong

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Julia Matthews

Project Number
J1726

Project Title
Ionized Water: Killing Germs and Saving the Earth

Abstract

Objectives/Goals
I will attempt to show that ionized water is more effective against bacteria than harsh chemicals such as bleach,lysol,alcohol,and clorox non-bleach solution.

Methods/Materials
I swabbed drinking fountains for bacteria and placed each in a seperate petri dish.In four of my experiments I measured two ml of bleach, lysol, alcohol, clorox non-bleach solution,and ionized water and placed each in one of the five petri dishes. As my manipulative variable,in four experiments I used one ml of ionized water and two ml of the other chemicals. I recorded immediate results and viewed each dish under a microscope at 40x power the next day. In my other experiments I repeated this by swabbing a dog food bowl for my bacteria samples. I repeated each experiment eight times.

Results
I found that the ionized water killed all of the bacteria in four out of eight experiments and the majority of the bacteria three times. However, in one of the experiments that used one ml of ionized water, the ionized water did not kill any of the bacteria. Bleach killed all bacteria four times but did not kill any bacteria three times.Lysol and alcohol killed all bacteria two times, the majority of bacteria three times,and no bacteria three times. Clorox killed all bacteria once, the majority twice, and no bacteria five times.

Conclusions/Discussion
My experiments proved my hypothesis. Ionized water is a safe yet powerful disinfectant.

Summary Statement
This project is about the effects of ionized water on bacteria as compared to other disinfectants.

Help Received
The Sheraton Delfina provided the ionized water.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Audrey M. Mayer

Project Number
J1727

Project Title
The "Clear" Choice

Abstract

Objectives/Goals
The objective of my project was to determine the best possible water choice for a tennis player on the court. I tested water sources from a drinking fountain, plastic water cannister on the court, tap water in a plastic container and tap water in an aluminum container.

Summary Statement
The best water source available to a tennis player on the court.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Zacariye Mohamed

Project Number
J1728

Project Title
Food to Go!

Abstract

Objectives/Goals
This project was done to know the safest type of packaging out of the three: Ziploc bag, plastic container and aluminum foil.

Methods/Materials
The food samples were tested to know the amount of bacterial growth before and after they are packaged. The food samples were roast beef, turkey, cheese, wheat and white bread.

Results
Using a Ziploc bag was the best type of packaging out of the packagings tested.

Conclusions/Discussion
Ziploc bags are more recommended to use but if not available plastic containers should be used. Aluminum foil should always be avoided because it has the most amount of bacterial growth.

Summary Statement
This project was tested in order to know the safest way to package food.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Natalie Ng

Project Number

J1729

Project Title

A Conductometric Biosensor for the Detection of Food-Borne Pathogens

Abstract

Objectives/Goals

Current detection methods for pathogens such as Salmonella are time consuming and laborious. Biosensors are a fast, portable, and user friendly test method that could potentially replace current laboratory techniques; my project aimed to design, build, and test a polyaniline-based conductometric biosensor for the detection of Salmonella, while using the FDA method as a reference. I hypothesized that the biosensor will give higher accuracy, a lower detection limit, and a faster response time than the FDA method.

Methods/Materials

First, I built a conductometric biosensor by preparing the individual membranes of the biosensor and placing them over a copper wafer fabricated on a microscope slide. I serially diluted a liquid culture of Salmonella enterica from 10^6 to 10^1 CFU/ml. I applied the sample to the application pad of the biosensor and recorded the resistance at 15 sec, 30 sec, 1 min, 2 min, and 3 min intervals. I also tested the biosensor with a mixed culture of Staphylococcus epidermidis and Salmonella. For the FDA method, I plated each concentration of Salmonella onto McConkey plates and incubated overnight.

Results

In the presence of the target antigen, a working biosensor should show a reduction in resistance. The conductometric biosensor showed significant resistance reductions from about 10 K-ohms (negative control of broth) to 2-3 K-ohms from the concentrations 10^3 to 10^6 CFU/ml, confirming the presence of Salmonella. At concentration of 10^2 CFU/ml, only one sample showed a decrease in resistance; the other sample showed resistance above that of the negative control sample. During the mixed culture experiment, the biosensor could detect Salmonella even in the presence of non-target antigens.

Conclusions/Discussion

The biosensor, which can detect the target antigen 15 seconds after the sample is applied, is a much more rapid test than the FDA method, which takes at least overnight to obtain results. Since the biosensor showed resistance reductions for all samples from 10^3 to 10^6 CFU/ml but only one sample of 10^2, the lower detection limit must lie between 10^2 to 10^3 CFU/ml. In my experiment, the resistance reductions were not proportional to the concentration of Salmonella, so I concluded that my biosensor can only detect Salmonella qualitatively. The FDA method proved the presence of Salmonella through a color change and appearance of growth.

Summary Statement

In this experiment, I designed, built, and tested a conductometric biosensor for its effectiveness in the detection of common food-borne pathogen, Salmonella, in pure and mixed culture.

Help Received

Professor Ouverney from SJSU for advice, materials, and lab space; Professor Alocilja and Dr. Okafor from Michigan State University helped me understand principle of biosensor; Ms. Sarah Thaler for her insigtful discussions and lab assistance; My science teacher and parents for support.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Chloe C. Peyton

Project Number
J1730

Project Title
A Silver Lined Future

Abstract

Objectives/Goals
This experiment evolved from last year's Science Fair. Previously, silver was found the most potent agent in killing bacteria. Findings fostered an interest in the potent antimicrobial properties of silver and I wanted to test for stronger silver concentrations and their effect as antimicrobial agents. Previously, a regular dime with copper center worked as an microbial, so how would a (90%) silver dime work, or a solution of silver nitrate or a piece of paper towel rubbed with a silver dime work?

Methods/Materials
I ordered 20 Sheep's blood agar filled Petri dishes. Eighteen of the Petri dishes were innoculated with household bacteria and two were used as controls. Sheep's blood agar was used because the sheep's blood feeds the bacteria. Four drops of silver nitrate were put into three Petri dishes and the same procedure followed with bleach, Purell, and rubbing alcohol. Circular pieces of paper towel were rubbed with a silver dime and placed into each of the three Petri dishes. The 90% silver dimes were placed into three Petri dishes. Petri dishes were incubated in a metal cookie tin at 37 degrees Celsius for six days. I used a surgical mask and latex free gloves while measuring the zones of inhibition in each Petri dish. I used a centimeter ruler to measure the zone of inhibition to determine the potency of antimicrobials to inhibit bacterial growth.

Results
Results varied from 2.4 centimeter to 0 centimeters for the zone of inhibition. The bleach killed on average 1.96 centimeters. The rubbing alcohol on average killed 0. The Purell on average killed 0.33 centimeters. The silver dimes on average killed 2.25 centimeters. The silver paper killed 0.166 centimeters. The silver nitrate killed on average 0.66 centimeters. Overall the metals were the most potent in inhibiting and killing the bacteria. The metals had an average of 1.0253 centimeters. The cleaning agents had an average of 0.763 centimeters.

Conclusions/Discussion
Results indicated that silver is the most potent antimicrobial tested. Individually the silver dimes, 90% silver and 10% metal alloy did the best job of limiting growth of bacteria. My hypothesis was supported by these results.
My next question is how much bacteria is left on your hands after rubbing a silver dime on your palms for 10 minutes as compared with the amount of bacteria remaining after using a cleaning agent?

Summary Statement
Examined the potency of silver in comparison with cleaning agents in inhibiting the growth of household bacteria.

Help Received
My mother helped correct the report and supervised me while working with bacteria; Ms. Reichelt correct my papers and provided additional guidance.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Esther Razo

Project Number
J1731

Project Title
Doorknobs of Disease

Abstract

Objectives/Goals
Do medical office doors carry staph? I hypothesized that at least 3 out of 10 samples would test positive for staph.

Methods/Materials
Nutient agar, petri dishes, sterile swabs, distilled water, log book. 20 samples were collected by swabbing local medical office doorknobs. Samples were swabbed into petri dishes and placed in a room temperature location. Daily observations were written in the log book. I had planned to have a microbiology lab test samples but when I called to confirm I was told that I needed to have a current TB test. I was not able to get a TB test in time befoe the sciend fair due date.

Results
Visually 4 out of 10 samples had growth on my first group of samples. In the second group of samples 9 out of 10 had growth.Bonnie from the lab suggested I do visual obeservations and a gram stain.I also did a gram stain and 1 sample tested gram negative which means it's not staph but it could be strep.

Conclusions/Discussion
Unfortunately I was not able to go into the microbiology lab due to regulations. I was able to conduct a 1 gram stain and found it to be gram negative.

Summary Statement
The cleanliness of our local medical office doors.

Help Received
Visited microbiolgy lab under the supervision of Bonnie. Mother provided transportation to medical offices and lab.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Anin Sayana

Project Number
J1732

Project Title
Novel Use of T4 Bacteriophage to Substitute for Antibiotics in the Treatment and Prevention of S. epidermidis Biofilms

Abstract

Objectives/Goals
Bacteria become resistant to antibiotics by forming biofilms that commonly attach to indwelling medical devices such as mechanical heart valves, pacemakers, and urinary catheters. The CDC estimates that 65% of hospital acquired infections are caused by biofilms which lead to the increase in hospital costs or disability of patients and may pose a health problem for people requiring indwelling medical devices. Current treatments usually involve the invasive method of removing the device and replacing it.
My goal is to see if T4 bacteriophage can be used to prevent and destroy a biofilm caused by Staphylococcus epidermidis. The widespread use of antibiotics in humans, animals, and agriculture plays a significant role in the increase of strains of drug resistant bacteria.

Methods/Materials
Growth of biofilm: A 1:100 dilution with 100ml TSB, 1ml of S.epidermidis culture grown overnight, 6 negative control (exposed to white light), and 6 positive control (UV light) was used.
Prevention of biofilm: A 1ml phage solution with 3ml of TSB with the concentration 5*10^8 phages/ml was prepared. Added 5.5ml of the 1:100 dilution and 0.5ml of phage into cuvettes and incubated overnight.
Treatment of biofilm: After biofilm creation, added the bacteriophage to cuvettes, incubated overnight, and pipetted 100uL of culture to TSA plates to incubate overnight. Absorbances were recorded from spectrophotometer. Experiment was performed over a period of 4 months in 3 trials using 33 cuvettes to research the effects of T4 on S.epidermidis.

Results
Biofilm growth: A biofilm successfully grew on the walls of cuvettes. Average positive control absorbance: 0.297; average negative control absorbance: 0.357. Higher absorbance=denser biofilm.
Biofilm Prevention: When adding T4 with S.epidermidis to the cuvettes, the difference in absorbances with the controls was 0.034 and 0.07. This showed that T4 prevented the formation of biofilm.
Biofilm destruction: Adding T4 after formation of biofilm showed a difference in absorbance from the control of 0.055, showing that the T4 could successfully destroy the biofilm.

Conclusions/Discussion
My results show that T4 prevented and destroyed the S.epidermidis biofilm. The prevention worked better than destruction of biofilm. This research proposes an alternative method to treat bacterial biofilms using the T4 bacteriophage.

Summary Statement
The purpose of this experiment was to see if T4 bacteriophage can be a possible alternative to antibiotics to prevent and treat S.epidermidis biofilms that cause infections in implanted medical devices of urinary bladder, kidney, and heart.

Help Received
My mentor, Ms. Sarah Thaler, supervised my experiments to ensure that I was using safe lab technique; my school science teacher Mrs. Nguyen answered my questions.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Paige A. Simons

Project Number
J1733

Project Title
What Solution Works the Best to Kill Candida albican in the Winter and in Summer?

Abstract

Objectives/Goals
The purpose of my project is to compare different types of substances to see what works the best to kill Candida Albican, a type of thrush bacteria, on horse hooves in winter and summer.

Methods/Materials
Put a cup of Water in each spray bottle. Take a bottle of water and put half a cup of Iodine in it. Take the second bottle of water and put half a cup of Bleach in it. Take the third bottle of water and put half a cup of Salt in it. Get the first horse out. Pick out all its hooves. Spray Iodine on the front right hoof. Spray Salt on the back right hoof. Spray Bleach on the back left hoof. Leave the front left hoof alone for the control. Get out the next horses and repeat steps 7-11. Let the hooves sit for four days. Take out the horses. Pick out the their hooves. Take a Q-tip and rub it in the crevasses of the frog in the hooves. Rub the Q-tip on the auger-plate. Tape the auger-plates together at both ends. Place auger plates in a warm, dark cabinet. Let the bacteria on the plates grow for three days. Take out all the plates on the third day. Take tape and top off the plates one at a time. Place clear counting grid over open plate. Count the squares the white bacteria is growing in. Let the hooves from the second testing sit for three days. Repeat steps 14-24. Let hooves from third testing sit for three days.
Repeat steps 2 through 12 for final testing.
Repeat steps 14 through 24 for the third testing.
Repeat steps 14 through 24 for final testing.
Materials:
3 spray bottles, 4 cups Iodine, 4 cups Bleach, 4 cups Salt, 8 cups Water, 2 hoof picks, 320 petri dishes w/Sabouraud's Medium, 10 horses, 10 halters, 1 grooming bucket, 1 box of Q-tips.

Results
The results of my investigation on what solution works best on the bacterial levels of Candida Albican in winter and in summer indicates that the control hoof had the least Candida Albican in winter and in summer.

Conclusions/Discussion
After completing my project on what solution works the best on the bacteria levels of Candida Albican in winter and in summer I found my hypothesis was incorrect. My hypothesis stated that saltwater would kill the most Candida Albican bacteria on horse hooves. What I found out when we finished the project was that the control hoof had the least bacteria on it, which means that by not putting anything on horses hooves, they naturally control their own bacteria.

Summary Statement
I tested what solution works the best to kill Candida Albican in the winter and in summer.

Help Received
My parents helped catch, hold ,and handle the horses.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Cole R. Smith

Project Number
J1734

Project Title
The Acid Test: How Bacteria Growth Rates Are Affected by Various pH Levels Over Time

Abstract

Objectives/Goals
The objective is to determine at what pH the microorganism Escherichia coli (E. coli) grows best.

Methods/Materials
I used 8 flasks full of a 100ml liquid yeast formula in order to give the E. coli something to grow in. Each flask was at a different pH ranging from pH 5.0 through pH 8.5, increasing pH by 0.5 each time. I also used 8 separate agar dishes with pH levels 5.0 through 8.5, increasing by 0.5 pH in every dish. Each dish had about 50,000 separate E. coli organisms. The plates were left to incubate overnight, while the flasks were checked every 30 to 45 minutes by a spectrophotometer.

Results
E. coli in pH 6.0 through pH 8.0 had a higher growth rate compared to E. coli growing in pH 5.5 and below and pH. 8.5 and above. The alkaline groups had higher growth rates than the acids.

Conclusions/Discussion
The microorganism E.coli prefers growing in a rather neutral pH. There is a point in pH at which E. coli cannot grow easily which is any acid lower than pH 6.0 and anything more alkaline than pH 8.0. Certain organisms grow better in various pH levels; it is dependant on the organism and its adaptations and the environment they are naturally found in.

Summary Statement
An analysis of the rate of growth of bacteria in varying pH level solutions, using E. coli as test bacteria, with the goal of determining the optimal pH for the highest rate of growth.

Help Received
Used lab equipment at the University of California, Santa Barbara under the supervision of Dr. Stu Feinstein, Director of the Neuroscience Research Institute, UCSB

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Rachel A. Smith

Project Number
J1735

Project Title
What Is Unseen in Your Ice Machine?

Abstract

Objectives/Goals
Abstract

In my project I am testing the amount of bacteria that can collect and grow on commercial ice machines. The four locations on the machine that I picked were the tube, the rim of the tube, the part that you push to get the ice and my control was the ice itself. I hypothesized that the tube would be the dirtiest because there the ice is constantly hitting it and it is moist all of the time.

Methods/Materials
In my project I controlled everything that I possibly could, such as the time of day I collected samples. Every sample was collected on a Tuesday night between 5:00 and 7:30. After that every sample was taken to the Pershing science lab, inoculated and streaked between 12:50 and 2:15 on a Wednesday afternoon. All samples were then placed in an incubator for two days until Friday afternoon when samples were counted between 12:55 and 2:30.

Results
In the end the piece that you push your cup up to had the most bacteria! The rim of the ice dispenser had an average of 4.2 bacteria spores, the ice had a 4.5, the tube had a 5.6, and the thing that you push had an average of approximately 7 spores! My highest number of spores on one plate was 35, which was on a tube from Jack in the box! Some numbers from the thing that you push your cup against were 20, 15, 13, and a few 0#s which gave it an accurate average.

Conclusions/Discussion
i have learned so much from this project and i am so proud of myself for making it thus far.

Summary Statement
In my project i collected samples fromvaroius locations of a commercial ice machine and calculated bacteria build up.

Help Received
my parents, peers, and my wonderful teacher Mrs. Marcarelli

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Vincent P. Strykers

Project Number
J1736

Project Title
Which Organic Materials Accelerate Algae Growth

Abstract

Objectives/Goals
Determine which organic materials such as horse manure or willow leaves can accelerate the growth of oedogonium (green algae).

Methods/Materials
Place organic materials in water for 5 days. Take water from the organic materials and place it in algae cultures. Test spectral transmittance using spectrophotometer. Allow algae to grow for 7 days. Test spectral transmittance again. Record difference in transmittance from first test.

Results
Banana peels accelerated algae growth the most in organic materials group. Willow and sycamore leaves accelerated growth the most in the tree leaves group.

Conclusions/Discussion
Organic materials accelerated algae growth more than tree leaves. Eggshells and horse manure almost accelerated algae growth as much as the banana peels.
Organic materials would be the best option for production of biofuel rather than tree leaves.

Summary Statement
How different organic materials can accelerate algae, which can be used for biofuel.

Help Received
Used Mr. Whittington's spectrophotmer (teacher from sanger high school)

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Johanna C. Walker

Project Number
J1737

Project Title
Algae Bio-Fuels

Abstract

Objectives/Goals
Three different strains of micro algae will be obtained from Carolina Biological Supply (Oedognium Filamentous, Spirogyra, and Oscillatora). These samples will be divided and placed in 250 mL culture flasks and commercially available growth media and allowed to grow under fluorescent lights for two weeks. The resulting biomass will be collected by filtration, dried and weighed. The differences in the amount of the biomass will be noted to determine the strain which has the most rapid growth.

Methods/Materials
Three different strains of micro algae and growth media were obtained from Carolina Biological Supply. Three samples of each strains were placed in culture flasks to grow for 2 weeks. All of the flasks were then put into an aquarium where the temperature would be kept the same. Each flasks had air bubbled through them at all times and there were ultra white florescent light bulbs on the sides of the tank. After the 2 week time-span, the algae was filtered with a Buchner funnel and a paper filter. Next the algae was completely dried in a oven, then weighed.

Results
Oedogonium Filamentous showed the largest amount of growth with a weight of 0.0792g. Second was Oscillatoria with a weight of 0.0696g. Last was Spirogyra with a weight of 0.0595g. The average weight of all of the different algae ranged from .08g-.06g. The results do not support my initial hypothesis that Spirogyra was going to grow the most. References showed Spirogyra grew the most. Spirogyra seemed to die during this experiment perhaps because the growth media was not appropriate and too basic. After a few days of bubbling air through the culture flasks, the pH level may have lowered because the Spirogyra strains began to grow again. The reason Oedogonium Filamentous and Oscillatoria did not die was probably because they were not as sensitive to change in pH. So I believe that because the Spirogyra had died about half-way through the experiment, it got behind all the other strains.

Conclusions/Discussion
The Oedogonium Filamentous grew the most during the 2 week time-span with an average weight of 0.0792g. Second was Oscillatoria, which had an average weight of 0.0696g after the 2 week time-span. Last place, with the smallest amount growth after the 2 week time-span, was Spirogyra with a average weight of 0.0595g. In conclusion, Oedogonium Filamentous grew the most biomass after the growth period.

Summary Statement
My project is about seeing which algae strain will be the best candidate for producing bio-fuels.

Help Received
The program, BEWISE, gave me the idea for my project. Dr. Mendola, from Scripps Institute of Oceanography helped me plan out my project and procedures.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Natalie J. Wu-Woods

Project Number

J1738

Project Title

The Effect of Essential Oils from Plants Used by Native Americans on the Growth of Bacteria

Abstract

Objectives/Goals

I predict that the oil extracts from plants used by Native Americans will inhibit the growth of bacteria (E. coli) on agar plates and a liquid culture.

Methods/Materials

I am using the method called hydrodistillation, this uses steam to take the oil out of the plant. After hydrodistillation I measured the amount of oil I collected. I tested the essential oils at different concentrations -- 50% and 100%. I punched out small discs of filter paper with a paper hole puncher. Then I used a micropipete to put ten microliters of one diluted oil onto the paper disc, which soaks in right away. Next, is putting my paper disc onto a plate with bacteria in it. I have an agar plate and will put a 100 microliters of the bacterial culture from step 2 onto the plate. I will use a spreader to spread the bacteria and then I will place the disks containing the essential oils onto the plate. The plates will be placed into an incubator at 37 degrees Celsius. After 20 hours of incubation, I measure how much the disc with herbal oils inhibited the growth of the bacteria. I measure the distance of the clear ring from the paper disc that does not have bacteria growth, record data and take pictures.

Results

Black sage, sagebrush, willow leaves, California rose hips, and toyon didn#t work at all, while white sage had an inhibition ring about 1mm big. The positive control gave me a huge 15mm ring, while, the negative control, gave me absolutely no ring.We then tested if the essential oil was killing the bacteria by placing the oil in tubes of bacteria and media, and see if the water was clearer, the same, or cloudier. The average of Control, or bacteria in media, after 30 minutes in a shaking incubator was 0.790 after starting out at 0.404. The white sage had an average of 0.285, black sage was an average of 0.258, and sagebrush was 0.245, Oregano; 0.246, and lastly, Cinnamon at the average of 0.280 for 30 minutes in the shaking incubator.

Conclusions/Discussion

In Conclusion, my project demonstrated that extracts of native plants do kill bacteria and could have worked quite well as medicine for the Native Americans. Black Sage, White Sage, and Sagebrush would be effective medical treatments for bacterial infections. Compound of these essentials oils might even be useful to new types of medical treatments that might even be able to save lives.

Summary Statement

I tested if oils from plants used by Native American as medicine really work by measuring their affect on growth of E. Coli.

Help Received

Used lab equpment at Inscent, Inc. under the supervision of Dr. Daniel Woods.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Vivian C. Yang

Project Number
J1739

Project Title
Which Soft Drink Is the Best to Support Dental Bacteria to Grow?

Abstract

Objectives/Goals
Previous studies showed that soft drinks are harmful to the teeth because of their high sugar content and acidity that may cause the enamel of the tooth to erode. However, whether soft drinks could also support the growth of harmful dental bacteria remains unclear. In this study, I tested the following hypotheses: (1) the common soft drinks can support human dental bacterial growth in the test tube; and (2) the sugar content in the soft drinks is highly correlated with its ability to support dental bacteria growth.

Methods/Materials
The human dental bacteria were obtained using clean toothpicks, which were placed in the test tubes containing 5 ml of the soft drink (Coke, Diet Coke, Coke Zero, Pepsi, Fanta, Dr.Pepper and Gatorade) supplemented with 2 ml of Luria Broth (LB) (containing the essential nutrients) to mimic the dental environment. The tubes were shaken in an Incubator-Shaker at 37oC for 24 hours. The bacteria culture was then diluted 1:1000 in LB solution, and 0.1 ml of the diluted culture was spread onto an LB agar plate. The plates were placed in a 37oC incubator for 24 hours to allow the bacteria to grow into visible colonies. The number of the colonies was counted and the original bacteria concentration was calculated. The bacteria count for each soft drink culture was then correlated with the nutritional values and measured PH of the soft drink.

Results
The study showed that Gatorade is the best to support dental bacteria growth in the test tube condition (2.95 million/ml), followed by Coke (1.87 million/ml), Pepsi (270K/ml) and Diet Coke (60K/ml). Coke Zero, Fanta and Dr.Pepper did not support any bacteria growth. The correlation analysis revealed that sodium is the only factor that is highly correlated with the ability of the soft drink to support dental bacteria growth in the test tube.

Conclusions/Discussion
This study confirmed my hypothesis that certain soft drinks can support human dental bacteria growth in the test tube. It also revealed a surprising result that the sodium rather than the sugar content in the soft drinks is highly correlated with its ability to support dental bacteria growth. Future studies should directly test the possibility that sodium addition to the soft drinks can enhance their ability to support dental bacteria growth in the test tube. Such studies may help to develop future "tooth-friendly" soft drinks for all of us.

Summary Statement
The study reveals that certain soft drinks can support human dental bacteria growth in the test tube and the sodium rather than the sugar content of the soft drinks is highly correlated with its ability to support dental bacteria growth.

Help Received
My father taught me lab techniques, Dr. Xiao-Hong Lu at UCLA helped me in the correlation studies, and I used lab equipment at UCLA under the supervision of my father and Dr. Lu.