CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sean W. Adams

Project Number
J1401

Project Title
Life As You Can't See It: Bacteria on Everyday Objects

Abstract

Objectives/Goals
My project is to determine which has more bacteria living on it: a store bathroom door handle, a cell phone mouthpiece, or the bottom of a woman's purse. My hypothesis is the bathroom door handles will have the most bacteria on them. I chose this because I think more people have touched them than the bottom of the purses, and usually only one person talks on their cell phone.

Methods/Materials
First I prepared six petri dishes with nutrient agar. I then went to a local Walmart, moistened a sterile swab with sterile water, rolled it on the men's bathroom door handle, and swabbed it on the agar inside the petri dish. I repeated this procedure on a McDonald's bathroom door handle, two cell phone mouthpieces, and the bottom of two purses. Then I covered the dishes, and put them in a cool, dark place. I examined the bacterial growth on Day 2, Day 4, and Day 7.

Results
On the last day of observation (Day 7), I found that the bottom of my Grandma's satchel had the greatest variety of bacteria living on it, while my Mom's leather purse had the least of both variety and amount of growth. However, the bathroom door handles had the largest total area of bacterial growth on them compared to the purses and cell phones.

Conclusions/Discussion
My hypothesis was correct that the bathroom door handles had the most bacterial growth on them. This helps you by showing that everyday items are dirty with bacteria and you should clean those items every once in a while. (Or you should open bathroom door handles with paper towels when leaving.)

Summary Statement
I plan to determine how much bacterial growth is on these everyday objects: bathroom door handles, cell phone mouthpieces, and the bottoms of purses.

Help Received
My science teacher, Mr. Hopper, for answering questions about the science fair and my Dad, for editing my paragraphs and helping me put the project and backboard together.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Katherine M. Bennett

Project Number
J1402

Project Title
Which Room in the House is the Cleanest?

Abstract

Objectives/Goals
The goal of my experiment was to determine which room in an average house is the cleanest. Bacteria, yeasts, mold and fungi live everywhere. Yeast and bacteria live in our bodies and are part of what helps us live strong healthy lives. But these same organisms also live in and contaminate the homes inhabited by humans. Through my experiments I hoped to determine which room in the house had the least bacteria, molds, yeast and fungi.

Methods/Materials
I used the following method for my experiment:
1. Prepare agar and Petri dishes
2. Collect samples from three different homes by swabbing the selected surfaces and transferring to the agar plates: a. Bedroom, 2 samples; b. Lavatory, 3 samples; c. Living Room, 2 samples; d. Kitchen, 3 samples; e. Laundry Room, 2 samples
3. Label and seal lids on agar plates, place each one in an individual zip top storage bag
4. Incubate each sample at 90 degrees F for three days
5. Make observations
6. Sterilize each plate with bleach and dispose in a hazardous waste container

I used the following materials: 36 petri dishes, Luria Bertani nutrient agar, 36 sterile cotton swabs, surgical grade face masks (enough for each researcher and assistant), surgical gloves, an incubation system, bleach, rubbing alcohol, selected surfaces for experimentation, and a sterile working (collecting) surface.

Results
After identifying the colonies, I counted each one and documented my findings. From this experiment, one can interpret more information about the cleaning maintenance of individual homes, than the cleanliness of average rooms. In order to get the information I was seeking, I would need to gather from a larger sample of homes.

Conclusions/Discussion
Before conducting my study, my hypothesis was that the cleanest room in the average house is the kitchen. I also hypothesized that the dirtiest room would be the lavatory. Through analysis it seems as if the lavatory is the dirtiest room and the laundry room is the cleanest. However, as I dug deeper, I saw that the number of bacteria that make the lavatory stand out is from only one source. So, in fact the bathroom may not be the dirtiest room. Results were inconclusive. In order to see this through, I would have to test

Summary Statement
I attempted to determine which room in an average house has the least bacteriea, mold, yeast and fungi.

Help Received
My father helped type the report, and acted as my lab assistant. My mother made suggestions about the layout of the board, asssisted in counting the colonies, and sterilization and disposal of plates.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Nikhil Bhambi

Project Number
J1403

Project Title
Poison Down the Drain: The Effect of Triclosan on Algae and the Environment

Abstract

Objectives/Goals
My objective was to see if the widespread household anti-micro bacterial, triclosan, will adversely affect the growth and population of freshwater species of algae. Throughout the course of my research, I formulated a hypothesis that the addition of triclosan will diminish the algae growth and population because triclosan inhibits and even stops certain functions that fungus, bacteria, and other organisms need in order for growth, reproduction, and survival.

Methods/Materials
Creating a solution of 20 micrograms/ liter by dilution with purified water, add 0.4, 0.6, 0.8, 1 percent concentrations of the solution to 20 milligrams of three freshwater algae species in test tubes (leave one of each specie for a control). I must then wait one day before testing the population of algae using a hemocytometer and counting the algae cells using a microscope. I shall continuously check after three days twice using a hemocytometer for a period of one week.

Results
As I measured the population of algae, I noticed a significant decrease of algae population in each category of species as the concentrations of the triclosan increased in comparison to the control. An interesting thing that caught my eye while I was taking an algae count was that the size and color of the algae was also being affected by the triclosan, as I saw that the increase of triclosan also caused the algae to decrease in size and take on a grey looking pigment.

Conclusions/Discussion
Due to the test results that I had gathered it appears that the triclosan significantly decreased the algae population in all species and at all concentrations. What was especially surprising was that on the last testing at the highest concentration, there were several instances where there was no trace of algae population left, so we can see the potent effect this chemical has. With these results we can see that the accumulation of triclosan in our waters can lead to the corruption of the algae population in the environment which in effect can disrupt the cycle of the ecosystem.

Summary Statement
Interestingly, even at minute concentrations, triclosan can have a potent affect on the population of algae.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jonathan T. Blanton

Project Number
J1404

Project Title
Household Surfaces and Bacteria

Abstract

Objectives/Goals
The goal of my project is to determine which common household surface material is best at denying the cultivation of bacteria in a normal environment.

Methods/Materials
The method used to acheive my objective was to sterilize eight common household surface materials and then contaminate them with bacteria. Then each surface was swabbed with sterile cotton swabs for a bacterial sample once a day for five days and applied to sterilized Petri dishes. The samples were then incubated in an incubator. Measurements were taken on the eight surfaces (porcelain, tile, glass, stainless steel, varnished wood, solid surface material, marble, and plastic) with a magnifying glass and the naked eye as to amount of bacterial growth. Chicken juices and sugar water were used as the source for bacteria.

Results
Stainless steel was the best material at resisting bacterial growth followed by porcelain, solid surface material and then plastic. Following this group was tile, varnished wood, and marble. Glass was the worst at resisting the growth of the bacterial colonies. A significant gap as to onset of bacterial growth ocurred between the top four materials and the bottom four materials. It took a signifcantly longer period of time for bacteria to begin growing on the top four materials.

Conclusions/Discussion
I found that stainless steel worked the best, followed closely by porcelain and then solid surface material. I concluded that the less porous the material the better that material is at denying the cultivation of bacteria. My manipulated variable did lead to a productive dependant variable, as I came up with a large amount of bacterial growth, but the bacterial growth varied from material to material. The less porous the material the longer it took for that material to obtain bacterial growth. I was correct in stating that for non-porous material, bacterial growth would not take place instantly, but it did happen somewhat faster than I anticipated. The materials that I believed would take the longest in contrast to the ones that would take the shortest amount of time were generally correct.

Summary Statement
My project was to see which common household surface materials best resisted the growth of bacteria and to find what common elements these materials shared.

Help Received
My parents helped assemble the presentation board, Mr. Dan Cullinane and Dr. Mark Pio helped with protocols, Mrs. Williams gave instructional advice, and Dr. Bruce Holland helped decipher the results.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Zoe M.F. Brier

Project Number
J1405

Project Title
How to Reduce Bacteria on a Sponge

Abstract

Objectives/Goals
My objective was to find out if time in a microwave affects the amount of bacteria on a sponge. My hypothesis was if a sponge is put in a microwave for a longer amount of time, then more bacteria will be killed.

Methods/Materials
My main materials were sponges, a microwave, agar, and agar dishes. I heated up the sponges in the microwave and tested the amount of bacteria on them with agar and agar dishes.

Results
My results were that more bacteria was killed if I put the sponge in the micorwave for longer, just like I hypothesized. I realized that putting the sponge in the microwave for two minutes really reduced a lot of bacteria.

Conclusions/Discussion
My hypothesis was correct. This proves that bacteria can be killed off on a sponge if put in the microwave. In the future, I would do research about what kinds of bacteria there were and if the microwave killed off only some types.

Summary Statement
My project was done to find out if a microwave oven reduced bacteria on a sponge.

Help Received
Mother helped boil agar.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Katelyn R. Carbiener

Project Number
J1406

Project Title
Can Cell Phones Harm Living Cells?

Abstract

Objectives/Goals
I wanted to see if it was possible for the radiation from a cell phone transmitter to harm living cells in your body. I used bacteria to represent the living cells, and a microwave oven to represent the microwave radiation from a cell phone transmitter. My hypothesis was that microwaves would be able to kill bacteria, but at the low power of a cell phone there would be no effect.

Methods/Materials
I used non-pathogenic acidophilus bacteria from dietary supplement capsules because I thought that bacteria might be sensitive enough to be killed by the microwaves. I diluted them in water, exposed them to the microwaves, then cultured them in nutrient media to measure the effects. A microwave oven has a similar frequency to a cell phone transmitter but a much higher power, so I exposed the bacteria for a short time to get the same energy. I used different exposure times to study the effect of energy, and I used different power microwaves to study the effect of power.

Results
I observed that the microwave energy could kill bacteria. I found that the higher energy exposure killed more bacteria, which is what I expected. I also found that for equal energies, exposure to a lower power for a longer period of time killed more bacteria, which I did not expect.

Conclusions/Discussion
The first part of my hypothesis turned out to be correct, because I observed that microwave energy could kill living bacteria cells. However, the second part of my hypothesis was wrong because when I observed that the lower power exposure for a longer time killed more bacteria I found that a low power cell phone could have an effect. Although my results predict that a cell phone could kill bacteria, because of the low power I would expect only skin cells on the surface of your body to be effected, and not as many would be harmed because skin cells are stronger than bacteria.

Summary Statement
This experiment uses bacteria and microwave energy to determine if it was possible for the radiation from a cell phone transmitter to harm living cells in your body.

Help Received
My father helped me by supervising my safe handling of the bacteria.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Christiana Y. Chen

Project Number
J1407

Project Title
Can Rose Plants Host Xylella fastidiosa?

Abstract

Objectives/Goals
To see if Xylella fastidiosa can be hosted inside a rose plant.

Methods/Materials
Stem cuttings of rose plants were from my backyard; Xylella fastidiosa was given by expert. For each experiment, first inoculate water into 3 rose plants, and X. fastidiosa into the other three. Then, wait about a week or more before isolation.

Results
A week after the isolation process of the first experiment, bacterial colonies were in the culture medium from the rose plants inoculated with X. fastidiosa. All three plants had X. fastidiosa growing inside, although number of colonies varied. There was as little as 2 colonies in one plant to 154 colonies. Roses inoculated with water had no bacteria colonies. In the second experiment one rose plant (with Xylella inoculated into it) had no bacteria growing inside. However, the other two had bacteria colonies (23 and 510).

Conclusions/Discussion
The results from both experiments show that the ordinary rose plant is able to host the pathogen X. fastidiosa. Therefore, my hypothesis that rose plants can host X. fastidiosa was supported. During this whole process, there were also no visible symptom differences between the roses inoculated with X. fastidiosa and water. This means that, roses can be a silent host of X. fastidiosa.

Summary Statement
The purpose of this project was to see if rose plants can host the plant pathogen, Xylella fastidiosa.

Help Received
Father helped write report; Mother helped edit report; Used lab equipment at the USDA Agricultural Research Center in Parlier, CA, under the supervision of Dr. Jianchi Chen; Rebecca Alvarez, Dr. Chen's lab assistant, helped isolate rose plants; Greg Phillipps, Dr. Chen's lab assistant, helped isolate rose plants.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Tess A. Chipault

Project Number
J1408

Project Title
Bacteria Facteria

Abstract

Objectives/Goals
Bacteria is everywhere, even inside our mouths. But who has the most bacteria in their mouths, humans or dogs? The purpose of this project is to determine which species harbors the most bacteria.

Methods/Materials
Swab samples of saliva were taken from 4 humans and 4 dogs. The samples were put in petri dishes inside a dark, homemade incubator for 5 days. With the use of a heat source (lightbulb), and thermometer, the temperature inside the incubator was kept at between 99.5 - 102.0 degrees.
Photographs were taken daily. The amount of bacterial growth and the smell of the dishes was recorded daily. After the 5th day, a final record was made of the bacteria appearance.

Results
Each of the samples showed a lot of bacterial growth, with the exception of my mom's. The growth of bacteria seemed to match an increase in smell. By the 5th day, the petri dishes smelled pretty terrible, but the visual appearance of bacteria was very clear.

Conclusions/Discussion
As was suspected, dogs have more bacteria in their mouths than humans. Dogs eat off the ground, and they eat everything, while humans each things meant to be eaten. For comparison purposes, the same test was used on a cat and a rat. We found that rats have a lot of bacteria in their mouths, even more than dogs.

Summary Statement
We share love and space with our dogs, but does our bacteria distinguish us?

Help Received
My dad helped build the incubator, we received petri dishes from Dr. Mike Campbell at UCSF, technical advice from Dr. Fred Neidhardt at UMich, my mom helped design the layout of the board and helped type.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alyssa N. Cook

Project Number
J1409

Project Title
Dermatophytes and Yeasts: Analysis of the Canine Claw

Abstract

Objectives/Goals
The objective is to determine if dermatophytes (fungi that typically grow on skin structures)and yeasts colonize the claw tissue of healthy dogs, including guide dogs used by the disabled, working dogs, and pets, and if so, to determine which age groups show the highest percentage of dermatophytes and which show the highest percentage of yeasts.

Methods/Materials
112 claw tissue specimens were obtained from professional groomers, taken from healthy dogs ranging in age from 3 months to 16 year 3 months old. All specimens were surface decontaminated, pulverized, and processed. One half of each specimen was treated with a 20% KOH solution and examined microscopically for yeast. The other one-half of each specimen was plated on Dermatophyte Test Media (DTM), incubated, and examined daily for culture growth and color change. The study was blinded and controlled.

Results
93% of 112 specimens were positive for yeasts or dermatophytes. Yeasts were found to be present in the claw tissue of all age groups, but not significantly more in any one age group. Dermatophytes, however, were seen in increasingly higher percentages in the claw tissue of older age groups of dogs as compared to younger age groups, from 19% in the 3 to 6 year age group, up to 75% in the 12 to 15 year old age group.

Conclusions/Discussion
The incidence of yeasts and dermatophytes in the claw tissue of otherwise healthy dogs has not been studied extensively to this point.The impact of these findings may help veterinary medicine in better diagnosing true claw pathogens, as opposed to non-pathogenic colonizers. In this study,it was found that yeasts and dermatophytes are common colonizers of canine claw tissue in all age groups, that yeasts colonize all age groups in a almost equal percentages, but that dermatophytes are found in higher percentages of older dogs claw tissue as opposed to younger dogs.

Summary Statement
This project investigates the colonization of healthy canine claw tissue with dermatophytes and yeasts as determined by culture and microscopy, and compares the percentages found to the ages of the dogs.

Help Received
This project and the collection of specimens were overseen by my science teacher, Mr. Mark Hobbs, and by Dr. Barbara Doty, DVM. Dr. Paula Harbison acted as lab assistant and helped to create the blinded study. My parents assisted in typing and ordering of supplies.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Gabrielle Corbett; Alice Mintz

Project Number
J1410

Project Title
How to Keep Your Jack-O from Turning Wacko

Abstract

Objectives/Goals
The objective is to determine which technique preserves jack-o-lanterns the best.

Methods/Materials
We obtained 30 pumpkins, 10 large and 20 small sized pumpkins. We then carved all of the pumpkins. The jack-o-lanterns were seperated into ten groups each with one large pumpkin and two small ones. Next, we applied a different preservation technique to each of the groups. Our preservation techniques were composed of rubbing the jack-o-lantern with salt, covering a jack-o-lantern with plastic wrap, rubbing a jack-o-lantern with vinegar, brushing on vegetable oil to a jack-o-lantern, submerging a jack-o-lantern in bleach solution, spraying hairspray on a jack-o-lantern and spraying a jack-o-lantern with Raid pesticide spray, placing garlic in the inside of the jack-o-lantern, covering the jack-o-lanterns with petroleum jelly,and finally leaving one as a control. For the next two weeks we measured the decomposition of our jack-o-lanterns by leaving them outside and recording how well they were rotting according to our relative scale.

Results
Our results show that when preserving a jack-o-lantern, soaking it in a bleach solution is the best technique. Using this technique the jack-o-lantern ends up looking visually better, smelling the best, and does not promote mold growth.

Conclusions/Discussion
Our conclusion shows that using different techniques to preserve pumpkins has a strong affect on how it will weather for two weeks. While some techniques slow down the decomposition process, others increase mold growth and decompostion.

Summary Statement
We investigated which technique and substance preserved a jack-o-lantern the best.

Help Received
Dad covered and uncovered the jack-o-lanterns every morning, parents helped us retreive materials.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Anujin Dambaev; Naveen Qureshi

Project Number
J1411

Project Title
How Spoiled Can You Get?

Abstract

Objectives/Goals
The aim of this project is to determine which food preservative (salt or vinegar) inhibits bacterial growth in food.

Methods/Materials
4 packets of no salt chicken boullion
20, 50 mL containers with lids
500 mL of hot water at 102.8 degrees farenheit
37.5 grams of salt
18.75 mL of vinegar
gram balance
permanent marker
60 nutrient agar plates
60 inoculation loops
mixing bowl
spoon
syringe for measuring
Dissolve boullion cubes into the hot water. Add different concentration of salt or vinegar to each container. Streak onto agar plates immediately after mixing preservatives into the broth. Then let broth sit at room temperature for a period of five days. Streak onto agar plates on days 1,3, and 5 and check bacterial growth.

Results
Salt: 830 bacterial colonies over a five day period.
Vinegar: 82 bacterial colonies over a five day period.

Conclusions/Discussion
We concluded that vinegar is a better preservative than salt. We also did some research to find out why it was. The answer is because vinegar contains about 4-6 percent acidic content so it was hard for the bacteria to grow

Summary Statement
Our project is about bacterial growth in food and how food preservatives help inhibit this growth so that foods can stay fresher longer.

Help Received
Mom- helped with providing materials and driving us to the lab. Jeff Cordell- letting us use his laboratory and his materials. Brother-for helping us make the graphs.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Asta E. Davidsdottir

Project Number
J1412

Project Title
Can Bacteria Get a Sunburn?

Abstract

Objectives/Goals
I wanted to determine whether bacteria can be used as a test for protection against ultraviolet ray damage and skin cancer. I used ultraviolet light (UV) to affect bacterial growth, and tested whether sunscreen protected against damaging effects of UV light. I hypothesized that UV light will kill the bacteria. Sunscreen should block the UV light and allow the bacteria to grow. My reasoning is that bacteria are like skin cells, which if they are exposed to sunlight (which contains UV light), will die or get severely damaged. The sunscreen will absorb the UV light and the bacteria will not be damaged.

Methods/Materials
Make agar petri dishes (about 20). Innoculate the dishes with a cloned bacterial culture. Cover half of a Petri dish with glass and the other half with Saran wrap, with and without sunscreen. Illuminate with UV light for 30 minutes. After 3 days growth, scrape 4 square centimeters of the bacterial film and measure protein with Bradford Reagent. Take micrographs of the bacteria at 1000X magnification

Results
When the bacteria were illuminated with UV light they all died. The bacteria were protected and did not die when the sunscreen was applied. My graphs show the amount of protein in the bacteria with and without illumination by UV light and confirm that the sunscreen protects the bacteria.

Conclusions/Discussion
I proved that my hypothesis was correct. UV light kills the bacteria but sunscreen blocks the UV light and allows the bacteria to grow. I learned that bacteria are somewhat like skin cells and that UV light damages the DNA in them causing them to die. We get a sunburn and I found that bacteria get a sunburn too. My project is relevant to skin cancer because in order to find cures for skin cancer, we need to know whether a particular drug works. We might be able to use bacteria for testing because I have discovered that bacteria react the same to UV light as skin cells do.

Summary Statement
I tested to see what effect ultraviolet rays have on bacteria and whether sunscreen can protect them.

Help Received
Mother and Father helped type. Father helped conduct experiment. I used equipment at Dr. David Deamer's lab, UC Santa Cruz.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Navi S. Dhaliwal

Project Number
J1413

Project Title
How Safe Is Your Water?

Abstract

Objectives/Goals
Objective of my science project was to find out the level of total coliform bacteria, E. Coli bacteria, chlorine, heterotrophic plate count (HPC) in various drinking water samples, and based on the results determine about safety of drinking water from these different locations.

Methods/Materials
Methods: Testing of Chlorine residual in water samples using Hach Colorimter method; Testing of Coliform bacteria in drinking water samples using Quanti-Tray method; Heterotrophic Plate Count (HPC) in Colony Forming Units per milli liter (CFU/mL) using Petri dishes.

Materials: 125-mL bacteria testing sterilized bottles with sodium thiosulphate tablets, Chlorine Testing Kit, Ice Cooler, UV Lamp, Incubator, Colilert P/A Reagent, Liquid Agar for HPC Testing, Petri dishes sterilized, Quanti-Tray Sealer, Quanti-Tray 97 Wells, HPC Colony Counter, Thermometer, and Water Samples

Results
All five samples (Bottled Water, Kitchen Snk Tap Water, City Park Drinking Fountain Water, Fast Food Restaurant Water and Dine-in Restaurant Water) tested negative for total coliform bacteria.

Chlorine residual in five water samples ranged from 0 to 2.4 mg/L with the highest value in the kitchen tap water and City Park Drinking Fountain Water.

Average HPC values in five water samples ranged from 1 to 86 CFU/mL with the highest value in the Fast Food Restaurant Water.

Conclusions/Discussion
All five water samples tested negative for total coliform bacteria and E.coli bacteria and considered safe for drinking based on testing of bacteriological quality.

Fast food restaurant water had the highest average HPC value of 86 CFU/mL possibly due to growth of HPC bacteria in the filter indicating need for changing the water filter catridge.

There was no clear relationship between total coliform bacteria and average HPC level in the water samples .

Summary Statement
My project is about determining safety of drinking water from various locations and testing for chlorine residual, total coliform bacteria and E.coli bacteria, and heterotrophic plate count (HPC).

Help Received
Transportation for collecting water samples from different locations in Bakersfield and delivery to laboratory, analysis of water samples by McRay Laboratory in Bakersfield, parents' help in proof reading of project documents , review of graphs, charts, and tables, cutting and pasting on the display board

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Austin C. Eadie

Project Number
J1414

Project Title
Does Antibiotic Medicine Given to Cows Have a Profound Effect on the Yogurt Produced?

Abstract

Objectives/Goals
The objective of my experiment was to determine if the anti-biotic medicine given to cows can have an effect on the yogurt produced.

Methods/Materials
I used two containers of culture certified organic yogurt, and two containers of culture certified non-organic yogurt. Organic yogurt is produced by cows that are not given anti-biotic medicine, while non-organic yogurt is produced by cows given heavy doses of anti-biotic medicine. I used regular soy-agar in standard sterile Petri dishes. I prepared a 10x dilution, and a 100x dilution, for both the organic and non-organic yogurt, and incubated them at 37 C for six days.

Results
I found that the organic yogurt significantly clouded the Petri dish indicating strong bacteria growth. I could hardly observe any growth in the agar with the diluted non-organic yogurt. This was consistent with both 10x and 100x dilutions. I concluded that my hypothesis was correct, and Lactobacillus bacteria was more present in organic yogurt than in non-organic yogurt

Conclusions/Discussion
Since Lactobacillus bacteria assists with digestion, these results could mean that it is healthier for most people to eat organic yogurt. It is also interesting that anti-biotic medicines, which according to the USDA are frequently given to non-organically raised cows, could have an adverse affect on the quality of the food produced. It is possible that the reason for the absence of bacteria in non-organic yogurt is due to anti-biotic residue in the yogurt itself.

Summary Statement
My project is designed to determine if anti-biotic medicine given to cows has an effect on the yogurt produced, and I found that there was an absence of bacteria in the yogurt produced by the cows given anti-biotic medicine.

Help Received
I received help from Mr. Atchley with my methods. Mr. Steely also allowed me to use his incubator, and his room for the experiment. My parents proof read my research and my mom helped me with my board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Jeremy A. Fuster

Project Number
J1415

Project Title
GSI II: A Gram Stain Investigation: Catalase and Coagulase: The Search for Staphylococcus aureus

Abstract

Objectives/Goals
My objective was to see if the gram-positive cocci in clusters that I cultured from commonly-touched school surfaces during my Science Fair project last year were staphylococcus aureus, and if so, whether or not they were resistant to antibiotics. My hypothesis is that most, if not all, the bacteria will be harmless and sensitive to antibiotics.

Methods/Materials
First, using a sterile swab, I swabbed the two surfaces which cultured the most bacteria last year: computer mouse and toilet flush handles. The swab was smeared on an agar plate and incubated for 2 days. The bacteria colonies that grew on the plate were observed. Each colony type was gram-stained. Those that were gram-positive cocci in clusters were re-plated on fresh agar plates; an oxacillin disc was added to the agar plate, and incubated for two days. The plates were observed for a ring of growth inhibition around the oxacillin disc. Bacteria from the agar were tested for catalase by smearing bacteria on a microscope slide and adding a few drops of hydrogen peroxide to it. Bubbling indicated a positive catalase test and that the bacteria were staph bacteria. The bacteria were also tested for coagulase. Both slide and tube coagulase tests were done. Rabbit plasma was added to a smear of bacteria on a slide. If clumps formed, the bacteria were coagulase-positive. In the tube test, bacteria were added to rabbit plasma in a test tube and incubated. If the plasma solidified, bacteria were coagulase positive and therefore staph aureus.

Results
All gram-positive cocci in clusters tested catalase-positive, but all of them tested coagulase-negative. This showed them to be staph species, but not staph aureus. Out of the 12 plates, only one staph species was resistant to oxacillin, showing no ring of growth inhibition around the disc.

Conclusions/Discussion
The most common bacteria found on the two surfaces were gram-positive cocci, and most were staph species, as proven by the positive catalase test. Since all of my coagulase tests were negative, none of the bacteria I isolated were S. Aureus. Coagulase is an enzyme that allows S. Aureus to break down body tissue and cause disease. My hypothesis was correct. The staph I found was coagulase-negative, and most likely staph epidermidis, a usually harmless bacteria commonly found on the skin. I was also glad to see that only one of my gram-positive cocci samples was resistant to oxacillin.

Summary Statement
My project is about discovering whether the bacteria on commonly touched school surfaces were S. Aureus, and whether they were sensitive to antibiotics.

Help Received
Father taught me how to perform catalase and coagulase tests and how to take pictures through a microscope. Kaiser Permanente Laboratory in Panorama City provided me with sheep blood agar plates, rabbit plasma, and oxacillin discs.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Arianna E. Gomez

Project Number
J1416

Project Title
Whater You Drinking?

Abstract

Objectives/Goals
Is it really safe to reuse a water bottle for drinking?
The researcher believes that it is not safe to reuse a water bottle because of the bacteria and germ build up. The few drops of water left over from previous tests may have come in contact with the subject's mouth, which may have bacteria. The bacteria from your mouth may then multiply on the mouthpiece and water after several uses.

Methods/Materials
While testing, the researcher had to hand out numbered water bottles every Tuesday and Thursday for five weeks. The subjects had to return them on Wednesday's and Monday's. While with the researcher, the water bottles would be tested for bacteria using the swabbing method. The subjects would use the first water bottle for two and one half weeks and then a new one for another two and one half weeks.

Results
The results are (from side one: mouthpiece) that on the first test, there were no water bottles with any growth. Test 2: 4 water bottles, test 3: 8 water bottles; test 4 and 5 had twelve water bottles. Test 6 was a new water bottle and 4 water bottles had bacteria without being drunk from. Test 7: 9 water bottles, test 8: 14 water bottles, test 9: 13 water bottles, and test 10: 15 water bottles. (Side two: water) Test 1: 0 water bottles, test 2: 4 water bottles, tests 3, 4, and 5: 14 water bottles. Test 6 is a new water bottle, had 4 water bottles, test 7: 10 water bottles, test 8: 15 water bottles, test 9: 14 water bottles, and test 10: 15 water bottles. The averages of bacteria ranged from 0.05 to 10 or more.

Conclusions/Discussion
The conclusion to my project is that it isn't safe to reuse water bottles because even after the first time you use a water bottle, bacteria begins to grow. The most amount of times you should drink from a water bottle is once, maybe twice because even after the first time the subjects drank from the water bottles, 4 of the water bottles had bacterial growth. After to many uses, you would probably get sick because of to much exposure to the bacteria.

Summary Statement
Is it really safe to reuse a water bottle for drinking?

Help Received
Mom helped seal Petri dishes; Dad helped refill water bottles; Mrs. Avilez from San Ysidro High School showed how to make graphs; Mr. Nevarez from Otay Ranch High School helped supervise use of lab equiptment and showed how to prepare agar, prepare Petri Dishes, count baceria, and he disposed of the

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Connor M. Keefe

Project Number
J1417

Project Title
Hand Washing Techniques: What Works Best?

Abstract

Objectives/Goals
The goal of this project was to determine the optimal techniques for reducing the bacterial contamination of my finger pads, using common cleaning methods available in most households, after doing a variety of household activities.

Methods/Materials
I used three types of bacterial contaminated substances; highly contaminated, moderately contaminated, and mildly contaminated. After performing a control plating on chocolate agar Petri dishes, I performed an intervention which was rinsing my hands in water for 10, 20, and 30 seconds each, washing my hands with soap & water for 10, 20, and 30 seconds each, and using non-alcohol or alcohol based antiseptic for 1 and 2 squirts each. Following the intervention I plated the same two fingers on the other half of the Petri dish. The plates were photographed and area in sq mm of growth calculated. I examined 6 finger pads at each intervention point.

Results
For the highly contaminated media, washing with soap & water for 20 seconds worked best, but rinsing your hands in water for 30 seconds also worked well. For the moderately contaminated bacteria using alcohol based antiseptic worked the best, but rinsing your hands in water only while rubbing them together worked almost equally as well. For the mildly contaminated bacteria everything worked well.

Conclusions/Discussion
The data indicated that while the soap and mechanical rubbing that occurs with hand washing is important, the most important factor may be letting the water continuously run over your hands while washing so that the bacteria are rinsed off more effectively. This dilution of bacteria by continuously running water combined with mechanical rubbing appeared to be the most effective in decreasing the concentration of bacteria on finger pads.

Summary Statement
Determining the optimal cleaning techniques for finger pads after doing a variety of household activities

Help Received
Father helped with experimental design, computer software use, and photography.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Apurva M. Khedagi

Project Number
J1418

Project Title
Milk Temperature + Active Bacteria Culture = Viscous Yogurt?

Abstract

Objectives/Goals
The objective of my project is to determine how temperature of milk affects the viscosity of yogurt. I believe that the temperature of milk will affect the activities of Streptococcus thermophilus and Lactobacillus bulgaricus bacteria which are present in yogurt starter culture. This activity will affect the viscosity of yogurt.

Methods/Materials
Six cups of milk at varying temperature was used to set the yogurt. One teaspoon of yogurt starter culture was added to each cup. After 10 hours of fermentation the viscosity of yogurt was calculated for 6 cups. Viscosity was measured using Stokes equation.

Results
Viscosities of yogurt was found to be changing, though not in a linear fashion. Initially, as the temperature of milk increased the viscosity of yogurt also increased. This linear relationship was observed till the temperature of milk was around 130°F. From that point onward, though the temperature of milk increased, the viscosity was observed to be decreasing.

Conclusions/Discussion
A group of lactic acid bacteria: Streptococcus thermophilus and Lactobacillus bulgaricus (present in yogurt starter culture) ferments milk sugars to produce lactic acid. The viscosity of yogurt depends on lactic acid production. There exists a symbiotic or proto-cooperative relationship between Streptococcus thermophilus and Lactobacillus bulgaricus bacteria. The coagulation of milk proteins is induced by thermophilic bacteria (Streptococcus thermophilus, and Lactobacillus bulgaricus) which propagate at high temperatures. As the concentration of lactic acid increases the proteins present in milk form gel and the result is viscous yogurt. This is how the temperature of milk facilitates bacteria in starter culture to produce viscous yogurt.

Summary Statement
Viscous yogurt is the product of an ideal temperature of yogurt milk and the stimulation of bacteria in starter culture.

Help Received
My grandmother gave me the recipe to make yogurt.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Elizabeth S. Koo

Project Number
J1419

Project Title
Humic Acid or Fulvic Acid: Which Organic Acid Can Suspend the Growth of E. coli?

Abstract

Objectives/Goals
My objective was to learn which organic acid; humic acid or fulvic acid could suspend the growth of E. Coli. I think Humic Acid will suspend the growth of E. Coli since it has an anti-bacterial and viral efficacy.

Methods/Materials
I made my own homemade incubator to cultivate bacteria under the supervision of Dr. James Pusavat. I put on latex gloves before cultivating anything. I cultivated E. Coli having it bought under the supervision of Dr. James Pusavat. I used three solutions with E. Coli, distilled water, humic acid (2% concentration fulvic acid), and fulvic acid (2% concentration). I repeated each cultivation two times. For results, I randomly chosen three 1/2 inch areas on the agar plates, and counted the colonies. Then, I added up the three colonies of each solution.

Results
I added the three randomly selected colonies on all solutions and it was:
A1 (1st Experiment of Distilled water on E. Coli) - Approximately 57 colonies
A2 (2nd Experiment of Distilled water on E. Coli)- Approximately 55 colonies
B1 (1st Experiment of Humic acid on E. Coli) - Approximately 6 colonies
B2 (2nd Experiment of Humic acid on E. Coli)- Approximately 3 colonies
C1 (1st Experiment of Fulvic acid on E. Coli)- Approximately 70 colonies
C2 (2nd Experiment of Fulvic acid on E. Coli) - Approximately 62 colonies
Humic acid has the least amount of growth in E. coli. This shows that humic acid is the best compared to all of them.

Conclusions/Discussion
My conclusion is that humic acid can suspend the growth of E. Coli because it can bind with protein part of the microbes. It then causes it to malfunction. However, fulvic acid had stimulated the growth of E. Coli because it is a chelator (detoxifier). It brings macronutrients and micronutrients to the E. Coli. They are both needed for supplementing a healthy human body.

Summary Statement
I'm seeing which organic acid, humic acid or fulvic acid can suspend the growth of E. Coli.

Help Received
Cultivation of E. Coli at home under the supervision of Dr. James Pusavat, Mom helped with board

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Marcus J. Kurth

Project Number
J1420

Project Title
Antimicrobial Activity of Some Medicinal Plants

Abstract

Objectives/Goals
To establish whether some common herbs or antiseptics possess antimicrobial characteristics. It is hypothesized that some of the plant extracts will indeed kill some bacteria, while others will not.

Methods/Materials
Herbs and Antispectics: Garlic, Oregano, Eucalyptus, Sage, Thyme, and Chloraseptic.
Bacterial Cultures: Escherichia Coli, Staphylococcus Saprophyticus, Staphylococcus Epidermidis.
Lab Equipment: 30 agar plates, incubator, sterile cotton swabs, sterile filter paper disks, sterile forceps, and bunsen burner.

Results
Some herbs had an antibacterial effect while others did not. Against E. Coli bacteria, Eucalyptus worked best by far, with Sage and Thyme also showing some zones of inhibition. Chloraseptic, Oregano, and Garlic had limited affect. Sage did best against Staph S. while Oregano was least effective. The antimicrobial effects of the other herbs was bounded by the efficacy of those two. Against Staph E., Sage was best again while the medicinal effects of the others was less.

Conclusions/Discussion
My research showed that some herbs will kill bacteria. This is the first of many steps needed to develop an antibacterial drug. New drugs are difficult to discover because they must possess two key attributes: they kill the bacteria but are nontoxic to humans. For example, the top bacterial killer in this report, Eucalyptus, is toxic to humans in large quantities, and therefore a great deal of care and trials would need to be undertaken in using this herb as a medicine. Nevertheless, finding new antimicrobial drugs is an important field since many bacteria are becoming resistant to antibiotics.

Summary Statement
The evaluation of the antimicrobial activity of commercial herbs against three pathogenic microorganisms.

Help Received
Used lab equipment at Saddleback College under the supervision of Dr. Karah Street.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Amy H. Lee

Project Number
J1421

Project Title
Brush Brush Brush! How Clean Is Your Toothbrush?

Abstract

Objectives/Goals
The object of this project is to determine how much bacteria are found in toothbrushes that are left in bathrooms and what factors might affect them.

Methods/Materials
1.Clean two bathrooms including two toilets with Comet disinfect bathroom cleaner or equivalent. Designate the first bathroom, Bathroom A, and the second bathroom, Bathroom B.
2.Place #1 cup which holds #1 toothbrush in Bathroom A on the top of toilet water tank. Place #2 cup which holds #2 toothbrush in Bathroom A near the sink. Leave the toilet lid open at all time.
3.Place #3 cup which holds #3 toothbrush in Bathroom B on the top of the toilet water tank. Place #4 cup which holds #4 toothbrush in Bathroom B near the sink. In this step leave the toilet lid closed at all time.
4.Brush each denture model (4 in all) with a toothbrush (4 in all) for 2 min and then rinse it with water for 10 sec twice a day (6 A.M. and 8 P.M.) for 6 days.
5.Take all the toothbrushes to a laboratory.
6.Swish each toothbrush a few times in the thiolglycollate media. Then close the lid. Place the media inside an incubator that is at 35 deg C in about 8% CO2 for 24 hrs.
7.Perform the streaking method on the blood and chocolate agars.
8.Place the agar plates in the incubator for 24 hrs. Cover the agar plates with the lid bottom or agar side up.
9.Record and compare the results.

Results
Significant levels of gram positive bacteria growth were present on all twelve toothbrush specimens regardless of the distances between the toilet and toothbrushes. Also, the test results did not make any difference whether the toilet lid was always open or closed. Total number of toilet flushes of bathroom A and B were almost exact.

Conclusions/Discussion
I learned from this experiment that my hypothesis was incorrect. All twelve toothbrushes had significant level of gram positive bacteria growth present. From the research, I learned that the germs or bacteria travel six to eight feet above the toilet through the air after it is flushed. Also, the bacteria droplets could be floating up in the bathroom air up to two hours. My experiment results showed that closing the toilet lid before flushing did not reduce the bacteria growth on the toothbrushes compared to the open toilet lid. This means that the bacteria leaked out from the tiny space between the closed toilet lid and the seat.

Summary Statement
My project explores how much bacteria are found in toothbrushes that are left in a bathroom and what factors might affect them.

Help Received
The Ridgecrest Regional Hospital Laboratory allowed me to use their incubator, thio media, blood and chocolate agars. Mrs. Chalise and Mrs. Sherri, both microbiologists at the hospital, helped me with the streaking the specimen on the blood and chocolate agars.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Austin H. Lee

Project Number
J1422

Project Title
Do Electromagnetic Fields Harm Algae Cells?

Abstract

Objectives/Goals
This experiment was conducted to see if there was any effect of electromagnetic fields on the growth and health of Chlamydomona.

Methods/Materials
In the experiment, two samples of Chlamydomona were thoroughly mixed with 1 mL of water in two test tubes. One of these was exposed to an electromagnetic field while the other wasn#t. Each test tube had a pipe in it which led to a bubbler. This kept the algae dispersed. Every hour for five hours, a sample of algae was taken from each test tube and was observed with a microscope. This experiment was repeated 10 times.

Results
The activity of the algae that were exposed to the electromagnetic field lessened as time passed while the activity of the algae not exposed gradually went up.

Conclusions/Discussion
The results suggest that electromagnetic fields weaken algae and lower their growth.

Summary Statement
The goal of the experiment was to find out what effects electromagnetic fields had on the health of algae.

Help Received
Sue at Carnegie Institution gave algae(Chlamydonomas); Father helped set up things and observed with me.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kyle C. Lee

Project Number
J1423

Project Title
Can Bacteria Become Immune to Antibiotics?

Abstract

Objectives/Goals
I will set up a experiment that shows if amoxicillin will kill all bacteria. Can the bacteria (bacillus) become immune to the amoxicillin.

Methods/Materials
I first obtained 36 petri dishes with nutrient agar already poured.
plates were placed at room temperature. steralized equipment.
I made concentrations and dilutions of amixicillin. I took 250 ml pill of amoxicillin and diluted with different amounts of water. depending on concentration needed. Weakest levels in first set of plates, continually getting stronger as experiment went on.
Pipette plates with weakest concentration rate of amoxicillin (6.25 x 10 to the negative 8 power grams per mil). Streaked 8 plates with bacteria. Incubate for 3-4 days. Observe growth of bacteria. Plate with most growth was then streaked onto a new set of plates with a higher dilution rate of amoxicillin. This was repeated until final dilution rate of (2.5 X10 to the negative fourth grams per mil).

Results
Series 1 all plates showed positive growth on all plates except 1.
Series 2 - two were negative on growth. one positive. and one contaminated
Series 3 - all plates were positive
Series 4 - all plates were positive
Series 5 - positive

Conclusions/Discussion
This shows that if you don't take complete dosage of antibiotic prescribed the bacteria will eventually become immune to it.

According to my experiment, I was able to prove that bacillus did eventually become immune to the amoxicillin.

Summary Statement
My project is going to prove if bacillus can become immune to the antibiotic amoxicillin.

Help Received
Teacher taught scientific process, high school teacher provided materials, mom and dad helped with supervision, and scientifically done correctly.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Sydney M. Locsin

Project Number
J1424

Project Title
Can Reading Make You Sick?

Abstract

Objectives/Goals
The objective was to find if there is bacteria that can make you sick on the magazines in the hospital lobby. I thought the more popular magazines would have more bacteria that cause disease.

Methods/Materials
For my experiment I used sterile swabs to swipe the five magazines: Bon Apetit, Time, Sunset, U.S. News, and Better Homes & Gardens. We used blood agar plates to grow the bacteria in a 37 degree celsius incubator then the lab used a gram stain test and microscope to identify what grew.

Results
After we took out the blood agar plates, it looked like little white dots and that was the bacteria that grew. Some of the plates had mold on it.

Conclusions/Discussion
My hypothesis was wrong. The bacteria that was found on the magazines was the same bacteria that can be found on any healthy person's hands.

Summary Statement
I tested if there was staff or strep bacteria on magazines in a hospital lobby.

Help Received
Grandmother performed incubating and clinical testing. Dad helped assemble board.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kelsey A. McDonald

Project Number
J1425

Project Title
Bacteria: Is Your Toilet Cleaner than Some Public Places?

Abstract

Objectives/Goals
To determine if the surfaces of some common public places, in which we all live, harbor a greater bacteria count than a common toilet.

Methods/Materials
Using 5 public surfaces (a shopping cart handle, an ATM button, an escalator, a door handle, and a toilet), I sampled each surface by swabbing the samples onto nutrient agar in petri dishes. After 10 days in an incubator, I measured the amount of bacteria grown in each petri dish, while keeping 1 petri dish swabbed only with sterile water, as a control.

Results
In my experiment, the shopping cart handle grew the most bacteria colonies with a count of 450 bacterias, the door handle grew 72 bacteria colonies, the ATM button grew 54 bacteria colonies, the escalator handle grew 36 bacteria colonies, while the toilet sample grew only 18 bacteria colonies.

Conclusions/Discussion
I concluded that the toilet sampled was the cleanest surface of all sampled, while the grocery cart handle was by far the most contaminated. This conclusion supports my original hypothesis. While it is a commonly held belief that toilets are very dirty, it turns out that ordinary public places we visit everyday could be more harmful to our health. My experiment leads me to believe that we need to be vigilant about washing our hands and food products in order to lessen a negative impact on ourselves and our society.

Summary Statement
My project is about measuring the amount of bacteria we encounter everyday, and comparing these amounts to the cleanliness of a toilet.

Help Received
Mr. Carlson lent me the incubator, my Mother purchased some supplies.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Adam J. Morton

Project Number
J1426

Project Title
The Effects of Xylitol on the Growth of Streptococcus mutans

Abstract

Objectives/Goals
The objective of this project is to determine if Xylitol will have an inhibiting effect on the growth of Streptococcus Mutans. Xylitol, a sugar alcohol found in plant cells, is used as a sugar substitute credited with an ability to actually reduce tooth decay.

Methods/Materials
I applied 1/2 gram Xylitol into five petri dishes with seven drops of Streptococcus Mutans rich broth. In five other dishes, one gram of Xylitol and broth were applied. In the last five, the bacteria was applied without the Xylitol. Petri dishes were placed in a home made incubator. Observations were made twice daily for eight days. Bacteria colonies were counted using Totallab 1100 colony counter.

Results
Resulting colony counts were: 28,888+-165 for the 1/2 gram group; 33,570+-195 for the 1 gram group and 35,011+-209 for the control (with bacteria but no Xylitol). The two groups containing Xylitol showed less bacteria than the control group. The number of colonies was lowest in the 1/2 gram group.

Conclusions/Discussion
The two groups with Xylitol exhibited fewer Strep. Mutans colonies than the control group, indicating that Xylitol does inhibit the growth of Steptococcus Mutans. The group with the larger (1 gram) amount of Xylitol had more colonies than the 1/2 gram Xylitol group. Further study to determine why the 1 gram group showed greater bacterial growth than the 1/2 gram group is recommended.

Summary Statement
Xylitol has a minor inhibiting effect on the growth of Streptococcus Mutans.

Help Received
Parents provided used parts to create incubator and helped purchase Xylitol and Strep. Mutans online.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alexandra I. Nutkiewicz

Project Number
J1427

Project Title
The Microbes Are Coming!

Abstract

Objectives/Goals
The objective is to determine which type of meat/fish has the least amount of bacterial contamination after thawing over an 8-hour period.

Methods/Materials
Sterile nutrient agar was poured into sterile Petri dishes. Two-ounce portions of chicken, pork, beef, and salmon were laid out to thaw at room temperature over an 8-hour period. Every hour a sterile inoculating needle was used to swab each sample and streak the agar plate. After a 48-hour incubation period the colonies were counted and plotted against time and temperature of the samples. A total of three trials were run.

Results
Results showed that beef had the least amount of bacterial contamination. Chicken, salmon and pork followed it. Both temperature of the meat or fish and time affect levels of bacterial contamination. As both increased so did the bacterial levels.

Conclusions/Discussion
After doing my experiment, my hypothesis proved to be incorrect. I was able to achieve my objective to determine bacterial contamination when meat or fish are left to thaw at room temperature. Food safety regulations are put in place for this reason. The Department of Health states that food that has thawed must not rise above 5*C for more than 4 hours. My data helps to support why food handlers should abide by this regulation. Food should be thawed by either the refrigerator or cold-water method. Food left to thaw to room temperature allows the opportunity for bacterial contamination and possible food borne illnesses.

Summary Statement
This project is about allowing meat or fish to thaw to room temperature and determining which specimen develops the least amount of bacterial contamination over time.

Help Received
Mother helped pour hot agar into petri dishes.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Ashish B. Pamula

Project Number
J1428

Project Title
Herbs: Are They the Secret behind Healthy Teeth and Gums? Phase III

Abstract

Objectives/Goals
The objective of my project was to find out if the herbs Clove Oil and Neem Extract could help prevent oral disease causing bacteria Streptococcus mutans and Porphyromonas gingivalis from growing under lab conditions.

Methods/Materials
Materials: The bacteria Streptococcus mutans and Porphyromonas gingivalis, blood agar plates, the herbs Clove Oil and Neem Extract, various toothpastes, and sterile paper disks.
Methods: Streptococcus mutans and Porphyromonas gigngivalis were plated on blood agar plates. Sterile filter disks soaked in herbs or toothpastes were place on the plates spread with the bacteria. The plates were incubated at 37 degrees Centigrade for 48 hours. Bacterial growth inhibition diameter was measured.

Results
In the control plates, there was no bacterial growth inhibition surrounding the disks. The diameter of the bacterial growth inhibition surrounding the disks soaked in Clove Oil for both bacteria was the largest. There was no bacterial growth inhibition surrounding the disks soaked in Neem Extract for both bacteria. There was smaller growth inhibition zone around disks soaked in various toothpastes for both bacteria.

Conclusions/Discussion
I found out that Clove Oil is a strong anti-bacterial agent against not only general bacteria that live in the oral cavity, but also against oral disease causing bacteria such as Streptococcus mutans and Porphyromonas gingivalis. In contrast, Neem Extract that was effective against the general oral bacteria, was not effective against the oral disease causing bacteria. My conclusions indicate that the hypothesis regarding Clove Oil being a strong anti-bacterial agent was proven correct whereas the hypothesis regarding Neem Extract was surprisingly incorrect

Summary Statement
Clove Oil is a strong anti-bacterial agent against the oral disease causing bacteria Streptococcus mutans and Porphyromonas gingivalis.

Help Received
I would like to thank my parents, Raj and Sujatha Pamula, for the help they provided me with this project. In addition, I would also like to thank my science teacher, Mrs. Dena Pruden, for her support and encouragement. I would like to thank San Jacinto Community College Microbiology Labratory for

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Ram D. Patel

Project Number
J1429

Project Title
The Power of Fruits and Spices

Abstract

Objectives/Goals
This experiment will show how fruits and spices can inhibit bacterial growth to allow us to live a healthy life.

Methods/Materials
1. Shredder
2. 6 thin cloths
3. Juicer
4. 7 test tubes
5. 3 fruits (lemon, lime, orange)
6. 3 spices (garlic, onion, ginger)
7. 6 droppers
8. 8. 3 Petri dishes
9. 9. Sterile swab
10. 1 bottle of sterile water
11. 5 loop prongs
12 . 12. Incubator
13. NS solution
14. 3 contaminated place

Results
Results: It was discovered that garlic was the best over all because it probably contained anti microbial property to inhibit the bacteria. Lime was the best fruit to inhibit bacteria because it has a strong amount of citrus acid. Lemon was the second best fruit because it also contained a strong amount of citrus acid. The other fruits and spices did not work because they probably did not contain the strong citrus acid or anti microbial property.

Conclusions/Discussion
Conclusion:
The experiment was to test what kinds of fruits and spices inhibit bacterial growth. It was hypothesized that the lime would work best because the citrus acid inhibits bacterial growth. It was also hypothesized that the garlic would work best because spices have anti microbial properties to inhibit the bacteria; which garlic has. To test the hypothesis, the bacteria were grown in the Petri dishes from three contaminated areas. The bacteria were singled out after the incubation. After the bacteria were singled out into there

Summary Statement
This project is to test if fruits and spices can inhibit bacterial growth

Help Received
Mother helped with making the board, Father helped with testing the project, Dr. Mohinder explained what to do and how to do it for the experiment

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Marina D. Plesons

Project Number
J1430

Project Title
Bacteria's Natural Enemies: The Effects of Natural Antibacterial Agents on Bacteria Found on Hands

Abstract

Objectives/Goals
My objective was to test my hypothesis that tea tree oil would be the most effective against bacteria found on hands because it is often used in disinfectants. My goal was to determine which of the three natural antibacterial agents I tested (grapefruit seed extract, tea tree oil, and apple cider vinegar) was most effective against bacteria found on hands.

Methods/Materials
I compared the effects of three natural antibacterial agents (apple cider vinegar, tea tree oil, and grapefruit seed extract) on bacteria cultured randomly from hands. I also tested the effects of these agents on several known harmful bacteria including Pseudomonas Aeruginosa, Staph Aureus, EColi, Enterococcus, Group A Strep, and Streptococcus Pneumonia. While conducting this experiment, I used methods such as the Kirby Bauer Disk Diffusion Test and streaking for isolation. To conduct this experiment, I used bacteria, and purported disinfectants, such as apple cider vinegar, tea tree oil, and grapefruit seed extract. I also used Petri dishes, blood agar and MacConkey agar plates, and absorbent wipes.

Results
The result of my experiment was that grapefruit seed extract was the most effective against bacteria found on hands. It had an average zone size of 24.06 mm and all of the zones were bacteriocidal. Apple cider vinegar did not work very well, with a average zone size of 11.52 mm and almost all of the zones were bacteriostatic. Tea tree oil was not very successful, with an average zone size of 14.39, except on one fungal hyphae I experimented on and Pseudomonas Aeruginosa.

Conclusions/Discussion
In conclusion, the results did not support my hypothesis that tea tree oil would be the most effective except in the cases of Pseudomonas Aeruginosa and one fungal hyphae I experimented on. These findings suggest that natural antibacterial agents might be useful in medicine. In order to really tell whether grapefruit seed extract could be used as an antibiotic, further research would have to be done. Because antibiotic resistance is becoming more common, these alternative options of treatment might be useful in the future.

Summary Statement
My experiment , which examined the effectiveness of 3 natural antibacterial agents against various hand-borne bacteria, produced unexpected results demonstrating that grapefruit seed extract was the most effective agent.

Help Received
Mrs. Brooks, Director of Microbiology at the Sansum Clinic, helped me refine the project and taught me the necessary techniquies for conducting my experiment; UCSB Prof. Mahan assisted me with the advanced statistical analysis; Mr. Penkala, science teacher at GVJHS, advised me on the format of the

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alexandra K. Pollack

Project Number
J1431

Project Title
Would You Like Bacteria with Your Burger?

Abstract

Objectives/Goals
This study compares the price and cleanliness of ground beef. My hypothesis is that more expensive ground beef will have lower levels of bacteria.

Methods/Materials
I bought samples of ground beef from seven different stores, ranging in price from $2.49 per lb. to $4.99 per lb. I cultured samples of each to determine the level of bacteria.

Results
The amount of bacteria in each ground beef sample varied significantly. Some of the lower-priced samples had very high levels of bacteria. But, there was not a direct relationship between the price of the ground beef and the amount of bacteria.

Conclusions/Discussion
I figured out that the price wasn#t the only factor of the presence of bacteria in ground beef. Other factors could include, the size of the store, the length of time the meat stays in the store, and the food handling habits of the workers.

Summary Statement
Over a limited period of time, I compared the levels of bacteria in raw ground beef from seven local stores.

Help Received
Mother helped get meat and do the experiment; Neighbor consulted on experiment procedures; Dad helped with data collection; Science teacher helped with organization of report.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Francesca P. Ricapito

Project Number
J1432

Project Title
Bacteria vs. Clorox Disinfectant Wipes

Abstract

Objectives/Goals
This experiment was based on how well bacteria can be cleaned from different surfaces. I predicted that the smoother the surface, the more bacteria the Clorox wipe will clean away. The more rough and bumpy the surface, the less the wipe will clean away. It is much easier for bacteria to get stuck in nooks and crannies on the surface you are testing than a smooth straight surface.

Methods/Materials
Materials:RODAC Agar plates,Clorox disinfectant wipes,Porcelain,Wood,Formica, Protractor,Sharpie pen
Methods:
A. Perform this procedure for each surface to be tested (wood, porcelain and Formica)
B. Clear a 6 inch x 8 inch space on the surface.
C. Take triplicate RODAC samples prior to disinfecting.
D. Take triplicate RODAC samples post disinfecting.
E. Let RODAC plates sit at room temperature or 72 hours.
F. After a minimum of 72 hours, count the visible bacteria colonies on each plate.
G. Record data on data sheet.
H. Data Analysis
i. Calculate the average positive control count and average test sample (post disinfecting) count for each surface tested.
ii. Calculate the reduction efficiency in percentage. Formula:
[1 # Avg number after cleaning÷ Avg number before cleaning] x 100

Results
The porcelain surface had the highest bacterial reduction, measuring 82%. The Formica surface had a calculated reduction of 64%. The wood surface was the most difficult surface to clean with a reduction of 39%.

Conclusions/Discussion
My hypothesis stated that the smoother the surface the more bacteria the Clorox wipe will clean away. This experiment confirmed that my hypothesis was correct. Porcelain is the smoothest surface tested and the calculated bacterial reduction for it is the highest at 82%.The Formica surface is much bumpier than porcelain and has calculated bacterial reduction of 64%.The wood surface was the most difficult surface to clean with a reduction of 39%.This is likely due to all the nooks and crannies in the wood surface.

Summary Statement
Whether the type of surface affects how much bacteria is wiped away using a Clorox disinfectant wipe.

Help Received
Mother helped obtain test materials and with test design and graphs; Brother allowed the use of his room and computer

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Vivian N. Rotenstein

Project Number
J1433

Project Title
Who Will Win the Battle against Bacteria?

Abstract

Objectives/Goals
Nowadays there is a variety of antibiotics that can fight bacteria, yet we are still looking to nature for answers and continue to try to emulate it. It is the danger of antibiotic resistance and the high cost of these medications that make us look for other sources for treatments. Based on prior research regarding the antibacterial properties of lysozymes in saliva, chamomile tea, and lysozyme in a concentrated powder form, extracted from egg whites, I hypothesized that while lysozyme in human and canine saliva, chamomile tea extracts, and lysozyme in concentrated form all have antibacterial properties, the lysozyme in concentrated form will fight bacteria more effectively.

Methods/Materials
I swabbed the nose of human subjects and distributed the mucous bacteria on agar plates that I placed afterwards in the incubator. I swabbed the mouth of dog subjects for canine saliva, as close as possible to the dog salivary glands (back by the molars). Then I swabbed human saliva (from a person with braces, who salivated more abundantly). The canine saliva, human saliva, chamomile extract, and lysozyme in concentrated form were placed over the bacteria cultures in separate agar plates and together with the control (with no antibacterial agent) in the incubator. I measured the growth of the zones of inhibition for each culture.

Results
For human saliva, zones of inhibition were small but rose steadily at a rate of 1mm-1.5mm per day. For canine saliva zones of inhibition increased at comparable rate due probably to the small amount of saliva collected. For chamomile tea, there was no zone of inhibition evident or the zones of inhibition were very small, and grew steadily at rate of 0.5 mm per day. For concentrated lysozyme, the zones of inhibition were much larger initially, then grew at a rate of 0.5mm-1mm. The control had no antibacterial agent, there were no zones of inhibition and a high concentration of Staphylococcus aureus could be noticed over the agar.

Conclusions/Discussion
As my hypothesis stated, the lysozyme in concentrated form from egg whites did have the highest antibacterial properties. However, one of the conditions of my experiment that could have altered the results of my project could have been the amount of canine saliva I was able to obtain. For my further work, I plan using Ready-Lyse Lysozyme Solution: specific activity of Ready-Lyse Lysozyme is 200-fold higher than that of egg white lysozyme.

Summary Statement
Checking the antibacterial properties of human saliva, dog saliva, chamomile tea and lysozyme in a concentrated powder form extracted from egg whites.

Help Received
Medea Creek Middle School laboratory under the supervision of my science teacher Ms. Jennifer Nelson, Dr.Keith Garb provided agar plates, MPBiomedicals provided the lysozyme concentrate from egg whites.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Madylynn K. Snyder

Project Number
J1434

Project Title
Aunt Bertha's Buns

Abstract

Objectives/Goals
The objective of this experiment was to determine if Aunt Bertha's family bun recipe created the tallest rise in the bread dough by combining yeast and the natural starches from mash potatoes in the bread dough. Yeast is the ingredient in breadmaking that causes the bread to rise. Yeast transform sugar and starch into carbon dioxide bubbles. Potatoes contain forms of both sugar and starch and a high concentration of amylose.

Methods/Materials
Boiled and mashed potatoes (plain potatoes-no additions) were added to an active yeast mixture containing lukewarm water and yeast. The dough was placed in callibrated beakers and covered with a cloth. The beakers were placed on a heating pad of 78 degrees. The dough was measured every 15 minutes for four hours. The control groups were two mixtures; 1) a mixture of 2) unleavened dough(no yeast)and leavened dough (addition of yeast).

Results
The dough containing mashed potatoes and yeast rose significantly higher than the control group dough. The dough rose an average of 20% higher than the dough with yeast and 80% higher than the unleavened dough.

Conclusions/Discussion
The results for this experiment were expected based on the scientific research and the family history of Aunt Bertha's buns. The yeast attacked and fed on the starches in the flour and then continued to feed on the natural starches in the mashed potatoes. In all three trials the results were the same.

Summary Statement
Aunt Bertha's Bun recipe which included the secret ingredient of mashed potatoes caused the dough to rise higher than the bread dough with yeast only.

Help Received
Mother helped type report, Lou Massei (Biology teacher at Monache High school provided lab equipment)

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Michelle A. Stukenberg

Project Number
J1435

Project Title
What's in Your Ocean?

Abstract

Objectives/Goals
My goal for my project was to find out how polluted the local beaches were. Also, if the pollution or bacteria in the water is harmful to humans.

Methods/Materials
First, I gathered water from the twelve different beach locations. Next, I put the water samples in Petri dishes with sterile cotton swabs. Then I put them into a cabinet in my garage. I would then watch them, log how the bacteria changed, and take pictures. Finally, when I was done logging my data, I disposed the Petri dishes.

I used 12 Petri dishes, 10 different ocean water samples, and 10 sterile plastic containers to collect my water samples.

Results
My results were as I expected. There was a large amount of bacteria in my ocean samples. After I had finished my 7 day logging, I took samples of the bacteria and put it under a microscope. What I saw in the bacteria from the Huntington Beach Pier- After Rain was disturbing, I saw Fecal Coliform. This kind of bacteria proves that if the bacteria levels get high enough the bacteria can cause serious illnesses.

Conclusions/Discussion
I concluded that our oceans from Huntington Beach Pier to Balboa Pier are very polluted and full of bacteria. Also, if we don#t do anything to reduce the bacteria amount in our oceans; they will become so polluted with bacteria that they will become untouchable. Finally, if everyone were to know about the conditions of our ocean water, I believe that more people would try and help to stop the continual growth of bacteria.

Summary Statement
My project is about ocean water bacteria and pollution, and whether or not it hurts the human body.

Help Received
My father drove me to the different beaches to get my water samples.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Alana Torres

Project Number
J1436

Project Title
Food for Thought: Microorganism Contaminants in Dried Fruits

Abstract

Objectives/Goals
Dried fruit contains a large amount of fiber, and it is widely accepted that eating a very high fiber meal, such as a large amount of dried fruit, can cause increased gas production and a shortened transit time of food through the intestines. This experiment was designed to try to determine if dried fruits contain heavy loads of bacteria or mold since these microorganisms might contribute to intestinal symptoms sometimes experienced after ingestion. Perhaps the bacteria or molds might affect the gut as pathogens or possibly by simply altering the normal flora of the intestine. It was hypothesized that through handling or exposure during the drying and/or packaging process, dried fruit might become contaminated with bacteria and/or mold.

Methods/Materials
In this study, non-sulfured dried fruits were vortexed with sterile water and then aliquots of the resulting solution were plated with Coliscan Easygel and incubated at 35 degrees C (95 degrees F) for 48 hours. The dried fruits tested were apricots, apple rings, cranberries, organic cranberries, cherries, mangos , and organic raisins. After a 48 hour incubation period, the plates were examined.

Results
The results revealed many bacterial colonies, some non-coliform (cream colored) and some coliform colonies (pink colored) on many of the plates. E. coli colonies (blue) were seen on the organic raisin plates. This indicates mammal fecal contamination. Many of the plates, especially those from the dried mango exhibited a large amount of mold growth and probably some yeasts.

Conclusions/Discussion
Even though dried fruits are a very low moisture food, they did appear to harbor bacteria and other microorganisms. Coliforms were found in several of the dried fruits tested and even E. coli in organic raisin samples. Aspergillus type molds were cultured from mango, and raisin samples. However, the confirmation of the presence of bacteria and mold growth from the dried fruits tested in this study does not necessarily prove that the bacteria and mold on dried fruit are the cause of the intestinal upset that sometimes occurs when a large amount of dried fruit is ingested.

Summary Statement
I tested ten different types of dried fruit using Coliscan Easygel growth media and found that these low moisture foods may still be heavily contaminated with bacteria and molds, including coliform and Aspergillus.

Help Received
Mrs. Hunker (Science Teacher) supervised; Used School lab

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Linda P. Vang

Project Number
J1437

Project Title
Determining and Exterminating House Bacteria

Abstract

Objectives/Goals
The objective of my project was to determine and exterminate bacteria on household objects. My hypotheses were that the doorknob would have the most bacteria, and the bleach would exterminate the most bacteria.

Methods/Materials
For my experiment, gather and use the following: distilled water, methanol, Lysol, bleach, alcohol, toilet flusher, doorknob, computer mouse, Petri dishes, pipettes, test tubes, cotton swabs, glass handle, glass bowl, scissors, a measuring cup, and paper towels.

To begin project, measure and fill test tube with 10ml of distilled water. After, swab designated area with a cotton swab for fifteen seconds. With scissors, snip off the top of swab into the water-filled test tube. For thirty seconds, agitate the tube so bacteria will spread throughout water. Using a pipette, vacuum up .2ml of the bacterial water from the test tube and release onto Petri dish. Next, wait approximately ten minutes for the water to soak in until flipping Petri dish upside down and storing into a warm, dark place for 72 hours to germinate. Repeat previous steps to other areas until all areas have a total of ten Petri dishes/trials. After that, repeat previous steps after cleaning each area with household cleaning substance and re-swabbing area until each cleaning substance also has total of ten Petri dishes/trials. After 72 hours, take out total of eighty Petri dishes to observe and record results.

Results
Remote control averaged 130 bacteria colonies, and the doorknob averaged 118. The computer mouse averaged 117, and the toilet flusher averaged 113 colonies. Lysol cleaned an average of 28%, and alcohol cleaned an average of 27%. Water then cleaned an averaged of 26%, and bleach cleaned 14%.

Conclusions/Discussion
My hypotheses were both incorrect; the remote control had the most bacteria, instead of the doorknob, and Lysol cleaned the most, instead of bleach. I determined that simple house areas are contaminated with bacteria, but there are also many easy household substances to exterminate them.

Summary Statement
For my project, I will be determining how much bacteria are on household objects and exterminating the bacteria with safe cleaning household substances.

Help Received
Parents helped with project idea; Mother edited board and helped take pictures; Mr. Whittington helped supply materials; Mrs. Bridger helped eit papers; Mrs. Cloud suggested improvements.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Haley F. Washburn

Project Number
J1438

Project Title
Do Different Environmental Conditions Affect the Effectiveness of Antibiotics?

Abstract

Objectives/Goals
The purpose of my science project is to determine how effective penicillin and amoxicillin are at creating an area of bacterial inhibition after being exposed to different environments.

Methods/Materials
My first series of tests for this project included 8 test substances. I had an exposure to freezing temperatures test, a sunlight exposure in a brown bottle test and in a clear bottle test, and a control test for both antibiotics. After 24 hours exposure I swabbed a petri dish with the bacillus subtilus bacteria and dipped an absorbent dot in my test substance then placed it in the dish to grow. I had 10 test dots per test substance. Two days in a warm dark place produced large overlapping areas of inhibition and very little bacteria growth. This prompted me to repeat all tests using antibiotics diluted with distilled water at 1:10 dilution.

Results
The average area of inhibition for the full strength amoxicillin control group was 21.7mm. The combined average area of inhibition for the test groups after 24 hour exposures was 16.1mm. Average area of inhibition for diluted amoxicillin control group was 16.9mm. The combined average area of inhibition for the test groups after 24 hour exposures was 9.2mm. The average area of inhibition for the full strength penicillin control group test was 14.7mm. The combined average area for the test groups after 24 hour exposures was 15.8mm. Average area of inhibition for diluted penicillin control group was 8.4mm. Average area of inhibition for the test groups after 24 hour exposures was 0mm.

Conclusions/Discussion
Through testing I discovered that amoxicillin was better at inhibiting the growth of the bacillus subtilus bacteria than pencicillin. Also, I learned that even though the antibiotics produced areas of inhibition after exposure to different environmental conditions, being exposed to those conditions did affect their ability to inhibit bacteria growth.

Summary Statement
This project is about determining whether or not storing your antibiotics in a manner other than what is suggested by the pharmacy has any affect on their ability to inhibit bacteria growth.

Help Received
Mr. Carl Gong supplied the petri dishes, bacillus subtilus bacteria, and helped with my experimental flow chart. Dr. John Inouye supplied the perscriptions for the antibiotics. Mrs. Hillary Cloud reviewed my work. My mom helped to type some of the written work and photograph the experiment.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Trenton D. Wilder

Project Number
J1439

Project Title
The Spinach Solution

Abstract

Objectives/Goals
I did my project on ways of washing spinach to eliminate bacteria. I used 5 different washes. My hypothesis was if I washed the spinach with a salt water solution then there would be fewer bacteria than the other washes. My goal was to see how to help people decrease bacterial contamination on their food.

Methods/Materials
Method:1-Separate unwashed spinach into 5 piles; 2-Mix 15g salt with 250ml distilled water; 3-Swirl 3 spinach leaves in solution for 5sec; 4-Place leaves on paper towel; 5-Moisten sterile swab in Easygel test medium; 6-Swab 2cm of 3 spinach stems & 2cm up veins of the leaves; 7-Put swab back into test medium; 8-Swirl in test medium for 5 sec; 9-Take swab out & press against inside of bottle; 10-Pour test medium into Petri dish; 11-Mark test number on outside of Petri dish; 12-Let incubate at 26.67-32.22 degrees C. for 48hrs; 13-Count each coliform colony; 14-Repeat test 6 times; 15-Take unwashed spinach, repeat step 1 & 4-14; 16-Take unwashed spinach leaves, repeat step 1, using 250ml distilled water, & steps 3-14; 17-Take unwashed spinach, repeat step 1, using 250 ml tap water, & steps 3-14; 18-Take unwashed spinach, repeat step 1, using 250ml tap water with 15ml vegetable spray, & steps 3-14; 19-After incubation bleach Petri dishes so there is no unwanted contamination. Independent variables were the way I washed the spinach. Dependent variables were the amount of colonies. Control was the unwashed spinach test. Constants were methods used to obtain bacterial samples & incubation time & temperature. Materials:30 sterile Petri dishes; 30 sterile swabs; 30 bottles of Easygel test medium; 6 bunches of unwashed spinach; distilled water; tap water; salt; 6 clean plastic bowls to hold solutions; fireplace for incubation; thermometer; marker; timer; paper towels; vegetable cleaner; bleach.

Results
On average the least amount of bacteria was on spinach washed in salt and distilled water,619 bacteria colonies. Second was spinach washed in vegetable spray and tap water,762 colonies. Distilled water wash left 865 colonies. Tap water left 911 colonies. The unwashed control had 1851 bacteria colonies.

Conclusions/Discussion
My hypothesis was correct. The 6% salt solution had the least amount of bacteria colonies. Future experiments could be to use increments of salt in the same amount of water or test ingredients in the veggie spray to see which has the best bacteria removal.

Summary Statement
Testing the amount of bacteria on spinach leaves after washing them in different solutions to determine which eliminates bacteria the best.

Help Received
My mother helped with the typing and took the photos; obtained information from Riverside County Environmental Health on prior bacterial outbreaks caused by produce; I spoke with Geoff Shouse of the Biology Dept. at UCR about the best way to take my bacterial samples.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Yuxin Zhu

Project Number
J1440

Project Title
The Effects of pH and Temperature on the Growth of Escherichia coli DH5a

Abstract

Objectives/Goals
The purpose of this project was to study the growth of the bacteria Escherichia coli DH5a under a variety of different pH and temperature, in order to discover and approximate the optimal value at which the cell was able to increase in size and divide the quickest.

Methods/Materials
Material used for this experiment included Eschericha coli DH5a, flasks, cuvettes, test tubes, adjustable pipettes, disposable tips, 12N HCl, 10N NaOH, graded transfer pipette, safety goggles, gloves, LB medium, lab coat, electric pipette filler, autoclaver, pH meter, Beckman DU640 spectophotometer, shaking incubators (New Brunswick Scientific)

The experiment was conducted through a three-step process. Each level of pH (2, 5, 7.4, 9, and 11) and temperature (4°C, 22 °, 37°C, 50°C, and 70°C) had three designated test tubes. On the first day, environments were set and the medium was prepared. Escherichia coli DH5a was then added. After the bacteria were grown overnight, a spectrophometer was used to measure how much bacteria was present.

Results
The experiments demonstrated that Escherichia coli DH5a#s optimal growing conditions are around pH 7.4. Both acidity and alkalinity could inhibit the growth of Escherichia coli DH5a bacteria. Escherichia coli DH5a also grew best at 37°C. Either lower or higher temperature could stall cell growth.

Conclusions/Discussion
Acids and bases had apparently created a negative impact on cell growth through a variety of factors possibly prohibiting certain cell functions, intracellular stability, and lengthening lag times. In cold temperatures, cell metabolism starts to slow, and growth is limited. At higher temperatures, cell parts started to fall apart and growth completely stopped.

However, this project in essence describes more than just the growth of Escherichia coli DH5a but of many other types of bacteria. Escherichia coli DH5a, because of its organization and physical properties, has long represented cells on a whole. For this very same reason, Escherichia coli DH5a is the basis of microbiology. In addition, this experiment shows that if proper care of food containing Escherichia coli or other bacteria was taken, then lives could be saved. From this experiment, we now know that most cells on a whole cease to function in higher temperatures, in acidic environments, and alkaline mediums. Indeed, this project has extended to tell of life itself, and its limitations.

Summary Statement
This project exhibited the growth of Escherichia coli DH5a, showing that certain temperature and pH variables inhibit its activities.

Help Received
Used lab equipment under the supervision of Dr. Genghui Zhu