CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Lesley M. Anderson

Project Number
J1301

Project Title
Bacteria Affected by Ultra-Violet Light

Abstract

Objectives/Goals
My objective was to see what the affect was of ultra-violet light on bacteria. I hoped that the bacteria would get killed, and wanted to see a decrease in bacteria colonies.

Methods/Materials
I first collected water samples at Arroyo Burro Creek. I immediately took the first sample with the water untouched by the UV light. I exposed the water sources to the light for 24 hours, taking samples of bacteria at 1 hour, 6 hours, 12 hours, and 24 hours. When completed, I took the samples to the microbiology lab of Cottage Hospital. My bacteria samples were incubated for 24 hours. I was then able to count colonies and record my data.

Results
The results I recieved weren't exactly what I wanted. After the first trials, there was a slight decrease in colonies, and then the numbers went back to even higher than the original sample. I repeated the experiment with a higher intensity lamp, and realized that now the colonies continued to decrease throughout the entire experiment.

Conclusions/Discussion
After being unsatisfied with my results, I decided to look on the Internet to find any information about the methods the city was proposing to use. I found exactly what I was looking for. I knew that I needed to have a higher intensity lamp, and my light was only 15 watts. I knew that Energy = Watts / Distance squared, (E=W/D^2), so I decreased the distance between the UV lamp and the water source. I learned that even the slightest difference in methods could prove devestating.

Summary Statement
My project is about the affect of ultra-violet light on bacteria of Arroyo Burro Creek.

Help Received
Lab equipment at Cottage Hospital Microbiology Lab, with help from Marian Jean, Microbiologist.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kaitlin M. Ball

Project Number
J1302

Project Title
The Five Second Rule: Dry Food vs. Wet Food

Abstract

Objectives/Goals
My objective was to learn if the five-second rule applies to dry food dropped on the floor. I thought that the dry food would have the same results as the wet food (Wet food was tested last year. I am comparing these results with this year#s project).

Methods/Materials
The materials used for this project were; graham crackers, a watch with a second hand, 40 Petri dishes, approximately 45 sterilized gloves, a black sharpie pen, a gallon-sized Zip-loc bag, agar, three different ground surfaces: grass, sidewalk, and kitchen floor, Q-tips, and a card table. My procedure was as follows. First I took a few graham crackers and put them in the gallon-sized bag. Then I broke each graham cracker into eighths. Next I gloved one hand and took a graham cracker out of the bag and swabbed it with a Q-tip. I swabbed the Q-tip in the Petri dish and put the top of the Petri dish back on. I repeated this process 9 more times for the Control Group. Then I gloved one hand, picked up a graham cracker, and dropped it on the kitchen floor for five seconds. I picked the graham cracker up immediately after five seconds were up, swabbed the side that touched the ground with a Q-tip, and swabbed the Q-tip in the Petri dish. Next, I closed the lid on the Petri dish. I repeated this process 9 more times for my Kitchen Floor Group. I repeated this process for my grass and sidewalk group, each 10 times. Finally, I taped the lids shut to all of the Petri dishes and placed them on a card table to watch them for 7 days.

Results
After I monitored the Petri dishes for 7 days these were my results. The results consist of graham crackers (this year#s project) and bananas (last year#s project). Graham Crackers; Control 1out of 10, Kitchen Floor 3 out of 10, Sidewalk 7 out of 10, and Grass 10 out of 10 had growth on them. Bananas; Control 3 out of 10, Kitchen Floor 10 out of 10, Sidewalk 10 out of 10, and Grass 10 out of 10 had growth on them.

Conclusions/Discussion
The results I uncovered proved that dry food doesn#t have the same results as wet food. This knowledge can help everyone have a better understanding of germs and how they could affect us. This can also help us from getting sick. If we don#t pick food up off the ground then that gives us a better chance of not getting sick.

Summary Statement
To learn if the five-second rule also applies to dry food dropped on the floor.

Help Received
Mom helped time the food on the floor, helped mix the agar, and helped put together the board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Alyssa E. Beck

Project Number
J1303

Project Title
What Are the Effects of Ultraviolet Light on Bacteria Mortality?

Abstract

Objectives/Goals
The purpose of this experiment was to observe the effects of short term ultraviolet light exposure on bacteria.

Methods/Materials
Escherichia coli (E. coli) and Serratia marcescens cultures were prepared by a technician at the University of California San Diego biology laboratory. I plated and labeled the samples and exposed the bacteria to ultraviolet light (at 254 nm) for two, five, and 30 minutes. Trypticase soy agar was used as the culture medium. The samples were plated. Half of each disk was exposed to ultraviolet light and half of each plate was shielded, so that each plate would serve as its own control.

The experiment was repeated using only the Serratia marcescens strain and shorter lengths of exposure times (15 seconds, 30 seconds, and one minute) to the 254 nm ultraviolet light in an attempt to establish at what exposure time mortality begins.

Results
After incubation, bacteria on the side not exposed to ultraviolet light (the shielded side) were observed to have grown into distinct, visible colonies. None of the bacteria exposed to ultraviolet light for two, five, or 30 minutes at 254 nm survived.

When the experiment was repeated, bacteria mortality was approximately 40-75% for Serratia marcescens exposed to ultraviolet light (at 254 nm) for 15 seconds and about 75-90% bacteria mortality for the 30 second exposure. One minute of exposure time to ultraviolet light resulted in 95-99% bacteria mortality. Therefore, complete mortality for Serratia marcescens is probably a little longer than one minute, but less than two minutes.

Conclusions/Discussion
Ultraviolet light exposure for short time periods, such as two or five minutes, was not expected to completely destroy the bacteria. Similarly, it was not expected that bacteria exposed to ultraviolet light (254 nm) for one minute would result in almost complete mortality. Surprisingly, very low exposure times, such as 15 and 30 seconds resulted in at least 40% bacteria mortality and bacteria exposed to 254 nm for one minute resulted in at least 95% mortality.

Summary Statement
In this experiment, I observed the effects of short term ultraviolet light exposure at 254 nm on Serratia marcescens and E. coli bacteria.

Help Received
Dr. Mandy Butler, Professor of Biology at the University of California San Diego, provided me with the laboratory and bacteria cultures for this experiment. Mrs. Hunker, my science teacher at The Rhoades School provided comments and guidance for my project. My parents provided transportation to and from

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Pallavi Bekal

Project Number
J1304

Project Title
Mother Knows Best: A Study of the Health Benefits of Spicy Cooking

Abstract

Objectives/Goals
People in equador regions use spices in food preparation for thousands of generations. By using these spices, are they keeping themselves healthy by keeping their food "clean?" My objective is to find out if spices have the ability to kill food-spoilage microorganisms. And if they do, which spices are most effective and by how much? This is what I plan to find out after I have conducted my experiment.

Methods/Materials
My experimental setup was designed to test volatile emission from the spices. After obtaining agar dishes, E. coli, and sterile swabs from CSUF, I carefully streaked E. coli on all of my dishes. Then I turned them upside down and I applied 1/4 tsp. of spice on the lid. I used all of the following spices: cinnamon, garlic, mustard, black pepper, coriander, lemon juice, and chilli powder. Then I left my dish at 27 degrees Celsius for 4 days. I had three replicates.

Results
The results of my experiment show that not all of the seven spices used were effective. Complete Inhibition- coriander 100%. Partial Inhibition- mustard 83%, cinnamon 67%, lemon juice 67%, black pepper 17%, and garlic 17%. None- chilli powder 0%.

Conclusions/Discussion
According to my results, spices do have antibacterial properties, but not all of them. This is potentially beneficial in tropical countries that have ineffective food storage methods.

Summary Statement
The purpose of this project is to see whether spices have antibacterial properties.

Help Received
I would like to thank Dr. Schreiber from CSUF for advising me on what species of bacteria to use and for providing me with the needed materials for this experiment. I would also like to thank Mr. Karsevar for allowing me to work on this project during class and for helping me fill out the forms.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Alana N. Brown

Project Number
J1305

Project Title
Beleaguered Beef: Guess What's Coming to Dinner?

Abstract

Objectives/Goals
The objective was to determine whether or not there is a difference between naturally grown ground beef and standard ground beef in terms of antibiotic additives. I hypothesized that the standard ground beef would show usage of antibiotic additives while the naturally grown ground beef would not.

Methods/Materials
I swabbed five agar dishes with the juice from standard and natural ground beef. The standard ground beef types were Porter's Premium and Raley's. The natural ground beef types were Coleman Natural, Whole Foods lean, and Whole Foods leanest. Additionally, I used one agar dish as a control, in which I did not swab it with the variable. I then incubated all six agar plates over a period of five days. From the growth of bacteria on each agar plate, I concluded whether or not antibiotics were used.

Results
In terms of percentage of bacterial growth covering the agar plates, the naturally grown ground beefs averaged 31 percent of their entire agar plates. Next, the standard ground beefs averaged 30 percent. Finally, the control averaged 20 percent. At times the some of the naturally grown ground beefs cultured fewer amounts of bacteria than some of the standard ground beefs. I attribute this to the fact that there is usually more effective sanitation in natural beef factories than in standard ones.

Conclusions/Discussion
My hypothesis was proven correct in that the naturally grown ground beefs cultured more bacteria because they had little or no antibiotic additives. Reversely, the standard ground beefs cultured less bacteria because of the presence of antibiotic additives. As much research states, antibiotic additives in meat are dangerous and should be prohibited. When humans consume this meat they risk health problems and possibly even death. My investigation proves that it is much healthier to eat naturally grown ground beef than standard ground beef. Therefore this finding could be very benefical to the public.

Summary Statement
My purpose it is find whether or not there is a difference between naturally grown ground beef and standard ground beef in terms of antibiotic additives.

Help Received
Mother checked my report for any errors

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Lindsey N. Drake

Project Number
J1306

Project Title
Which Acne Medications Are Most Effective against Propionibacterium acnes?

Abstract

Objectives/Goals
The objective is to determine which acne medications are the most effective in inhibiting the growth of Propionibacterium acnes, over-the-counter or prescription.

Methods/Materials
The active ingredients of two prescription antibiotics, three over the counter acne medications and two plant extracts were tested in vitro in duplicate two separate times against P. acnes. The bacterium was incubated under anaerobic conditions in the presence of disks containing the study medications and a control disk. The diameter of each inhibition zone was measured to the nearest millimeter and recorded.

Results
Tetracycline was the most effective, with an average inhibition zone of 46.25 mm, followed by Clindamycin with a 45.5 mm inhibition zone. Surprisingly, Oregano oil had the third largest inhibition zone of 31.25 mm. Benzoyl peroxide 10%, Benzoyl peroxide 2.5%, the equal mix of Tea Tree oil and Oregano oil followed with inhibition zones of 24.75 mm, 23 mm, and 19.67 mm zones, respectfully. Lastly, with inhibition zones of 0 mm were the control, Salicylic acid, and Tea Tree oil.

Conclusions/Discussion
The prescription acne medications are the most effective in vitro against Propionibacterium acnes.

Summary Statement
My project compares the in vitro effectiveness of prescription verses over- the -counter acne medication aginst Propionibacterium acnes.

Help Received
Worked under the supervision of Dr. Dale A. Schwab and used incubator at Quest Diagnostics,Nichols Institute.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Sahar H. El Abbadi

Project Number
J1307

Project Title
Chicken Sushi: A Good Idea? A Study of Bacteria Growth in Varying Acidic Environments

Abstract

Objectives/Goals
The objective of my project was to discover the effect that liquids of different acidities would have on the growth of bacteria found on raw meat. It was predicted that the stronger the acid, the more the growth of the bacteria would be inhibited.

Methods/Materials
Petri dishes were prepared with an agar-broth mixture. Six different solutions, water, vinegar, 0.5 normal HCl, 1 normal HCl, pure lemon juice, and lemon juice diluted with an equal part of water, were prepared, and their pH measured. Pieces of chicken, each approximately 1 cubic centimeter, were placed in each liquid for two minutes. The chicken pieces were then removed, and each one rubbed over the surface of a Petri dish. Other pieces of chicken not dipped in any solution, were also rubbed against the surfaces of five Petri dishes, for comparison. The Petri dishes were then sealed. After four days, the lids were removed from the Petri dishes, and the percent of surface area covered in visible bacteria colonies was measured.

Results
There were no visible bacteria colonies on the surfaces of the Petri dishes rubbed with chicken dipped in 1 normal HCl, while the 0.5 normal HCl showed the next least amount of bacteria growth. The Petri dishes rubbed with chicken dipped in pure lemon juice had a larger amounts of bacteria than those rubbed with chicken dipped in diluted lemon juice and vinegar. The Petri dishes rubbed with chicken dipped in water grew the most bacteria out of the chicken dipped in any solution, while the Petri dishes rubbed with chicken not dipped in anything had the most bacteria.

Conclusions/Discussion
My conclusion is that stronger acids tend to inhibit bacteria#s growth, unless there is another affecting factor, such as the sugar in the lemon juice, which seems to have affected the speed at which the bacteria grew.

Summary Statement
This project is a study of the effect that different acidic solutions have on the growth of bacteria found on raw chicken.

Help Received
Mother sterilized materials in pressure cooker; Dr. Martina Michenfelder of UCSB supplied HCl.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kathleen M. Farrelly

Project Number
J1308

Project Title
What Is the Best Way to Clean Your Toothbrush?

Abstract

Objectives/Goals
My objective was to determine the best way to clean your toothbrush. My investigative question was whether or not washing your toothbrush in water would get rid of all the germs. My hypothesis was that the toothbrush cleaner would work better at cleaning a toothbrush and eliminating germs than plain water.

Methods/Materials
I had my family take turns spitting in a cup until there was about 1-½ inches of spit in the cup. I dipped 12 toothbrushes into the cup and let them sit in plastic bags for 2 days. I divided the toothbrushes into four groups: control group (doing nothing), water group (rinsing the toothbrush in hot tap water for 10 seconds), Aqua Blast group (soaking a toothbrush in Aqua Blast for 10 minutes) and dishwasher group (placing toothbrush in top rack of dishwasher using Cascade soap). I pressed each toothbrush into a petri dish with nutrient agar solution. I repeated the experiment 2 more times. My Dad supervised me during the experiment and I wore protective gloves.

Results
I took pictures of the petri dishes at 30 hours and 75 hours. Using a scale of 1 to 10, I rated the amount of bacteria where 1 had no bacteria and 10 had a lot of bacteria. I completed tables and charts and computed the average amount of bacteria for each group. By assigning numerical values, I was able to determine which method worked best at cleaning a toothbrush and eliminating germs.

Conclusions/Discussion
The Aqua Blast did work better at cleaning a toothbrush and eliminating germs than plain water; however, I was surprised that the dishwasher method worked best. I was also surprised that rinsing your toothbrush off with water was not much better than doing nothing at all to your toothbrush after brushing. Most people simply rinse their toothbrushes off with water; I think they would change their habits if they saw the results of my experiment. I concluded that the dishwasher method was best, was more cost effective and may be safer for you and the environment.

Summary Statement
My project was to determine the best way to clean your toothbrush.

Help Received
My Father was my designated supervisor while I did the experiment. My Father ordered the petri dishes and nutrient agar solution for me from the Internet. My Father took pictures of the petri dishes for me. My Father disposed of the petri dishes when the experiment was over.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Christine Goetsch; Caroline Logan

Project Number
J1309

Project Title
How Much Bacteria Is on Your Retainer?

Abstract

Objectives/Goals
The goal of our science project was to see if time and brushing effected the amount of bacteria growth on retainers.

Methods/Materials
First we gathered ten test subjects that were willing to be a part of our experiment. Then, we gave them directions as to what to do. Following that, we took samples of the bacteria colonies from each of their retainers. Thus, with the help of the Sansum laboratory and Dr. Jane we were able to incubate the bacteria colonies.

Results
After spending many hours in the laboratory counting bacteria samples, we came to realize, the longer the retainer is in ones mouth without being brushed, the more bacteria is present. We found this by incubating the bacteria and then counting each colony that appeared on the petri dishes. We noticed that the students who wore their retainers for 4 hours had less bacteria than the people who wore their retainers for 16 hours. Furthermore, the people that did not brush their teeth had more bacteria then the people who did brush their teeth.

Conclusions/Discussion
We came to the conclusion that time and brushing do effect the amount of bacteria growth on retainers. The longer the retainer is in ones mouth without being brushed the more bacteria will be produced. This is because bacteria feeds of plaque and one develops plaque when they do not brush their teeth.

Summary Statement
It was about the effects that time and brushing had on the amount of bactiera present on ones retainer.

Help Received
We used the Sansom Laboratory with the help of Dr. Jane

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Carolyn Goldenberg

Project Number
J1310

Project Title
Is Garlic Antibacterial?

Abstract

Objectives/Goals

The purpose of this project was to see if fresh garlic, garlic powder, and Kyolic, aged garlic extract are antibacterial. First the fresh garlic was crushed and mixed with 20 milliliters of water and that was used as the 1X dilution. From there, 1/4X and 1/16X serial dilutions were made. For the garlic powder one teaspoon was put in 20 milliliters of water, and again, 1X, 1/4X and 1/16X serial dilutions were tested. For the Kyolic the serial dilutions were taken straight from the extract. All were plated with E. coli bacteria. This was done for four different trials. The data was graphed and recorded.

All the dilutions of fresh garlic killed a large amount of bacteria. The 1X stock killed all the bacteria on the plates. The average number of bacteria that grew for fresh garlic in the 1/4X stock trials was 210 colonies, while the 1/16X stock grew an average of was 672.5 colonies.

Kyolic killed a very small amount of bacteria. The average number of bacteria that grew was 787.5. The average number of bacteria that grew for the 1/4X stock was 1050, and an average of 865 colonies grew in 1/16X stock. This can be compared to the control group, with no garlic product, which grew an average of 1185 colonies.

Although the garlic powder was tested it was uncountable because it produced bacteria on its own.

Summary Statement

Raw garlic, garlic powder, and a garlic supplement were tested to see if the effects on bacteria.

Help Received

Mother helped gather the materials, father helped with the idea, used lab equipment at Scripps Research Institute under supervision of Dr. Cravatt, Mrs. Brenda Joseph with my board, and my teachers Miss Reynolds and Miss Young for their instruction.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)

Karel Hage; Timothy N. Tran

Project Number

J1311

Project Title

Isolation of Staphylococcus aureus from Raw and Pasteurized Milk

Abstract

Objectives/Goals

Our objective was to determine if Staphylococcus aureus (S. aureus) could be isolated from raw and pasteurized milk. Our hypothesis was that the raw milk would contain Staphylococcus aureus whereas the pasteurized milk would not.

Methods/Materials

: First primary isolation of all milk samples was performed by inoculating thioglycolate broth with 1 ml of milk (raw or Pasteurized) and incubated. Next, secondary isolation was performed by inoculating mannitol salt agar (MSA) and columbia colistin-nalidixic acid agar (CAN) with inoculum from thioglycolate broth and incubate. Finally, tertiary isolation was performed by inoculating 5% Sheep blood agar (SBA) with suspected colony from MSA or CAN and incubated. All samples were incubated at 37 deg. C for 24 hours aerobically.

We then Gram-stained to determine whether the subcultured bacteria were Gram-positive or Gram-negative.
Gram-positive cocci bacteria were found in the raw milk samples. Slide coagulase, Tube coagulase, and latex agglutination (BBL# Staphyloslide# Latex Test) tests were used to determine if the organism was S. aureus. API staph test strip was run to confirm these tests. Gram-positive rods were found in the pasteurized milk samples. API 50 CH test with API 50 CHB medium was used to identify the organism.

Results

· All brands of raw milk tested contained S. aureus. The S. aureus colonies were found to be resistant to penicillin, and one brand, Claravale Farms, was resistant to ampicillin.
· No S. aureus was found in the pasteurized milk samples.
· The pasteurized milk samples that were tested contained two different Bacillus species: Bacillus subtilis and Bacillus lichenformis which are environmental microbes.

Conclusions/Discussion

Through our research, we concluded that pasteurization of milk does not make it totally free from bacteria as both raw and pasteurized milk contained bacteria. Raw milk contained S. aureus, which causes food born illnesses.

Summary Statement

This study was carried out to investigate whether different brands of raw and pasteurized milk contained Staphylococcus aureus bacteria that are harmful to humans.

Help Received

Used lab and equipment at SJSU under supervision of Dr. Bill Murray, Professor of Biology at San Jose State University; Mentoring by SJSU undergraduates Miss Daphne Fong, Miss Vasu Rangaswamy, Miss Kathy Tran; Mynra Hage for backboard help.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Arman A. Hamamah

Project Number
J1312

Project Title
Do Different Dilutions of Disinfectants Affect the Development of Bacterial Resistance?

Abstract

Objectives/Goals
The purpose of my experiment is to determine if bacterial resistance (after repeated exposure to a disinfectant) depends on the concentration of the disinfectant. The independent variable is the different concentrations of the disinfectant (percentage). The dependent variable is bacterial inhibition (percentage). The hypothesis is that if the bacteria are exposed to less concentrations of the disinfectant, then more resistance develops.

Methods/Materials
Bacteria used were Staphylococcus Aureus E. Coli, and Gram positive Bacillus. Disinfectants used were Ammonium Chloride, Sodium Hypochlorite, Hydrogen Chloride, and Pine Oil. For each, 10,20,30, and 50% concentrations were prepared. Each bacterium was exposed to each disinfectant concentration. Resistant bacteria were re-exposed to the same solution 5 times. Zones of inhibition were measured each day. At the end, resistant bacteria were isolated, cultured and diluted. The degree of inhibition for each bacterium and each disinfectant concentration was calculated using viable cell count method. Resistance is measured by sequential change in the zones of inhibition and percent inhibition of the bacteria exposed to the specific disinfectant.

Results
Zones of inhibition showed resistance development for E.Coli and Staph. Aureus exposed to all concentrations of Sodium Hypochlorite, Hydrogen Chloride, and Pine Oil. Viable cell count method showed resistance developed for E. Coli exposed to Hydrogen Chloride and Pine Oil. My hypothesis was not supported, as resistance, when developed, did not depend on disinfectant concentration.

Conclusions/Discussion
Bacterial resistance can develop to disinfectants; however, it does not depend on disinfectant concentration.

Summary Statement
Different bacteria were repeatedly exposed to four different concentrations of several disinfectants, and bacterial resistance was measured by sequential changes in zones of inhibition and viable cell count method.

Help Received
Laboratory staff provided space, materials, and guided me with streaking techniques. My parents guided me and provided transportation throughout the experiment.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Michael P. Hartman

Project Number
J1313

Project Title
Which Ground Beef Has the Least Bacteria?

Abstract

Objectives/Goals
The objective was to determine whether freshly-ground or pre-packaged beef has the least bacteria. My hypothesis was that freshly-ground beef has less bacteria than pre-packaged ground beef.

Methods/Materials
Samples of freshly-ground beef and pre-packaged beef were purchased from three different stores. One-tenth of a gram of each sample was placed in Thio broth, from which serial dilutions were made. Samples from each dilution were inoculated onto two sets of blood and McConkey agars and incubated for 24 hours. Colonies were then counted.

Results
Colonies were counted for each set of cultures at each dilution and the absolute number of bacteria were calculated. Freshly-ground beef had less bacteria than pre-packaged beef. Surprisingly there was one brand of pre-packaged beef that had minimal growth on all plates tested. It was later discovered that this brand was irradiated prior to shipping.

Conclusions/Discussion
Freshly-ground beef had less bacteria than pre-packaged beef, unless the pre-packaged beef had been irradiated. Based upon my results, the FDA should require that all ground beef be irradiated, in order to minimize the number of cases of bacteria-related foodborne illness.

Summary Statement
Freshly-ground beef has less bacteria than pre-packaged beef, unless the pre-packaged beef has been irradiated.

Help Received
Mother proofread written report. Seton Hospital Micro lab staff instructed me on dilution and inoculation techniques, with use of lab and supplies.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Claudia Huizar

Project Number
J1314

Project Title
pH Tolerance of Microbes

Abstract

Objectives/Goals
I wanted to find out if pH level would effect the growth of microorganisms.How tolerant are microbes of an acid, neutral or base environment? I also wanted to know if the microbes i tested were equally tolerant of different enviroments.

Methods/Materials
Inoculating Agar Plates
1.Remove one of the applicator sticks from the package (don#t let the tip touch any surface).
2. Lift the top of the culture dish and remove some of the culture (about the size of a peppercorn) with the applicator stick.
3. Transfer the culture onto the surface of the pH 3 gar with a streak from top to bottom of the dish.
4. Repeat steps 2 and 3 with the other dishes of agars each with a different pH (use a fresh applicator stick).
5. Label dishes according to pH and microbe introduced to it.
6. Incubate B. brevis, B. coagulans, and S. cerevisiae at 37°C, and the other cultures at room temperature for 72hrs.

Results
With all my testing, I was able to prove and learn many things. First of all, before doing this project I was ignorant about many factors that cause the growth of many microbes. I proved that not all microbes are vulnerable to acidic or alkaline conditions. For example, certain microorganisms might grow best in an acidic environment others in an alkaline enviroments. Some of them might not have a certain pH at which they do best.

Conclusions/Discussion
My hypothesis was incorrect since not all microbes did bad in an acidic condition. Every microorganism has a pH value, which is a certain environment they can no longer grow in. Bacillus brevis grew best under the pH of seven, nine and 11. Bacillus coagulans grew best under the pH level of three, five, and seven. Micrococcus luteus grew best under the pH of seven, nine and eleven. Penicillium chrysogenum grew in every type of environment. Pseudomonas fluorescens grew best in every condition on the first and second test except the pH level of three. Saccharomyces cerevisiae grew in every ph level I tested. Bacteria are more sensitive to an environment change than a fungi is.

Summary Statement
I used different pH levels to test the growth of many microorganisms.

Help Received
My teacher, Brent Susman ordered some of the materials in order for me to complete my project such as the cultures.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Scott L. Karney-Grobe

Project Number
J1315

Project Title
Meat That's Raw: How Do You Thaw?

Abstract

Objectives/Goals
Which method of defrosting meat is safest & which method of cooking kills the most bacteria?

Methods/Materials
10ml graduated cylinder,100 disposable 1ml pipettes,Digital scale(g),100 disposable 20ml test tubes,1gal distilled water,Styrofoam chest,2 100ºC thermometers,15w bulb,blender,40 tryptic-soy agar plates,60 disposable inoculating loops,6 saran cutting sheets,aluminum foil,plastic wrap,850w microwave oven,standard oven,stereo microscope,2lbs(each) boneless,skinless beef,chicken,pork
Test 1-Thawing Meat at room temp & in fridge. A.Cut,measure,& weigh 13 pieces of each meat(avg-4.5cmX5.3cmX2.3cm)(avg-68g); B.Puree 1 piece of each meat(controls) in blender,dilute(9-11 times) & plate samples; C.Incubate samples-60 hrs at 40°C.Divide plate into 4 quadrants,count CFU in 1 quad & mult by 4 to get total CFU/ml; D.Wrap remaining meats in plastic wrap & foil,freeze for 14 days; E.Thaw ½ of samples at 22°C on counter until meats reach internal temp of 22°C; F.Thaw remaining meats in fridge until soft.Bring to internal temp of 22°C on counter(10 min); G.measure bacteria count(step C).
Test 2-Cooking Meat in Microwave: A.take 2 samples of each meat thawed on counter & in fridge & cook in microwave until internal temp of 72°C-beef,77°C-pork,85°C-chicken; B.measure bacteria count of cooked meats(Test 1 step C).
Test 3-Cooking Meat in Standard Oven: A.Repeat A & B above using oven heated to 190°C.Beef-20 min.Chicken-15 min.Pork-17 min.

Results
Test 1:meats thawed on counter had much more CFU than those in fridge.Order of CFU/ml for meats(all tests):beef>pork>chicken.Meat thawed in fridge had comparable bacteria counts to controls
Test 2:Thawing method had no effect on CFU in cooked meats.All meats had less than 400 CFU.
Test 3:Meats thawed on counter were not safe to eat after cooking.All had CFU/ml>400.Oven cooking resulted in meat sitting in bloody juices released during baking.Meats thawed in fridge were safe to eat.Microwave cooking seemed to cook meats more uniformly in less time & no juices formed

Conclusions/Discussion
safest method of defrosting meat is refrigerator because meats aren't exposed to air that has bacteria & warmer temps.Method of cooking meat that kills most bacteria is microwave because it penetrates meat faster in less time.My hypothesis was half correct in that defrosting meats in refrigerator is safer than on counter.I was wrong about oven killing more bacteria than microwave.

Summary Statement
Determining which method of defrosting meat allows the least bacteria to grow and which method of cooking kills the most bacteria.

Help Received
Mom helped with some parts of testing, Dad helped with board and building incubator, Wayne Valley High School donated testing supplies

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kelly C. Kean

Project Number
J1316

Project Title
Yeast Past Its Code Date: Has It Really Expired?

Abstract

Objectives/Goals
The goal of this experiment was to find out if yeast, past its code date, was still viable. Live yeast digest sugars and produce carbon dioxide as a byproduct.

Methods/Materials
In this experiment, samples of 3.5 grams of yeast with 70 grams of sugar and 240 mL of 40° C water were mixed well in a #Ziploc# bag. The air was pushed out of the bag to accurately measure the carbon dioxide produced. The start times were recorded. The bag was sealed, set in a 24° C environment, and then timed until the bag popped open. The procedures were repeated with four samples from each code date. For the second experiment, a graduated cylinder was filled with water in a large bowl and flexible tubing was placed inside. One gram of yeast was mixed with 2.5 grams of sugar in a vortex tube. 15 mL of 40° C water was added. The water level displaced by gas was recorded after two, three, and four hours after the start time.

Results
The control samples, code dated 10/17/05, had an average time of 2 hours and 27 minutes until the bags burst. The yeast samples with a code date of 10/16/ 2002 burst after an average time of 3 hours 43 minutes. The yeast samples that displayed a code date of 6/13/99 had an average popping time of 3 hours and 54 minutes. The 1/11/97 yeast samples had an average bursting time of 4 hours, 46 minutes. The oldest samples, with a code date of 8/24/96, popped the bag in an average of 9 hours 24 minutes. For the second experiment, surprisingly, within the four hour trials the yeast produced gas, the two code dates tested, 10/16/02 and 10/17/04, did not show much difference in gas production.

Conclusions/Discussion
There was a definite correlation between the code date and the amount of time it took the bags to pop. Yeast past its code date still contained viable yeast cells, but the living yeast cells were fewer in number. The gas production rate for the control samples showed the most consistency between samples. Yeast companies probably mark a code date, because even though all of the yeast cells die at different times, before this date enough yeast will be alive to guarantee the yeast dough will rise in a predictable, reasonably short amount of time. For the second experiment, repetitions of the two samples tested (10/16/02 and 10/17/04) did not show much of a difference in their water displacement.

Summary Statement
This experiment was designed to test if yeast packets code dated 1996, 1997, 1999 and 2002 still contain viable yeast cells.

Help Received
My mother supervised my experiment with at home. My science teacher lent me her scale, old yeast samples, and other tools needed for the projects.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Rhea-Lanee L. Lansang

Project Number
J1317

Project Title
Fungus Among Us

Abstract

Objectives/Goals
ABSTRACT

My project, Fungus Among Us, deals with a unique kind of fungus, Arthrobotrys conoides. In this project I also used Rhabditis nematodes. I wanted to see what the preferential feeding temperature for Arthrobotrys conoides to eat the Rhabditis nematodes.

In my project, I had a Petri dish of A.conoides and a tube culture of Rhabditis. I made 20 agar dishes using cornmeal agar. With a scalpel I inverted a cubic centimeter piece of the fungus (the fungus was still with the agar) onto the new agar dish. I then let the fungus grow for about three days in the new dish. Then I inoculated the fungus with Rhabditis nematodes. I divided my dishes, four per each temperature. After finishing my dishes, I put them in five different places with five different temperatures. I used two incubators, on refrigerator and a classroom. I used five different temperatures, 100C, 150C, 170C, 200C, and 250C. Soon after pitting the dishes away, I observed each dish under a microscope. I divided them into four quadrants. I also looked at each dish from four different angles. Then I recorded how many nematodes I found alive and how many cuticles I found.

My hypothesis was that 250C was the temperature in which more nematodes would be consumes. I thought that because if you convert all the temperature that I used, they are 500F and above. 250C to me was closest to an outside temperature. I thought that since most fungus such as mushrooms, grow outside, then maybe the fungus would be more active and grow more thus leading to more nematodes being consumed.

After about 80 tests, my hypothesis was correct. 250C was the temperature in which the most nematodes were consumed. After 250C, came 170C, 150C then 200C. I was surprised that 200C had the least amount of nematodes because it was the second highest temperature.

Summary Statement
I wanted to see what the preferential feeding temperature was for Arthrobotrys conoides.

Help Received
Mr. Brent Susman

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Celeste M. Lindsay

Project Number
J1318

Project Title
Toning Up, or Being Contaminated? The Mystery Behind Bacteria Levels in Gym Equipment

Abstract

Objectives/Goals
I am testing the bacteria level in gym equipment.

Methods/Materials
30 Hach Paddle Testers (20 Bacteria and 10 Mold); Thermometer; Bleach; One low watt light bulb; Masking Tape; Duck Tape; One large cardboard box; Saran Wrap.

(for testing gym equipment): 1.Gather all materials. 2.Remove Paddle Tester from vial. 3.Press one side of the paddle to a piece of equipment. 4.Turn the paddle over and repeat. 5.Incubate the paddle tester. 6. Wait 24-48 hours and then record data. 7. Pour bleach into vial and let sit for 1 hour to clean and then dispose.

(for making incubator): 1. Gather all materials. 2. String light bulb so that heat reaches inside of box. 3. cut a square opening in the side of the box and cover it with Saran Wrap taped around the edges. This is for viewing bacteria. 4. Put thermometer inside of incubator and turn on.

Results
For my science fair project, I tested bacteria in gym equipment. My results were very shocking. For my first round of bacteria testing, the Free Runner had the most bacteria at about 8 colonies and then the Chest Press had about 6 colonies. The step mill had 3 and the leg press and cross trainer both had 1 colony. For my second round of bacteria testing, the cross trainer had the most bacteria at 15 colonies. The step mill had the least at 2 colonies. For my third round of bacteria testing, the leg press had the most at 15 and the chest press had the least at 1 colony. For my fourth round of bacteria testing, the most was the Free Runner with 21 colonies and the least was the Chest Press with 2 colonies. For my first round of mold testing, the Chest Press had the most amount of bacteria at 41 colonies and the rest of the equipment only had one colony.

Conclusions/Discussion
My hypothesis was not proved correct by my testing. The chest press seemed to be tied with the cross trainer for most bacteria content. Although, I was surprised that all of my equipment tested registered and was even. Some problems I overcame while testing included too much light, not enough time, and frequent times of abandonment. I think my project will help further the amount of knowledge that an average person has about the bacteria in a workout environment.

Summary Statement
I am testing bacteria in gym equipment.

Help Received
Mother helped gather samples.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Erin L. Lowry

Project Number
J1319

Project Title
A Study of the Effects of Green Tea on Oral Bacteria

Abstract

Objectives/Goals
My project was to determine if green tea inbibits the growth of oral bacteria.

Methods/Materials
Two procedures involving five test subjects were performed to determine if green tea inhibits the growth of oral bacteria. Each procedure consisted of three trials for each test subject. For procedure #1, saliva was collected from each test subject and then mixed in tubes containing melted nutrient agar. Each tube was labeled with the test subject#s initials and trial number. The agar was poured into labeled petri dishes and allowed to solidify. Green test disks were dipped in green tea extracts and placed on the saliva inoculated nutrient agar. For the control, blue test disks were dipped in distilled water and placed on the agar away from the green tea test disks. The petri dishes were placed in an incubator and checked for growth and inhibition of growth around the test disks at 24, 48, and 72 hours. For procedure #2, 5 petri dishes containing plain nutrient agar and 5 petri dishes containing nutrient agar mixed with green tea were prepared for each test subject. Sterile tongue depressors were placed in the test subjects# mouths and then placed gently on each of the fields of nutrient agar. Inhibition of growth was then compared between the dishes with plain agar and the dishes containing nutrient agar mixed with green tea. Each petri dish was given a score of 0-5 based on the number of bacterial colonies formed on the agar in the area where the tongue depressor was placed. A score of 0 meant no colonies were formed, a score of 1 meant 1-5 colonies, a score of 2 meant 6-10 colonies, a score of 3 meant 11-15 colonies, a score of 4 meant 16-20 colonies, and a score of 5 meant too many colonies to count.

Results
My results for procedure #1 were that green tea did not inhibit the growth of oral bacteria, but in some cases increased the growth of oral bacteria. In procedure #2, green tea did inhibit the growth of oral bacteria. The agar without tea had more bacterial growth in the areas inoculated with saliva than the agar with tea.

Conclusions/Discussion
I am unable to determine if green tea inhibits the growth of oral bacteria. The results of my two procedures were inconsistent. The first procedure failed to show inhibition of growth of oral bacteria with green tea while the second procedure did show inhibition of growth of oral bacteria, therefore my results are inconclusive.

Summary Statement
My project was a study of the effects of green tea on oral bacteria.

Help Received
My mother helped type the reports and dispose of materials. My father helped build the incubator and the board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Anirudh G. Madabhushi

Project Number
J1320

Project Title
Do Bacteria Like Gasses?

Abstract

Objectives/Goals
The objective of this project was to determine whether aerobic bacterial growth is influenced by various gaseous environments. I believe that aerobic bacteria will grow the best under an oxygen environment.

Methods/Materials
4 sheep blood agar plates inoculated with a culture of bacteria (Staphylococcus epidermis) were used in this experiment. Each of these plates were then placed in a Mylar resealable bag and filled with a different gas. The gases used in this experiment were carbon dioxide (CO2), nitrous oxide (N2O),oxygen (O2), and ordinary air (control group). These bags were then placed in an incubator for 24 hours.I performed three trials.

Results
On an average, the plate placed in the bag with oxygen had the most number of bacterial colonies, while the plate in the carbon dioxide bag had the least number. The colonies in O2 plate were bigger in size(about 2X the CO2). However, the colonies in N2O were bigger than those in O2(about 2.5X the CO2)even though their number were less.

Conclusions/Discussion
My conclusion is that various gases do indeed have an influence on the growth of aerobic bacteria and aerobic bacteria grow the best under oxygen. However the disparity in size between 02 and N2O needs to be further studied.

Summary Statement
My project is about the influence of various gases on the growth of aerobic bacteria.

Help Received
I used equipment of Monte Vista Lab under supervision of Mr. Jeff Cordill. Dad helped me fill the gases at Hemet Hospital Operating room and took me to lab. Mom helped me prepare journal.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Caitlin R.S. Merrill

Project Number
J1321

Project Title
Temperature Tincture: The Effects of Temperature on Bacterial Pigmentation

Abstract

Objectives/Goals
I really enjoyed my project this year. In my project, I tested how temperature affected the pigmentation of four different bacteria. From my research, I knew that the bacterium Serratia marcescens alters its color at different temperatures, and I wanted to explore this. I also wanted to see if this applied to other pigmented bacteria.

Methods/Materials
My project consisted of qualitative tests. First, I gathered my types of bacteria. I used Serratia marcescens, Rhodospirillum rubrum, Micrococcus luteus, and Sarcina aurantiaca. Next, I made agar from a powder. I then sterilized it and poured it into plates. After that, I made nutrient broth for the bacteria to grow in. I also sterilized this. I then inoculated the broth with the bacteria and let it grow for a few days. Next, I began my first set of tests. Using a pipette, I put each of the four bacteria onto two different plates. I then spread the bacteria with a bent glass tube. I let these incubate for two days and then observed them. I recorded the colors and drew images of the plates. I repeated this process eight times, doing tests at 25, 28, 31, 34, 35, 36, 37, 40, and 43 degrees Celsius.

Results
Analyzing my results, it appears that Serratia marcescens is a pretty special bacterium. All the other pigmented bacteria I tested held the same coloration, whereas Serratia marcescens lost its red pigmentation at 37 degrees Celsius.

Conclusions/Discussion
The pigment in Serratia marcescens is called prodigiosin. Once the growth temperature of Serratia marcescens is raised to 37 degrees, the pigment stops being produced. It is believed that an enzyme used in the production of prodigiosin is affected by the temperature so that the pigment is no longer made. As you can see, my project came up with some pretty interesting results.

Summary Statement
I tested how temperature affects the pigmentation of Serratia marcescens, Rhodospirillum rubrum, Sarcina aurantiaca, and Micrococcus luteus.

Help Received
I used the lab equipment of Ocean View Junior High School under the supervision of Mr. Brent Susman.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kelli M. Muirheid

Project Number
J1322

Project Title
Does the Surface Clarity of Plastic Bottles Affect Solar Water Disinfection as Measured by the Presence of E. coli?

Abstract

Objectives/Goals
Solar water disinfection (SODIS) is a method for improving the safety of drinking water in third world countries. 2-liter clear plastic bottles are filled with available water and then placed horizontally in the sun for six hours. Bacteria such as e coli are destroyed due to a combination of heat and UV rays. In actual application, bottles are reused multiple times. My objective is to determine whether SODIS is still successful if the recommended 'clear' bottles are scratched and more opaque in appearance.

Methods/Materials
Nine 2-liter soda bottles were scratched to three levels of opaqueness. Six bottles were left unscratched (3 were controls). An equal amount and concentration of e coli was added to each bottle. The bottles were sealed and placed horizontally in the sun (the control were left in darkness). Samples from each bottle were inoculated onto agar plates, incubated at 37 degrees for 24 hours, and then compared to the controls.

Results
All levels of scratching (light, medium, and heavy) allowed for the presence of e coli after sun exposure, with the Level 3 (scratchiest bottles) having the highest average number of escherichia coli colonies. Only the clear bottles showed no evidence of e coli growth. The e coli growth was highest for the controls.

Conclusions/Discussion
There is a direct relationship between the scratchiness of the sun-exposed clear plastic bottles and the presence of e coli. Based on my results, only unscratched clear bottles should be used for SODIS. Further research could possibly reveal whether longer UV exposure might minimize the affects of the bottle opaqueness, especially for the lightly scratched bottles.

Summary Statement
My project tests one of the variables present when using the SODIS method to disinfect drinking water.

Help Received
I received both the needed supplies and helpful advice from Mr.K. at the Biology Laboratory at Fresno State University. My father helped with digital pictures and my mother helped in coordinating appointments.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Janna E. Nikkel

Project Number
J1323

Project Title
Staph Aureus: Resistant or Sensitive to H(2)O(2)?

Abstract

Objectives/Goals
The objective of this project was to observe if 3% hydrogen peroxide could kill the bacteria, staphylococcus aureus.

Methods/Materials
A brief procedure of the experiment is as follows:
Control - Mixed a .5 suspension of staphylococcus aureus and normal saline. Used a calibrated loop to spread the bacteria onto a blood agar plate, and incubated it for 24 hours. Next, mixed a 1:1 dilution of the .5 suspension of staphylococcus aureus and 3% hydrogen peroxide. Used a new calibrated loop to spread the bacteria onto a blood agar plate and incubated it for 24 hours. Repeated the test one more time. Collected the results for each test by observing the growth of the bacteria on the blood agar plates and counting the colonies. Calculated and recorded the results of the two trials. Repeated the above procedure for the serial dilutions of staphylococcus aureus and 3% hydrogen peroxide of 1:2, 1:4, 1:8, 1:16, 1:32, 1:64, 1:128, 1:256, and 1:512. Each time the experiment was done the amount of hydrogen peroxide was doubled, although the amount of staphylococcus aureus stayed the same. All these dilutions were tested two times for a total of 22 tests.

Results
The results do support my hypothesis that 3%hydrogen peroxide does kill staph aureus. The control and the dilutions of 1:1 to 1:64, the colonies were too numerous to count. Dilution 1:128, the average colony count was 62.5. Dilution 1:256, the average colony count was 30. Dilution 1:512, the average colony count was 1.5.

Conclusions/Discussion
Initially, the staph aureus was protected by the enzyme catalase produced by the staph aureus bacteria. It broke down the 3% hydrogen peroxide into water and oxygen, which is nontoxic to the staph. Eventually, with the higher dilution of 3% hydrogen peroxide there was not enough catalase produced to break it down. The 3% hydrogen peroxide is a reactive oxygen species, which kills the staph aureus bacteria by destroying its cell structure.

Since staph aureus seems to become resistant to antibiotics perhaps more studies should be done on the use of hydrogen peroxide as an alternative. However, it did take a high dilution of the hydrogen peroxide to kill the bacteria.

Summary Statement
I observed the effects of 3% hydrogen peroxide on the bacteria, staphylococcus aureus.

Help Received
Used Memorial Hospital lab under supervision of Tracy and Steve Langenfeld. Mom cut paper for board. Dr. Szick-Miranda helped understand conclusion.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Se Hi Park

Project Number
J1324

Project Title
Kimchi, Spicy Korean Culture: So Hot, but Healthy

Abstract

Objectives/Goals
For my science fair project, I experimented to determine how the growth of lactic acid bacteria is affected by salt, pepper, and time of fermentation in Korean traditional dish, Kimchi. Afterwards, I also took a survey to find out under what kind of condition this food is most popular.
I hypothesized that the salt would decrease the bacteria, and pepper and time would act as incentive to motivate them. For people#s preferences, I hypothesized that they will prefer Kimchi with standard amount of salt (17g), pepper (19g), and time of fermentation (5 days).

Methods/Materials
I made ten dishes of Kimchi varying either the amount of salt, amount of pepper, or the time of fermentation. Then I measured the number of the lactic acid bacteria in each sample by diluting it with the LB media, spreading on a petri dish, and reserving in a 37 Celsius incubator overnight. At the end, I surveyed ten Korean adults to see which Kimchi people preferred the most.

Results
Salt did decrease the bacteria, pepper and time increased the growth, and the Kimchi with normal amount of salt, pepper, and fermentation time were most favored.

Conclusions/Discussion
The data of my experiment confirmed my hypotheses. It also proved that the growth of lactic acid bacteria is affected by the amount of salt, pepper, and the time of fermentation. It further verified that the optimum condition for Kimchi fermentation is predictable.

Summary Statement
My project was to determine how the growth of lactic acid bacteria in Kimchi is affected by the amount of salt, pepper, and time.

Help Received
I used lab equipment at the University of California Los Angeles under the supervision of Dr. Henian Wang.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Justin J. Persky

Project Number
J1325

Project Title
Demolishing Dental Bacteria

Abstract

Objectives/Goals
The objective is to determine which type of dental hygiene (manual tooth brush, rotary tooth brush, mouthwash, or dental floss) reduces the most number and variety of dental bacteria.

Methods/Materials
After each dental hygiene method, I obtained a dental bacterial sample by scraping my front teeth with a sterile needle. It was then swabbed on a petri dish and incubated for 48 hours. Finally, the surface area of bacterial growth was measured for each dental hygiene method. A gram stained slide was made from each dental hygiene petri dish. These slides were microscopically examined using a 40x oil immersion lens.

Results
Rotary tooth brushing decreased the most surface area of dental bacteria from a control of 664 mm^2 to 11 mm^2/ 4 trials. Mouthwash decreased the surface area of dental bacteria to 24 mm^2/ 4 trials and manual tooth brushing decreased the surface area of dental bacteria to 27 mm^2/ 4 trials. Dental floss decreased the least surface area of dental bacteria to 120 mm^2/ 4 trials. Manual and rotary tooth brushing decreased the variety of dental bacteria to only gram-positive cocci. Mouthwash and dental floss decreased the variety of dental bacteria to gram-positive cocci, gram-negative cocci, and gram-positive/negative bacilli.

Conclusions/Discussion
My conclusion is that rotary tooth brushing is the most effective in decreasing the number and variety of dental bacteria. Mouthwash and manual tooth brushing were intermediate in decreasing the number of dental bacteria. Dental floss was the least effective in decreasing the number and variety of dental bactera.

Summary Statement
My project is about dental bacteria and which dental hygiene method reduces the most bacteria on my teeth.

Help Received
Grandmother taught me to use a microscope.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Jessica K. Ruane

Project Number
J1326

Project Title
Can I Eat That?

Abstract

Objectives/Goals
The purpose of my research was to see if there are foods that are potentially dangerous to neutropenic patients that are not listed on the food guides they are given by their doctors. I was most interested in the foods routinely consumed by teenagers that had been opened and used by multiple users. These foods would be studied for the presence of bacteria.

Methods/Materials
Potentially harmful foods and test foods were studied. Using sterile technique I placed 1 ml of each food item into 10 ml of thioglycollate broth, incubated for 18 hours 35*C. then cultured .001 ml onto agar plates. The plates were incubated for 72 hours then observed for the presence of different colony types and the colony counts in colony forming units(CFU) were determined per ml of each food item.

Results
All potentially harmful foods grew up to four different bacteria with CFU ranging from 1,000,000 CFU to 3,500,000 CFU. Eleven of the thirteen test foods grew 1 to 3 different bacterial species ranging from 1,000,000 to 2,500,000 CFU.

Conclusions/Discussion
Both potentially harmful food and test foods grew high counts of bacteria. Growth of bacteria in test foods was related to (1)poor protection of the product during storage, (2)many entries into a product by many users, (3)the product being direct from nature and (4)nutrients present in the food that could support the growth of bacteria. Four recommendations were developed to guide teenagers undergoiing chemotherapy make safer food choices.

Summary Statement
I studied bacterial contamination in food items often consumed by teenagers to see if they would be safe to consume while neutropenic from chemotherapy.

Help Received
Used laboratory equipment at Cedars Sinai Medical Center with their supervision

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Lauren E. Ruh

Project Number
J1327

Project Title
Effects of Different External Factors in Changing the Effectiveness of Various Antibiotics

Abstract

Objectives/Goals
I wanted to see medications reaction to a household substance which was mixed with bacteria.

Methods/Materials
I used 5 different medications, Duricef, Zithromax, Augmentin, Omnicef and Cifzil. Then mixed it with 4 different things you would find in your kitchen, salt, coffee, soap, wine. Next I put the household substance medication mixture on a disk (hole punched coffee filter) then the disk was placed into a petri dish infested with bacillus substillus (bacteria) then I recorded for two days.

Results
Salt .9 Wine 1.108 Soap .97 Control 1.016 Coffee .95
Those are the average of each household objects mixed with 5 different medications and bacteria.

Conclusions/Discussion
After completing my project I have found that wine is best at preventing bacteria growing while mixed with a medication. This does not increase the effectiveness of the drug though! The least effective household substance was salt.

Summary Statement
I wanted to see what would happen to medication if it was mixed with household substances, then mixed with bacteria

Help Received
Mr. Whitington (teacher) provided materials, Mother helped type, Mr. Case (teacher) provided lab space, Dr. Cohen provided auto claving machine.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Kelsey L. Schuetz

Project Number
J1328

Project Title
There's a Germ Out There. Can You Tell Me Where?

Abstract

Objectives/Goals
Does the Kitchen, the Bedroom, the Bathroom or the Living Room harbor the most germs? If the Living Room harbors the most germs, is there a relationship between the amount of germs and the frequency of touch?

Methods/Materials
Materials: Shoebox, 7 petri dishes, Agar, sterile cotton swabs, Neosporin for control. Wipe samples from four rooms of the house were collected and observed during Phase I. Three wipe samples from areas in the room with the most germs were collected that receive a lot of touch (computer mouse, remote control, telephone) and three wipe samples from relatively untouched areas (window sill, and fan, and lamp shade) were collected using sterile cotton swabs. One control (neosporin) sample was collected. The wipe samples were grown in petri dishes and observed for eight days. Colonies, sizes, and types of bacteria and fungi were recorded in data tables.

Results
The areas that had a lesser frequency of touch grew more bacteria and fungi.

Conclusions/Discussion
The living room (the remote control) had the most germs in the Phase I sampling. Because the remote control had the most germs, I thought it was because it was touched a lot. However, in Phase II, the untouched areas grew the most bacteria and fungi. My conclusion is that areas that are not touched so often grew more microbes because they were not disturbed, while the areas that are touched might have grown less since they are cleaned every so often.

Summary Statement
My project is about which areas of the house have the most germs and if there is a relationship between the amout of germs and how frequently the areas are handled or touched.

Help Received
My mother helped cut out display title letters.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Barbara A. Shinaver

Project Number
J1329

Project Title
Effectiveness of Various Spices in Promoting or Inhibiting the Spoilage Rate of Food

Abstract

Objectives/Goals
The purpose of my science project was to determine which types of commonly available spices would inhibit the growth of bacteria in food, and could be used as food additives to help prevent spoilage.

Methods/Materials
I used five different types of spices, each added to three different types of foods. I choose Beach Nut Naturals baby foods as my test foods because they are foods that contain no added preservatives. For the spices I used: onion, garlic, salt, orange zest, and curry. For the foods, I used: Vegetables & Beef, Vegetables & Chicken, and Chicken.
I mixed one teaspoon of each spice with each different jar of food. My control consisted of an open jar of each food with no spices added. All jars stood at room temperature for 48 hours. I mixed down a dilution solution sample from each jar of food and swabbed it into an agar plate. After incubation, I counted the bacterial colonies in each plate to determine the relative bacterial growth from each sample.

Results
The results of my experiment showed that the garlic and salt were overall the best inhibitors of bacterial growth in food. Curry was consistently the highest promoter of food spoilage, causing the most bacterial growth in all of the different types of food.
In interpreting my data, I also learned an unexpected fact: the type of food to which the spice was added played as big a role in the outcome of food spoilage as the type of spice that was added to the food.

Conclusions/Discussion
Spices do have an effect on the spoilage rate of food. They can promote or inhibit the growth of bacteria depending upon the type of spice and the type of food to which it is added.

Summary Statement
I used diverse spices and added them to certain types of food to show that there are spices that can inhibit the spoilage rate of food.

Help Received
Used lab equipment from local high school. Parents helped me with sterilization with flame.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Justin A. Sotomayor

Project Number
J1330

Project Title
Ethyl Alcohol vs. E. coli

Abstract

Objectives/Goals
My objective is to determine if the amount of Ethyl Alcohol in soap will affect the amount of E. coli killed/removed when washing hands with the soap. My hypothesis is that the more Ethyl alcohol used when making soap, the more E. coli will be killed/removed.

Methods/Materials
To achieve my objective, I prepared three soaps, each containing 30ml Castor oil, 10ml 40% NaOH, and 100ml saturated NaCl with a different amount of Ethyl Alcohol:10ml,30ml,50ml. To test each soap I soaked my hand in E.coli suspencion then washed my hands with one soap. After washing, I blotted my hand on one sheep blood agar plate (commercially made). I repeated this process with the two other soaps and incubated all plates at 35°C for 24 hours.
I used antibacterial soap in between the process to avoid carry over of bacteria present.

Results
All plates had almost the same amount of E. coli growth. The average growth of E. coli for the 30ml soap was 1 colony, the 50ml soap was 1 colony, and the 10ml soap was 2 colonies.

Conclusions/Discussion
After several tests and observations I was able to determine that the amount of Ethyl alcohol in each soap did not affect the amount of E. coli killed/removed, proving my hypothesis incorrect.

Summary Statement
Will the amount of Ethyl alcohol in soap affect the amount of E. coli killed/removed when washing hands?

Help Received
Used laboratory equipment at Quest Diagnostics under the supervision of Julie Sotomayor, Microbiologist.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Neil D. Tennyson

Project Number
J1332

Project Title
Saving the World One Yard at a Time: How do Fertilizers Affect the Growth of Algae?

Abstract

Objectives/Goals
Fertilizer in runoff increases algae growth, and I want to determine which fertilizer will decrease the amount of algae growth in water. I believe a fast acting three-ingredient fertilizer will cause the most algae growth, and a time-release fertilizer will cause the least algae growth because a time-release fertilizer only lets off a small amount of nutrients at a time.

Methods/Materials
Three types of fertilizer were used: 14-14-14 time-release, 12-0-0 fast-release (one-ingredient), 15-30-15 fast-release (three-ingredient). A mixture of pond water and distilled water with a precise amount of fertilizer was added to twelve 1-pint glass jars. The jars were covered with cheesecloth and set in sunlight for 35 days. After 35 days the algae was scraped onto separate coffee filters, and weighed while wet with a gram weight scale.

Results
The one-ingredient fertilizer grew the most algae, 1.3 grams. The fast-acting three-ingredient fertilizer grew 1.2 grams. The time-release fertilizer resulted in the least amount of algae growth, .4 grams.

Conclusions/Discussion
The time-release fertilizer grew the least algae, as I hypothesized. I would recommend this fertilizer for gardening to reduce algae growth, but I would research in the future how well it helps plants grow. The one-ingredient fertilizer grew the most algae, and the fast acting three-ingredient fertilizer grew less algae, but only by .1 gram.

Summary Statement
Determine which fertilizer will grow the least algae in water.

Help Received
My father showed me how to do the calculations to equalize the fertilizer solutions. He assisted me by instructing me on how to use the programs Excel and Photoshop for my graphs and color intensities. My father also helped me glue the papers to my board.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Elena M. Tessler

Project Number
J1333

Project Title
A Bug's Life: The Effect of Alkalines and Acids on Bacterial Growth

Abstract

Objectives/Goals
The objective was to determine the effect of alkalines and acids on bacterial growth. I hypothesized that the strongest acid and the strongest base (the 10% concentrated solutions) would each inhibit bacterial growth the most.

Methods/Materials
Pure samples of Micrococcus luteus and Serratia marcesceus were obtained. 7 blood agar plates each were inoculated with the two types of bacteria. Then a 1%, 5%, and a 10% concentrated solution of the acid and the base each was created, and applied to 6 paper discs each. The paper discs were placed on the inoculated plates. The blood agar plates were then incubated, and the zone of inhibition around each paper disc was measured.

Results
Consistently in my testing, the strongest acid and the strongest base each inhibited bacterial growth more than the weaker concentrations of acid or base. Additionally, the 10% acid's zone of inhibition was usually slightly greater than that of the 10% base.

Conclusions/Discussion
My hypothesis was correct; the strongest acid and the strongest base proved more effective in the inhibition of bacterial growth. The bacteria in my experiment reacted this way possibly because they were sensitive to the increased level of H+ ions (as present in the acidic solutions), or the level of 0H- ions (as present in the basic solutions).

Overall, I believe my project was a success. I also believe my testing was relevant to real-life issues in the medical and scientific world. Scientists and medical experts are constantly trying to create the perfect antimicrobial agent to use when dealing with a certain bacteria. As each strain of bacteria is different, they each require a different agent. pH, acidity, and alkaline are important factors that must be taken into consideration when creating the perfect antimicrobial agent for a certain bacteria. Tests such as mine provide information on how a certain type of bacteria might react when introduced to an environment of extremely high or low pH, thus showing how strong acids and alkalines affect the bacteria's growth. This information can then be used to create the antibacterial agent.

Summary Statement
I determined the effect of alkalines and acids on bacterial growth by growing bacteria cultures and introducing them to strong acids and bases.

Help Received
Used lab equiptment at Pacific Union School under the supervision of Mr. Lane; Recieved guidance and supplies from pathologist Dr. Vogelsang of Mad River Hospital; Recieved pure bacteria specimens from biology teacher Mrs. Condit of Arcata High School.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Alex J. Thompson

Project Number
J1334

Project Title
Do Different Diets in Ruminant Animals Affect the Microorganism Colony Growth?

Abstract

Objectives/Goals
The purpose of this experiment is to find out if different diets of the ruminant species affect the growth of microorganisms.

Methods/Materials
Materials:
10 samples of steers on grain, steers on hay, goats on grain, and goats on hay,
40 test tubes with rubber corks, Incubator, nutrient agar plates, rubber gloves
Electronic gram scale, 40 250ML jars
Procedure:
1.Take all samples of manure. Remember the samples aren#t taken from one animal, but rather a pool of different animals from that diet and species.
2.Dilute the manures 1- 100 (manure to water).
3.Put 5 drops of the dilutions on the plates and spread it with the spreader.
4.Seal the plates with parafilm.
5.Put the plates in the incubator for 48 hours.
6.At the end of 48 hours take the plates out of the incubator and count the number of colonies growing on the plates by doting the colonies with a sharpie.

Results
The results show that the steers on grain ranked the highest in microorganism growth. The goats had the lowest counts and the goats on grain ranked the absolute lowest.

Conclusions/Discussion
In conclusion, the steers that were fed grain had more microorganisms growing than the other samples. The goats on grain had the least amount growing. This is surprisingly just what I expected. The steers have the largest digestive systems so it gives the manure more time to pick up any microorganisms. I also thought that the grain diets would have a higher count because there are more nutrients. On this I was partly correct. This was true for the steers, but not for the goats. This may have been because the ten samples I took from the goats on grain were young so they might not have had fully developed rumens. Therefore, this may be why the goats on grain had the lowest count.

Summary Statement
The purpose of this experiment is to find out if different diets of the ruminant species affect the growth of microorganisms.

Help Received
Dr. Jim Selgrath and Dr. Ralph Phillips on the correct methods for conducting experiment.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Joseph W. Valdez

Project Number
J1335

Project Title
Does Oregano Oil Have an Antibiotic Effect on the Bacillus cereus bacteria?

Abstract

Objectives/Goals
My research was to determine if Oregano oil works as an antibiotic on the Bacillus cereus bacteria because there are claims on the Internet that Oregano oil, through its primary ingredient carvacrol, is effective as an antibiotic on the majority of bacteria. However, my hypothesis is that Oregano oil does not have an antibiotic effect on the Bacillus cereus bacteria.

Methods/Materials
Following the Kirby-Bauer Disk Diffusion Method, I placed a filter paper disk soaked in Oregano oil (Carvacrol 6 mg), five other disks with known antibiotics (Chloramphenicol 30 mcg, Penicillin 10 mcg, Gentamycin 10 mcg, Ampicillin 10 mcg and Tetracycline 30 mcg) and a control disk in a petri dish with the Bacillus cereus culture in a nutrient agar solution. I covered the petri dish and let it stand at room temperature. I then measured any growth inhibition zones around these disks after 24, 48 and 72 hours.

Results
There was no growth inhibition zone around the disk with Oregano oil. However, growth inhibition zones were found around the following disks: Chloramphenicol (2.5 cm), Gentamycin (2.0 cm), and Tetracycline (1.0 cm). These zones appeared after 48 hours and remained the same size after 72 hours. The disks coated with Penicillin and Ampicillin did not have growth inhibition zones around them. Also, as expected, there was no growth inhibition zone around the control disk.

Conclusions/Discussion
My hypothesis is supported. Oregano oil does not have an antibiotic effect on the Bacillus cereus bacteria. We must, therefore, continue to be wary of any generalized and unsubstantiated claims of the effectiveness of any herbal product like Oregano oil because these claims are not subject to review and approval from the Food and Drug Administration. Self-medication by relying on these claims can have serious side effects in addition to the untreated original condition possibly worsening. In the future, I would like to research and test Oregano oil on other bacteria such as E. coli and Staphylococcus. I can also conclude that not all antibiotics are effective against the Bacillus cereus bacteria.

Summary Statement
My project was about researching and testing whether Oregano oil had an antibiotic effect on the Bacillus cereus bacteria.

Help Received
Mom surpervised my research and my handling of the bacteria culture. Dad helped me select the topic and type the report.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Hailey A. Wilder

Project Number
J1336

Project Title
Water: To Drink or Not To Drink, That Is the Question

Abstract

Objectives/Goals
My objective was to see if coliform, E. coli, and overall bacterial counts substantially increased in body contact versus non-body contact water sources.

Methods/Materials
Materials needed: Water samples, Tetrazolium salt pre-treated petri dishes, Test tubes, Eye droppers, Coliscan bottles, Total count bottles, Ice and ice chest, Towel, Labels for petri dishes and test tubes, Permanent marker, Oven disposal bag, Incubation area, Thermometer. Method used: Collect water samples. Store them wrapped in a towel on ice in ice chest. Using permanent marker and labels, label petri dishes with: name, date, water sample source, and medium type (TC 1, TC 2, TC 3, C 1, C 2, and C 3). Also label test tubes with same information as above. Determine the proper amount of inoculum. Using the dropper, measure the correct amount of water. After measuring the correct amount of water, open a bottle of total count (TC) and deposit the water into the bottle. Replace the cap and swirl gently. Remove the cap and pour into the correct pretreated petri dish. Repeat the steps above for the other tests including coliscan (C). Incubate for 24 hours at 35 degrees Celsius. Remove dishes from the incubated area and count all colonies on the total count dish, report results in terms of colonies per milliliter of water. Count all of the purple colonies on the coliscan dish, and report the results in terms of E. coli per milliliter of water. Count all of the red, pink, and purple colonies on the coliscan dish, and report the results in terms of coliform per milliliter of water.

Results
Of the body contact water sources, Lake Perris had the most total bacterial colonies overall, as well as the highest numbers of coliform and E. coli. The pond water showed large amounts of bacteria including coliform but no E. coli. Massacre Canyon Stream also showed high overall bacterial counts and coliform counts. E. coli was also present. The non-body contact Lake, Diamond Valley Lake, had very low bacterial and coliform counts and no E. coli. My control, tap water, had no bacteria present.

Conclusions/Discussion
My conclusion is that body contact water sources have more overall bacteria, more coliform and more E. coli bacteria than non-body contact water sources.

Summary Statement
My project is a comparison of bacterial levels in different body contact versus non-body contact water sources.

Help Received
Mother helped type report; Father took me to test sites; Action Construction donated test kit; Tyler Skrove recommended where to get the test kit.

CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
Corey J. Willis

Project Number
J1337

Project Title
Phylogenetic Comparison of Pacific Coast Marine Algae: Cystoseria osmundacea and Halidrys dioica

Abstract

Objectives/Goals
Phylogenetic taxonomies of different organisms derived from DNA sequence comparison of conserved genomic regions can be used to establish sensitive, quantitative relationships between different organisms. Taxonomic relationships between and among species have classically been established through morphologic and/or biologic studies.

Methods/Materials
Quantitative comparisons are difficult and the effects of environmental factors can create ambiguity. Techniques of molecular biology - DNA isolation, polymerase chain reaction, cloning, gene sequencing, and sequence analysis - were applied to the ribulose-1,5-bisphosphate carboxylase (rubisco) spacer region of the chloroplast DNA from Cystoseria osmundacea and Halidrys dicoica.

Results
The results from these analyses established the phylogenetic relationship between the two Pacific Coast marine algae, as well as among populations of C. osmundacea sampled from environmentally distinct locations (north and south of Pt. Conception, California). H. dicoica samples obtained from the same location showed no genetic variance, thereby serving as a control for the experimental techniques. The genetic variance between the H. dicoica samples and the various samples of C. osmundacea ranged from 0.8% to 1.3%. Genetic variances of 0.1% to 0.8% were observed between the various samples of C. osmundacea. However, no genetic variance was seen between samples of C. osmundacea obtained from locations north of Pt. Conception. These results were used to generate a phylogenetic map illustrating the evolutionary relationship of the rubisco gene of these Pacific marine algae.

Conclusions/Discussion
From these results, two conclusions can be reached: (1) H. dicoica and C. osmundacea, while being morphologically distinct, genetic analysis shows less than 1.3% variability these two species, and (2) environmental factors give rise to genetic variances in C. osmundacea.

Summary Statement
Molecular genetic analysis was used to establish the phylogenetic taxonomy of (1) two morphologically distinct species of Pacific Coast algae

Help Received
Graduate student and researcher, Julio Harvey for supervising my steps and teaching me about the project and methods Mrs. Baumgart for guiding me and spending large amounts of time sincerely trying to comprehend my project Department of Ecology and Evo