CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Rachel L. Abramson

Project Number

S1401

Project Title

Beach Closings: Is It the Kelp?

Abstract

Objectives/Goals

My purpose is to test a new theory that decaying kelp could be one of the sources of elevated fecal indicator bacteria that has caused Cowell Beach to be posted with swimming advisories. My goal is to determine if decayying seaweeds are indeed the cause of increased coliform levels measured at Cowell Beach and which species may be the culprit.

Methods/Materials

I collect samples of seaweed in sterile Whirl-Pac bags from Cowell Beach. Next i crush the seaweed in the bag, shortly thereafter I add 100ml of sterile water to each bag and incubate at room temperature for 24 hours. After 24 hours, I emply the Membrane Filtration Process filtering the samples through a filter, plating on media and incubating for 24 hours at 44.5 degrees C. I count and record number of fecal coliform colonies per 100ml of water.

Results

Coliform counts revieved from the kelp samples were sporadic and did not fallow any trend. They did not strongly correlate with the coliform counts from the ocean.

Conclusions/Discussion

Overall my results were not what I expected. Although I did find positive Fecal Coliform growth in kelp samples from Cowell beach, it did not highly correlate with the coliform levels in the water. I concluded that a factor determining coliform levels in the kelp is the amount of decay that has occurred, which is what catalyzes the bacteria growth. Spikes in bacteria growth can be attributed to external factors, such as increased storm run off from the storm drains. Although, my second experiment did provide a valid conclusion. From my tests I can conclude that the bacteria E.coli can successfully grow off of nutrients made up of only kelp and artificial sea water. This proves that kelp is a possible host for fecal coliform bacteria living in the ocean and on the shores.

Summary Statement

To examine kelp as a source for fecal coliform levels of my local beaches.

Help Received

Used lab equpment at University of Santa Cruz under the supervision of Dave Bernick

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Dhruv T. Amin

Project Number

S1402

Project Title

The Prevalence and Prevention of Methicillin-Resistant Staphylococcus aureus in High School Environments

Abstract

Objectives/Goals

The objective of this experiment was two fold: to find the prevalence of Staphylococcus aureus and Methicillin-resistant Staphylococcus aureus (MRSA) in high school settings, and to test the ability of Clorox Disinfecting Wipes (CDW) to kill these bacteria.

Methods/Materials

The prevalence was tested by sampling each area with a selective and differential medium, Mannitol Salt Agar (MSA), to find colonies of Staphylococcus aureus. Then, colonies were counted and transferred onto another medium, MSA with Oxacillin, and processed to assess the presumptive prevalence of Methicillin-resistant Staphylococcus aureus. After wiping the same surfaces with Clorox Disinfecting Wipes, samples were taken again and processed.

Results

In all four high school environments tested, Staphylococcus aureus was present and MRSA was presumptively present. The two locker rooms had a mean number of 72.55 Staphylococcus aureus colonies per plate and the two classrooms had a mean number of 10.15 Staphylococcus aureus colonies per plate. Out of 50 MSA with Oxacillin plates, 23 grew colonies presumptively positive for MRSA. The CDW were effective in killing the bacteria in all but one case.

Conclusions/Discussion

Methicillin-resistant Staphylococcus aureus (MRSA) is an emerging illness that affects healthy individuals and may have devastating consequences, including death. Staphylococcus aureus was present and MRSA was presumptively present in the various high school environments tested. The experiment proved that Clorox Disinfecting Wipes would be effective in controlling MRSA in high school settings.

Summary Statement

My project is about the prevalence and prevention of Methicillin-resistant Staphylococcus aureus in high school environments.

Help Received

I obtained lab materials and used lab equipment at the Clorox Technical Center in Pleasanton under the supervision of Dr. Ellen Jones.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Joseph P. Antonios

Project Number

S1403

Project Title

A Study of the Effects of Variable Gravitational Environments on Genetic Transformation in E. coli

Abstract

Objectives/Goals

This scientific experiment sought to measure the effects of microgravity (zero gravity) on bacterial genetic transformation in comparison with those of normal gravity through the use of the pGLO plasmid, which provides for both the increased resistance to antibiotics and the ability to luminesce under ultraviolet light.

Methods/Materials

Of the plates prepared, one-third were used in a control situation; as such, they were exposed to a constant gravitational environment and hindered from the uptake of the pGLO gene. The remaining two-thirds were introduced to the pGLO gene under variable conditions: one-third was kept in normal gravity (as in the control situation) and the final four plates were placed in the clinostat.

Results

In addition to a general increase to the amount of colonies present, those in the clinostat exhibited the greatest percentage of transformed colonies. They also expressed the pGLO gene earlier than the plates that were growing at normal gravity.

Conclusions/Discussion

It can be clearly stated that E. coli grown in a microgravity environment exhibits the greatest adeptness at genetic transformation in that it is able to express the gene at a greater rate efficiency.Combining bacterial replication, genetic recombination, and the use of microgravity conditions may be the key to processing medicines more effectively. The first would ensure quantity (production), the second, efficiency, and the third, speed.

Summary Statement

This experiment examined bacterial genetic transformation in simulated microgravity environments in order to find a way to produce organic medicines, such as insulin and interferon, more efficiently.

Help Received

School provided lab and most equipment; science teacher provided

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Oscar Y. Baterina, Jr.

Project Number

S1404

Project Title

Culturing Strains of Chlorella pyrenoidosa Increasingly Resistant to Copper Algaecide

Abstract

Objectives/Goals

This experiment was conducted in order to determine if stains of the freshwater algae, Chlorella pyrenoidosa, could be developed that were increasingly resistant to common copper algaecide toxicity.

Methods/Materials

After culturing stocks of algae with High Salt Media, Chlorella pyrenoidosa samples were exposed to a ten fold concentration, using the equation C1V1=C2V2, of copper algaecide to determine the LC50. Observing and recording the number of live cells of Chlorella pyrenoidosa at various concentrations of copper algaecide for 24 hours determined the LC50, which was confirmed to be 1.794 mg/L. Then, the survival rate of the algae was observed daily as the concentration of the algaecide was gradually increased over a 11 day period. Finally, the resulting acclimated strain of algae was exposed to high doses (over the expected limit of 2.99 mg/L) of copper algaecide to see if they were more resistant, compared to a strain not previously exposed to copper algaecide that was exposed to high doses of copper algaecide.

Results

From the data, it was determined that the acclimated strain of Chlorella pyrenoidosa is significantly more resistant to copper algaecide toxicity than the unexposed strain that was abruptly exposed to relative concentrations of copper algaecide.

Conclusions/Discussion

The copper algaecide concentration of 3.887 mg/L was the observed limit, in which Chlorella pyrenoidosa were not present, for the unexposed strain of Chlorella pyrenoidosa during the shocking treatments. According to the data, acclimated strains of the algae in the concentration of 3.887 mg/L survived significantly compared to unexposed strains of Chlorella pyrenoidosa. This experiment indicates that there were strains from the first generation of Chlorella pyrenoidosa that possessed the hereditary trait to survive the lethal concentrations of copper algaecide, making them increasingly resistant.

Summary Statement

Create a strain of green algae commonly found in swimming pools resistant to a lethal dose of a copper-based product used to terminate their existance and compare it to an unexposed strain that was abruptly exposed with the same chemical.

Help Received

Used lab equipment at Mount Miguel High School science department under the supervision of the Biochemistry Advisor Mr. Todd Linke

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Sudarshan Bhat

Project Number

S1405

Project Title

An Analysis of the Movement of E. coli through Spinach

Abstract

Objectives/Goals

The U.S. Food and Drug Administration (FDA) reported an outbreak of E. coli O157:H7 in spinach plants in September of 2006. Two hundred and five illnesses and three deaths were linked to this incident. This project was designed to find out if and how much bacteria could make it to the leaves of a spinach plant during different periods of the plants growth cycle using bottom watering. I hypothesized the Escherichia coli would spread faster in the plants that are exposed later to the contaminated water than the plants exposed earlier in their growth cycles.

Methods/Materials

Five groups of plants were grown whose ages varied from one week to five weeks. These plants were then contaminated with E. coli through bottom watering. The amount of bacteria on the leaves was measured by blotting each leaf. The amount of bacteria on the surfaces of the leaves was determined by making an extract by using a mortar and pestle and growing the liquid in Agar. Grown on nutrient agar, the colonies were counted to obtain the raw data. ANOVA was used to see if the differences in the amounts of bacterial growth were statistically significant.

Results

The data collected from the extracts showed that the oldest plant had an average of 18 colonies, while the youngest had just one. Overall, the amount of bacteria found in the leaf increases as the plant got older. However, during the second week, the amount of bacteria increased slightly probably due to an increased demand for nutrients because of the more rapid growth when compared to the plants that were one week and three weeks old. In addition, the higher leaves tended to have fewer bacteria than the lower leaves because of the way the nutrients are carried through the leaf. I also found that inferior sides of the leaves had higher levels of contamination then on superior sides. This suggests that the inferior sides of the leaves should be more thoroughly cleaned before consumption.

Conclusions/Discussion

I found that my hypothesis was correct other than the slight increase in bacterial concentration during the second week probably due to the rise in growth rate during this time period. Though visible data shows that the amount of contamination varies as the age changes, the analysis of variance showed that there was no significant difference between the age groups. So no matter when the spinach is contaminated, there is bad news for spinach-lovers around the globe.

Summary Statement

This project explores the changes in bacterial content in Spinach plants exposed to water contaminated with E. coli at different periods of the plant's growth cycle.

Help Received

I acknowledge my family for their support and the science teachers at Lynbrook High School for their help throughout the implementation of this project. I would especially like to thank my advisor, Mrs. Alonzo.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Chingiz Bigalimov

Project Number

S1406

Project Title

What Helps Fungi Grow?

Abstract

Objectives/Goals

If I add SuperThrive or Vitamin B1 or Auxin to an agar solution in which a fungus will be planted, then the fungus will grow faster.

Methods/Materials

Materials:
Balance
30 Petri dishes
Nutrient Agar (Micro Biology Grade)
A microscope
Digital Camera
Vortex
Pipettes
Microwave
10ml Test Tubes
100ml Beakers
Sterile loop
Bunsen burner
Ethyl Alcohol
Spread Plate

Results

After five days the most fungus growth appeared to be not on the SuperThrive Petri dishes but on those of the Nutrient Agar. The Super Control groups, just like the Vitamin B1, Auxin and the Control group have shown no fungus growth. SuperThrive, however, has shown tiny growth of fungus with just 4 tiny colonies per 5 Petri dishes in comparison to Nutrient Agar group which had shown itself as great media for fungus with about 90 large colonies per dish.

Conclusions/Discussion

My experiment did not support the hypothesis that SuperThrive (or any of its active ingredients by themselves) encourages fungus growth in a plant. The experiment, however, gave a rise to conclusion that the SuperThrive (or any of its active ingredients) encourage the plant to release other chemicals that might act as nutrients to the fungus and create a perfect environment for fungus to grow and spread on the plant.

Summary Statement

If I add SuperThrive or Vitamin B1 or Auxin to an agar solution in which a fungus will be planted, then the fungus will grow faster.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Mallory L. Blair

Project Number

S1407

Project Title

E. coli in Ground Beef

Abstract

Objectives/Goals

My objective in this experiment was to get a better understanding of food borne illnesses. I believed that in my experiment I would be able to prove that the more you cook a hamburger the less E coli can be found. My experiment focused on E coli in ground beef after I read numerous articles on it. My experiment included E coli, 64 ¼ cup patties of ground beef and sixty four dishes of agar. For each stage I planned to cook I cooked a control as well as four infected hamburgers. I then aloud the Hamburgers to cool to room temperature and then swiped for E coli. In conclusion to my experiment, I found that my controls had no E coli and that the rare cooked hamburgers percent cover was 21% more than both medium and well cooked patties. In conclusion to my experiment my knowledge of food born illnesses expanded greatly. I am of the belief now that the consumer can only do so much to prevent infection and that government programs are essential.

Methods/Materials

Make 65 dishes of agar, Set one dish of agar aside and thoroughly infect it with E coli, Make 64; ¼ cup hamburger patties, Infect 16 hamburgers to be cooked rare, Infect 16 hamburgers to be cooked medium, Infect 16 hamburgers to be cooked well done, Set 16 aside as controls to be cooked at each stage, Set pan at 400 degrees, Rare: 60 seconds, Medium: 2 minutes, Well: 4 minutes, Let cool down to room temperature, Label agar dishes, Swipe center of patties with Q tip and place on agar dishes

Results

All three of my TTEST showed 99% chance of being different. To complete my experiment I measured the percent cover of E Coli in my agar dishes and averaged it out. The averages were as fallows: Rare: 36% cover, Medium: 5% cover, Well: 2% cover and Control: 0% cover. The Standard deviation was .10 for rare, .02 for Medium and .01 for Well cooked.

Conclusions/Discussion

In conclusion to my experiment I found that there was a 21% difference in the percent cover of E coli between the rare cooked and well cooked patties. Through my experiment I was able to determine that E coli, although it was not fully killed, is less likely to survive in extreme heat. This proved my hypothesis correct, that by cooking meat all the way through, E coli has a difficult time surviving because of the extreme heat. My experiment yielded very dependable results, as my TTEST yielded 99% chance of being different in all three tests.

Summary Statement

The point of my experiment was to show that the more thoroughly meat is cooked the harder time E Coli has surviving.

Help Received

My science teacher assisted me in making agar dishes and supplied me with the E Coli

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Michelle Chang; Apiradee Sanglimsuwan

Project Number

S1408

Project Title

Inhibition of Bacterial Growth by Light Wavelengths and Antibiotic Exposure

Abstract

Objectives/Goals

The purpose of this experiment is to test different conditions to impair or promote the growth of bacteria. Plates of bacteria were tested with different wavelengths. Bacteria was also grown alongside another bacteria, one which produced antibiotics. The effects of the interaction of the bacteria were observed.

Methods/Materials

In the first part, common soil bacteria was isolated and colonies were plated. Each plate was placed in a box with red, yellow, or blue wavelength with one plate in a dark box serving as the control. The bacteria was allowed to grow overnight and a colony count was taken.

In the second part, bacillus subtilis was plated with other bacterial species including bacillus megaterium, bacillus cereus, bacillus thuringiensis, enterobacter cloacae, and enterobacter aerogenes. They were let to grow overnight and a colony count was taken. The effects of growth was also noted.

Results

The results varied from day to day. The number of colonies grown under red, yellow, blue, or dark light differed each time the bacteria was plated.

As for the latter part, bacillus subtilis plated with other bacteria sometimes did not inhibit the overall growth. However, many times fungi grew.

Conclusions/Discussion

Though the results were seemingly random, a slight pattern can be made out in the data regarding bacterial growth. For the colonies under a red wavelength, the colony growth had a spurt in every other generation, generating prominent red peaks in the graph of the colony counts. The bacteria grown under light of a blue wavelength dominated in those generations the red did not and seemed to grow better overall. The yellow wavelength light had no consistent effect on the bacterial growth. But the light was not found to inhibit bacterial growth in anyway, even though the bacteria were isolated from soil not usually exposed to much light.

The results of the growth of bacteria in the presence of bacillus subtilis are inconclusive as they vary from day to day with inconsistent outcomes. Because fungus grows many times in random plates, it is difficult to judge whether or not a pattern is present and if B. subtilis is inhibiting growth.

Summary Statement

The purpose of this project is to test different light wavelengths and indirectly expose antibiotics through bacillus subtilis to inhibit growth of bacteria.

Help Received

Teacher helped purchase materials (bacterial cultures, plates, etc.)

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Jane Chen; Elora Lyda

Project Number

S1409

Project Title

The Effect of Tc-99 on the Genetic Transformation of E. coli and L. lactis

Abstract

Objectives/Goals

This project was designed to test whether or not genetic transformation of the pGLO gene was possible in species of Monera after they were mutated by radiation exposure. By doing this experiment, one can see how mutations caused by radiation affect gene transfer and DNA replication.

Methods/Materials

Results from a previous experiment showed that both Escherichia coli and Lactococcus lactis were able to express the green fluorescent protein if cultured under normal conditions. In this experiment, both bacteria were exposed to Technetium-99 for 15 and 30 minutes. Then, using a genetic transformation procedure, the pGLO gene, originally derived from the jellyfish Aequora victora, was inserted into the bacteria. The bacteria were then allowed to grow for three days. Bacteria that underwent successful genetic transformation were able to express the green fluorescent protein that coded for a glowing of the bacteria colonies under an ultraviolet lamp. This bioluminescent trait and the resistance to ampicillin were two visible traits of a successful genetic transformation in the bacteria.

Results

The Escherichia coli bacteria exposed to Technetium-99 for fifteen minutes and the Lactococcus lactis bacteria exposed to the radiation for fifteen minutes were able to express the green fluorescent protein. The Lactococcus lactis strand that was exposed to 30 minutes of radiation was not able to express the pGLO gene.

Conclusions/Discussion

In conclusion, radiation does affect genetic transformation of the pGLO gene in Monera. The Escherichia coli exposed to fifteen minutes and thirty minutes of Technetium-99 and the Lactococcus lactis exposed to fifteen minutes of radiation were able to successfully express the green fluorescent protein by genetically transforming the pGLO plasmid. On the other hand, the Lactococcus lactis exposed to fifteen minutes of radiation was unable to express this gene. This is due to the fact that the radiation altered the DNA plasmid of the bacteria so that the restriction enzymes could not cut the nucleotide sequences in the correct places to allow for the insertion of the new DNA. Thus, the bacteria were not able to incorporate the new gene into their genome and express the green fluorescent protein.

Summary Statement

The effect of Tc-99 on the genetic transformation of the pGLO gene in Escherichia coli and Lactococcus lactis

Help Received

Used radiation source at Corona Regional Medical Center

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Junxing (Cici) Chen

Project Number

S1410

Project Title

Battle with the Bacteria: How Well Does E. coli Survive on the Cutting Boards?

Abstract

Objectives/Goals

The objective is to find out which cleaning method (water wash, soap wash, or salt wash) can best eliminate E. coli contamination from the wooden cutting boards.

Methods/Materials

Used E. coli ATCC strain to contaminate the wooden cutting boards, which were later washed with tap water, soap solution, or salt. Each board was then sampled to agar plates. After 24 hours incubation, counted all the colonies and compared to the control (which was not washed).

Materials include E. coli ATCC strain, 2 ml 0.85% saline, Mcfarland Standard No. 2, sterile swabs, sticks, agar plates, wooden cutting boards, soap, and salt.

Results

The results showed a significant decrease in bacterial growth after long periods of salt wash were applied. It reduced the colony counts by approximately 67% from the control while the water wash and the soap wash reduced the colony counts by approximately 49% and 60%.

Conclusions/Discussion

My conclusion is that salt rubbing under flowing water with vigorous and long enough washing period is more effective than the soap wash as usually recommended. This suggest that the commonly use soap wash should be considered replace by the more natural and safer cleaning method-salt wash in kitchens.

Summary Statement

My project is looking for a cleaning method that can prevent pathogenic contamination from wooden cutting boards and moreover, reduce the food borne illness that is caused by cross-contamination.

Help Received

Mother helped and advised my project. Science teacher, Ms. Karen Kelly supported and helped me throughout my project. Used lab equipment at John Muir Laboratories, Walnut Creek, CA under the supervision of Denise Tucker and Audria Buchanan (CLS).

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Sean A. Curtice

Project Number

S1411

Project Title

Reducing Bacterial Growth in Commercial Mushroom Production Using Antiseptic Herbal Extracts

Abstract

Objectives/Goals

Developing an herbal antibacterial that is safe to use on Agaricus bisporus would be very useful in the mushroom cultivation industry. It was hypothesized that herbal antiseptics such as garlic and tea tree oil can be used to reduce bacterial growth in commercially cultivated Agaricus bisporus fertilizer without producing negative effects upon the mycelia.

Methods/Materials

Mushroom fertilizer samples provided by Monterey Mushrooms were treated with tea tree oil solution and garlic extract solution. The samples were tested for bacteria on tryptic soy agar in comparison to control samples. Tea tree oil dilutions in 1/10 increments were then tested. Mycelium samples treated with each of the dilutions were also grown in sabouraud agar.

Results

Tea tree oil was found to be effective against bacteria. It was discovered that smaller concentrations (about 0.01%) of tea tree oil allowed for fungal growth, while larger concentrations did not. The final results of this study showed that tea tree oil can be applied to Agaricus bisporus without inhibiting mycelial growth.

Conclusions/Discussion

The results of this study yield important knowledge that could be exceedingly advantageous for the mushroom industry. The findings were sent to contacts at Monterey Mushrooms, who were quite interested and intrigued, and acknowledged that the discovered information was potentially very useful to the mushroom industry.

Summary Statement

This study seeks to reduce the growth of harmful bacteria in commercially grown Agaricus bisporus using various herbal extracts.

Help Received

Mr. Wayne Bautista of Monterey Mushrooms provided Agaricus bisporus fertilizer; Mr. Ed Smith, author of Therapeutic Herb Manual, reccomended herbal extracts; Ms. Jill Giesick, microbiologist, made recommendations for bacteria testing; Dr. Jay Vavra at High Tech High supervised laboratory work

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Kelsey L. De Avila

Project Number
S1412

Project Title
The Correlation between Manure Composting Time and the Presence of Escherichia coli on Spinach

Abstract

Objectives/Goals
The goal of this project is to prove that composting time is needed to kill the e. coli bacteria and also to prove that there is a direct correlation between manure composting time and the presence of e. coli on spinach.

Methods/Materials
Manure; 5 plant containers; Spinach seeds; Shovel; Soil; Water; Watering can; Latex gloves; Half of a milk carton; 33 Petri dishes; 9.0 g of Agar; 1.5 g of Yeast; 300 mL of distilled water; Microwave; Flask; 33 inoculating loops; Incubator; Freezer.

Results
For 4 weeks composted: zero e. coli colonies. 3 weeks composted: an average of 2 e. coli colonies. 2 weeks composted: an average of 19 e. coli colonies. 1 week composted: an average of 37 e. coli colonies.

Conclusions/Discussion
Due to recent events in 2006, e. coli has broken out through the United States.There were 5 containers, each of them were growing spinach. In 4 out of 5 trays cow manure with different composting times (1-4 weeks) was placed onto the spinach early in the experiment. One month later the leaves were tested proving that e. coli dies off between weeks 3 and 4 of composting. With the recent outbreaks in spinach, consumers should be one of the first to know what they might have purchased.

Summary Statement
To see if there is a correlation between manure composting time and the presence of e. coli on spinach

Help Received
Mrs. Hampton my teacher at Arlington High and also Mr. Ellis from Arlington who provided the pure e. coli for e. coli control.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Fritz Foo

Project Number
S1413

Project Title
Capsaicin and Microbial Relations

Abstract

Objectives/Goals
The objective of the experiment was to test whether capsaicin would inhibit the growth of common bacterial strains. The swabbed bacteria came from a household bathroom, under a cat's claw, and human phlegm from a sore throat, representative of indoor, outdoor, and somatic bacteria. The experiment was conducted to primarily fuel my own curiosity and also set out to prove or disprove the old wives' tale that eating chili peppers can reduce the chances of catching a cold. After my initial research, I hypothesized that capsaicin would inhibit bacterial growth due to its caustic nature.

Methods/Materials
The project consisted of 35 petri dishes, 25 of which were pre-prepared and the 10 manually sterilized with an autoclave. The pre-prepared dishes came with a special pre-manufactured agar solution, whil the blank plates were filled with Luria agar. Approximately 750 kilograms of Habenero Chilis were used to prepare a capsaicin glaze. Initial bacterial strains were taken from the aforementioned sites, cultured, then transferred to the actual plates used in the experiment. In the control plates, nothing was added; however, in the variable group, a capsaicin spread was added on one-half of the agar.

Results
After seven days of data collection, a conflict of quantitative versus qualitative data emerged. Based on the data gathered from random sampling, the capsaicin showed no effect and, in some cases, even stimulated bacterial growth. However, based on visual qualitative data, it was obvious that the control group had produced larger, albeit less defined and countable colonies. Under a light microscope, the growth patterns suggest the capsaicin had effectually dispersed the bacteria into roaming, isolated colonies, whereas the control group lived in dense colonies near one another.

Conclusions/Discussion
After careful analysis of the quantitative and qualitative data, the original hypothesis can be validated because, as proven under the microscope, it was clear the control group (unaffected by capsaicin) had healthier colonies and larger areas of dense colonies. The bacteria existent on the capsaicin were sparsely populated. Based on the results of this experiment, I would be willing to assert the claim that mother was right -- eating chilis may deter illness.

Summary Statement
Capsaicin and Microbial relations discussed the effect of capsaicin on bacterial growth; all-in-all, the peppers reduced the number of bacterial colonies.

Help Received
Mrs. Pearce for providing me the incubator and teaching me how to use an autoclave; Mr. Wogee for providing the petri dishes and agar plates; My parents for allowing me to convert the garage into a biohazardous site; My cat for allowing me to swab his claws

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Yamila D. Hernandez

Project Number

S1414

Project Title

Differentially Altering the Ability of Haemophilus to Form Biofilms using Subtherapeutic Doses of Multiple Antibiotics

Abstract

Objectives/Goals

When studies began showing the concept of antibiotic resistance, researchers felt that the remedy was to give patients lower dosages of antibiotics, as subtherapeutic dosages lead to the inhibition of initial microbial adherence. However, the flaw in many researchers# thinking was that all antibiotics behaved the same way at subtherapeutic doses. Most researchers also believed the difference between planktonic cells (individual bacterium) and biofilms (many bacteria) was virtually none. Bacteria are actually in biofilms for the duration of their existence. It is only when making the transition from biofilm to biofilm that the bacteria are in a planktonic state. The difference between planktonic cells and biofilms is that the latter are much more resistant to antibiotics than are planktonic cells. Researchers believed that they could treat antibiotic resistance by only examining planktonic cells, when in reality it can only be treated by looking at biofilm formation.

Methods/Materials

96-well microtiter plates were used throughout the experiment, as they go beyond Petri-dishes which are only able to test for planktonic cell growth and inhibition. Microtiter plates have the ability to test for biofilm growth and inhibition, as they can be introduced to a Victor 3-V Perkin Elmer, 595 nm, plate reader. As biofilms are the predominant state of bacteria, it was fitting to use a plate reader which tested for biofilm growth of Haemophilus influenzae after crystal violet had been added, followed by water, and finally the addition of ethanol.

Results

The plate reader showed a significant biofilm spike for Benzylpenicillin. In other words, Benzylpenicillin was shown not only to fail at subtherapeutic doses, but also to cause patient health to drastically worsen as biofilm formation increased at such a low dose. This spike is what contributes to antibiotic resistance in patients.

Conclusions/Discussion

Often times patients do not fully finish taking their antibiotics or are started on a sub-therapeutic dose. In the case of some antibiotics, such as Benzylpenicillin, this method leads to a rendering of a much more harmful bacterium than would have been present had no antibiotic been administered or had an MIC (Minimal Inhibitory Concentration) dose been put into place immediately.

Summary Statement

My project examined the effect of using subtherapeutic doses, of four antibiotics, on the planktonic cells and biofilm growths of Haemophilus influenzae.

Help Received

My parents drove me to UCLA; I used the lab equipment at UCLA under the supervision of Dr. Bradley and Dr. Damoiseaux; SCAS (Southern CA Academy of the Sciences) provided me with a grant to conduct my research.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Brianna L. Lawrence

Project Number

S1415

Project Title

Death to Biofilm: Determining the Best Biocide Solution for Biofilm Elimination

Abstract

Objectives/Goals

Bacteria are very diverse organisms and can live in any environment. They attach to all surfaces and form layers known as biofilm. These biofilm exist in every hydrated system and are known to carry pathogenic bacteria. As biofilm grows pieces of it float freely in the water. These free floating bacteria have the ability to harm many people. The objective of this experiment is to determine which water treatment best destroys biofilm.

Methods/Materials

Untreated well water was collected from a public source. Next, PVC pipe was purchased and cut into 24 four-inch sections. PVC piping was chosen because it is a common plumbing material. Each section of piping was filled with the untreated water and placed in a well ventilated area at room temperature for 12 days. Every three days, four samples of bacteria were viewed under a microscope at medium power to observe progression of growth. The bacteria count was recorded. At the end of the growing period, a final bacteria count was recorded for each sample. Meanwhile, five biocides were chosen as disinfectants: Hydrogen Peroxide, Alcohol, Ammonia, Chlorine, and Iodine. These biocides were chosen for their natural cleaning abilities. Each compound was measured and mixed with purified water to create five solutions. The well water was poured out of four pipes and one biocide solution added. After a specific amount of time, a sample from each pipe was viewed under the microscope for a bacteria count and recorded. This process was repeated for each solution. The data was analyzed to determine the best biofilm disinfectant.

Results

The Alcohol solution was the best disinfectant with a 66% elimination of bacteria. Alcohol#s average decrease of bacteria per field of view under the microscope was 39 bacteria. Close behind was Ammonia with 64% bacteria elimination, its bacteria count also decreased by 36 bacteria. Hydrogen peroxide was able to kill 57% with a decrease of 37 bacteria per field of view. Chlorine and Iodine had very close results. Iodine had a disinfectant percentage of 54%, and Chlorine had a disinfectant percentage of 55%. Iodine#s bacteria count decreased by 33 bacteria, and Chlorine#s count decreased by 29 bacteria.

Conclusions/Discussion

The results from the experiment show the best biofilm disinfectant is the alcohol. My hypothesis stated chlorine would work the best; therefore my hypothesis was refuted.

Summary Statement

Using different biocide solutions to determine which one kills biofilm the most effectively.

Help Received

Mother helped put board together; Jacob from Home Depot cut the PVC pipe into 24 pieces

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Jeffrey C. Peterson

Project Number

S1416

Project Title

Yeast Lipoprotein Resistivity to Sulfide Inhibition

Abstract

Objectives/Goals

To see if a state of anaerobic respiration can be induced into S. cerevisiae.

Methods/Materials

FeS was ionized using muriatic acid to create H2S gas. Yeast and sugar mixtures were then exposed to this gas in 4 trials. Two contain some baking soda to neutralize the acidity of the gas. 6 others were then used as control. These consisted of sodium sulfate, sodium bisulfite, and untreated, having 2 of each. Every other trial is sealed. Measurements of the density of each solution is taken every 12 hours, while each is also aerated each time as well.

Results

The baking soda free H2S gas and the untreated control both decreased in density. However, the H2S gas exposed solution settled at a much lower density than that of the control. The other controls didn't show a great enough change in water density to be accounted for.

Conclusions/Discussion

The yeast and sugar solution exposed to the H2S without any baking soda had the greatest decrease in density. This means that the sulfide ions had indeed inhibited the ETC in the mitochondria of the yeast, shutting off aerobic respiration and producing alcohol. Because alcohol has a lower density than water, the decrease was greater than that of the control. The other controls simply killed the yeast.

Summary Statement

This project explores the induction of an artificial suspended animation on yeast.

Help Received

Dad found purchased materials and paid for board printing

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Christina M. Pimentel

Project Number

S1417

Project Title

Microscopic Analysis of Mushroom Spores under a Variety of Conditions

Abstract

Objectives/Goals

The purpose of my experiment was to observe the effects of contaminants such as scraps of food on the development of organisms (in this case, mushroom spores). I believe that the scraps of food will prevent any mushrooms from growing or at least delay their growth rate.

Methods/Materials

11 containers were filled with approximately equal amounts of different food wastes. Mushrooms were grown under identical environmental conditions and observed in regards to their growth patterns. Samples from the fully grown mushrooms were taken and observed under a microscope. The spores were introduced to water, salt, and calcium nitrate and their reactions were recorded.

Results

The pH levels of the soil after a few weeks of being introduced to the wastes were within one or two increments of the pH levels of the wastes. Mushroom growth was delayed about one week from the average maximum growth expected timeline. When observed under the microscope, water made the spores separate quickly, calcium nitrate made them separate slowly, and salt caused them to remain stable.

Conclusions/Discussion

The liquid wastes did not have a large effect on the mushrooms because they either evaporated or just ran through the containers. The solid (and powder) wastes had a larger impact on the mushrooms because they were stuck in the soil and had to disintegrate within the compost. The waste that emitted an odor (number 7) attracted flies, which laid eggs and which eventually was the cause of the maggots and disruption of growth. Most of the mushrooms# growth patterns were only changed by about one week, which was due to the different pH levels. However, the high pH level of container 11 and the maggots on container 7 halted the growth. Mushrooms, therefore, have varied pH levels in which they can grow, but extreme levels (very acidic or very alkaline) can cause them not to grow, to grow at a very slow pace, or to grow with possible defects.

Summary Statement

My experiment studies the effects that different food wastes have on the spore growth of mushrooms.

Help Received

Science teacher, Mrs. Flagan gave suggestions; Mother helped glue some posterboard sections; Mushroom Kit obtained from Pulpit Rock (ordered from Carolina catalogue).

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Argenis O. Ruvalcaba

Project Number

S1418

Project Title

Preventing E. coli Contamination

Abstract

Objectives/Goals

My goal or objective is to demonstrate how E.coli bacteria is affected through the use of anti-bacterial cleaners and detergents. I expect to find the potency of each solution.

Methods/Materials

In this experimentation, there were various tasks that were completed. I have been organizing my experiment in various increments. The first part, or phase, of my experiment was to examine bacterial growth of E.coli, on nutrient rich Petri dishes. This first part of the experimentation showed the bacterial growth upon the presence of the antibacterial cleaners and detergents of 10%, 15%, 20%, 25%, and 100% dilutions. The second phase demonstrated the effectiveness of the antibacterial cleaners and detergent measuring the Zone of Inhibitions.

Results

The results demonstrate that the use of antibacterial cleaners and detergents such as Purell Hand Sanitizer, do dramatically eliminate E.coli bactria.

Conclusions/Discussion

To conclude my experiment I would like to say that this experiment was in dedication for all those who died due to E.coli contamination. I have learned based on my data and experiences that washing our hands and being sanitary can make drastic changes upon our lives.

Summary Statement

My experiment is based on the prevention of E.coli bacteria contamination through the use of antibacterial cleaners and detergents.

Help Received

My biology teacher, Mrs. Schramm helped me with questions I had about this perticular subject.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Robyn A. Saldino

Project Number

S1419

Project Title

Is Green Really Clean? A Comparison of Chemical and Chemical-free Cleaning Methods

Abstract

Objectives/Goals

I wanted to find out whether a microfiber cleaning cloth and room temperature tap water will remove surface bacteria from household surfaces as well as a bleach based cleaning wipe. I took cultures from three surfaces: the bathroom sink, the bathroom counter, and the edge of the bathtub.

Methods/Materials

I began by taking a control culture from each surface using a sterile cotton swab and a sterile nutrient agar plate. Then I divided each surface in half and cleaned half with a microfiber cloth and water. I swabbed this half three separate times and plated the swab three separate times. I cleaned the other half with a bleach based wipe, then swabbed and plated it three separate times. I repeated this process on each surface.

Results

24 hours: The only plates that showed and growth were one bleach plate from the sink and one from the counter.

48 hours: All plates showed visible growth, except for one microfiber plate from the sink and one from the counter, and one bleach plate from the sink and one from the counter.

72 hours: All plates showed visible growth except one microfiber plate from the counter, and one bleach plate from the counter.

Conclusions/Discussion

I concluded my hypothesis to be correct. In fact, the microfiber cloth and water removed more bacteria than the bleach based wipe. The bleach plates showed far more bacterial growth than the microfiber plates. I would like to find out what type of bacteria grew on the plates, and I would like to find out what the least amount of bleach is that can be combined with a microfiber cloth to remove all surface bacteria.

Summary Statement

I wanted to find out whether a microfiber cleaning cloth and tap water would remove surface bacteria as well as a bleach based cleaning wipe.

Help Received

Mother took pictures of experimental process. Friend at Moorpark College provided sterile agar plates and sterile swabs. Neighbor loaned me his laptop to complete graphs.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Sushant Sundaresh

Project Number

S1420

Project Title

Host-Bacterial Specificity during Legume-Rhizobium Symbioses

Abstract

Objectives/Goals

The research examined the control sequence between host plants and nitrogen fixing bacteria and determined whether such bacteria were screened at successive host-regulated checkpoints during the nodulation process. It was hypothesized that while host-bacterial symbioses had multiple control doors, Nod factor signaling was the most important checkpoint during legume-Rhizobium symbiosis.

Methods/Materials

Rhizobium meliloti, specific to Alfalfa, and NGR 234, specific to Macroptilium, were utilized because of their non-overlapping host-specificity. Fifty specimens each of Alfalfa and Macroptilium were grown and inoculated, cross tested under all possible combinations of host plants and bacteria; the resulting nodulation statistics were analyzed to empirically map the control sequence for nodulation.

Results

Each host plant evinced specificity to the Nod factors of its bacteria in naturally occurring symbioses. For example, Alfalfa rejected NGR 234, only allowing R. meliloti to infect its root hairs and nodulate. However, when bacteria were injected directly into the host, the plant#s control system failed to regulate the invading bacteria and allowed nodulation to occur.

Conclusions/Discussion

During artificially instigated symbioses, the Nod factor control door was bypassed, disproving the hypothesis that Nod factors alone determine specificity. By demonstrating that nitrogen fixing bacteria are less host-specific than previously assumed, this research opens up the possibility for the mass production of crops with a clean, natural nitrogen source, which could reduce fertilizer usage and greenhouse gas emissions simultaneously.

Summary Statement

This research set out to prove that host-bacterial specificity was absolute and rigid, but ended up challenging that premise, opening up the possibility for environmentally beneficial and economically attractive agricultural production.

Help Received

Dr. Gage, of the University of Connecticut, sent me Alfalfa and Macroptilium seeds. Dr. Harley, of the Harker High School, let me work in his classroom.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Devesh M. Vashishtha

Project Number

S1421

Project Title

Hot & Cramped: The Impact of Global Warming and Habitat Fragmentation on Microbial and Floral Diversity: Year II

Abstract

Objectives/Goals

This first of two objectives of this study is to analyze the effects of gradual warming on microbial diversity in southern Californian beach, mountain, and urban environments. The second is to compare the microbial and floral diversity within fragments of different sizes resulting from habitat fragmentation.

Methods/Materials

In order to test microbial diversity as a result of warming, soil samples were incubated at an elevated temperature of 21.6 degrees Celsius and then analyzed using the BIOLOG EcoPlates and BIOLOG EcoPlate reader. The plate test utilized 31 carbon-based substrates in order to determine both microbial diversity and the unique signatures of individual microbes within each soil samples. A similar test was run to study the impact of habitat fragmentation on microbial diversity. Flora samples were catalogued in a comprehensive database.

Results

From the data, it was evident that elevated temperatures resulted in a distinct increase in microbial activity. A relationship could also be determined between the size of a fragment tested and microbial and floral diversity within that particular fragment. It was evident that as temperature and fragment size increased, microbial and floral diversity heightened as a result.

Conclusions/Discussion

This experiment provides both an observational and analytical basis for the effects of global warming and habitat fragmentation on microbial and floral diversity. The data suggests that with continual increases in global temperatures and the destruction of natural ecosystems, microbes and flora will suffer a decrease in diversity. This experiment contains applications in mathematics, as it established general formulas relating the size of a fragment and microbial and floral diversity within that particular fragment.

Summary Statement

This experiment analyzed the impact of global warming and habitat fragmentation upon microbial and floral diversity within southern California.

Help Received

Used lab equipment at UCI under the supervision of Professor Kathleen Treseder; Lab Manager Maria Garcia helped form the experimental procedure.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)

Zachary E. Wolinsky

Project Number

S1422

Project Title

A Study on the Effects of Green Tea Extract in Regulating the Formation of Dental Biofilm

Abstract

Objectives/Goals

The objective is to determine the efficacy of herbal green tea extract in regulating dental biofilm in a simulated environment.

Methods/Materials

Consent was given to work in the microbiology laboratories of Dr. Wenyuan Shi at UCLA. Saliva was collected from my mouth and was diluted with Brain Heart Infusion (BHI) media. The oral bacteria was isolated using a centrifuge and was subjected to diluted green tea extract for five minutes. The mean number of bacterial cells observed through a Nikon phase contrast microscope was compared between the controlled bacteria and the treated bacteria.

Results

Over a time span of ten hours, the mean number of bacterial cells observed increased at an exponential rate. After ten hours, the untreated bacterial biofilm reached a mass in which individual bacterial cells were indistinguishable, while the treated bacteria yielded a biofilm with an estimated 90% less mass than the control.

Conclusions/Discussion

Green tea contains high amounts of polyphenols, chemicals with potent antioxidant properties. This widely consumed tea has the potential to be used for a multitude of medical purposes. In administering the diluted green tea extract to the bacteria, an interaction occurred. Almost instantly, the pellet of bacteria within the 2mL test tube had become a dark brown color. Re-suspending the treated bacteria into the BHI media also proved an interaction between the extract and the bacteria occurred because the bacterial pellet became a strongly bonded clump. A time-lapse video ten hours in length also displayed that the green tea extract decreased the individual bacteria cells# ability to stick to one another. These data suggest that green tea has powerful properties in regulating biofilm growth and it is beneficial because it hinders oral bacteria from forming sticky bonds to you teeth and becoming dental plaque.

Summary Statement

My project is an observational study on how dental biofilms form and how the formation of these biofilms can be regulated using diluted Camellia sinensis (green tea) extract.

Help Received

Used laboratory equipment at the UCLA School of Dentistry under the supervision of Dr. Wenyuan Shi and Dr. Renate Lux; Mother helped assemle display board; Father helped conduct lab experiments.

CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY

Name(s)
Emily J. Zolfaghari

Project Number
S1423

Project Title
Pre-Washed or Not? A Process to Eliminate E. coli 0157:H7

Abstract

Objectives/Goals
#How many times should manufacturers wash their produce to remove E.Coli 0157:H7 if sold pre-washed?#My hypothesis was #If the average number of times(3) factories wash their vegetables does not sufficiently remove E.Coli 0157:H7,than increasing the number of times washed will remove the remaining E.Coli.#

Methods/Materials
Tested on: Bok Choy,spinach,lettuce,celery leaves,radish leaves,beet leaves, flat parsley,basil,leek,and watercress. For each of the 10 vegetables tested, I used 10 leaves;thus 100 leaves.I created a scale for each,covering leaves with 100% ,75% ,50% ,and 25% contamination of Glo Germ. I covered 9/10 leaves with 100% contamintaion. The one without was left to see the percentage of cross contamination that occured.¼ teaspoon of Glo Germ for the smaller vegetables was used with 10 C of water and ½ teaspoon for the larger vegetables with 20 C of water.I put one vegetable type in water and took them out to examine.After 10 times of washing I stopped due to cross contamination.After each rinse,I gave each leaf a percentage # of E.Coli remaining and averaged it out to find the remaining after each wash.I touched the produce stem so I would not remove any contamination and wore gloves.While leaves were examined under UV light, the remainder were laid on foil. After each round, I changed the foil and gloves, never changing the water unless changing vegetables.

Results
Produce types should be washed at different rates.Celery should be washed: 10 times for an average of .8% E.Coli remaining on 10 leaves.Bok Choy: 8 times for 3.8%.Spinach: 10 times for 11.3%.Beet leaves: 9 or 10 times for 4.6%. Basil: 9 times washing.Flat parsley: 10 times for 13.1%.Leek:4 times for 34%.Lettuce: 10 times, 3.3%.Radish leaves: 10 times 15.3%.Watercress:10 times for 4.7%.

Conclusions/Discussion
I consider my experiment inconclusive because recording the amount of E.Coli remaining,I used the naked eye.However,Glo Germ mimics bacteria with a 98% physical accuracy.Glo Germ and large bacteria are 5 microns large.The scale created could not reflect each leaf exactly because each is physically different.My results drawn are essential for the protection of many lives.It makes visible the contamination left on vegetables and mimics the procedures companies use when selling pre-washed produce.It protects people from hemocolitis and hemolytic uremic syndrome caused by E.Coli and could have saved half-million lives over 10 years.

Summary Statement
Discovering a procedure to sufficiently remove E.Coli 0157:H7 from pre-washed produce; thereby eliminating the possible deaths in America from E.Coli 0157:H7 contamination from our food supply.

Help Received
Mother for driving me and purchasing all equipment...and BELIEVING in me!