CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Jessica L. Cao

Project Number
S1501

Project Title
Beat Blemishes for a Bargain

Abstract

Objectives/Goals
The objective of this experiment was to identify (a) how Neutrogena, Clean & Clear, baking soda, toothpaste, apple cider vinegar, salt water, and Neosporin would affect the proliferation of E. coli and (b) which of these treatments would inhibit bacterial proliferation the most, thus indicating its effectiveness in treating acne. My hypothesis was that all of the treatments would inhibit the bacterial growth with Neosporin as the most effective, followed by other bactericidal medications, and then those that are bacteriostatic.

Methods/Materials
Two nutrient agar plates were divided into four sections labeled Water, A1, B1, C1, D1, E1, F1, and G1. The letters correspond with the medication, while the numbers correspond with the trial. Sterile cu-tips were used to transfer liquid E. coli culture onto each of the plates. A sterile disk was then soaked in distilled water as a control and placed onto the corresponding section of the plate using sterile forceps. The process was then repeated with each of the seven medications, resulting in each lettered section containing one disk that has been soaked in corresponding medication. The complete sequence was repeated for trials two through five. All ten plates were inverted and incubated at 37ºC. After 48 hours, the diameters of the zones of inhibition (areas of no bacterial growth surrounding the medication disks) were measured and recorded.

Results
Upon collecting the data, there were no zones of inhibition around the disks treated with water, Neutrogena On-The-Spot Vanishing Cream, and salt water. The zones of inhibition averaged (in diameter), 9.6 mm around disks treated with Clean & Clear, 19.2 mm around disks treated with baking soda, 16.4 mm around disks treated with toothpaste, 28.6 mm around disks treated with Apple Cider Vinegar, and 16.8 mm around disks treated with Neosporin.

Conclusions/Discussion
The data collected mostly refuted my hypothesis that all treatments would have an effect on the bacterial proliferation with Neosporin exhibiting the most inhibition. Two treatments, the Neutrogena On-The-Spot Acne Cream and salt water that did not have any effect on the growth and Apple Cider Vinegar exhibited the most inhibition followed by baking soda, then the Neosporin, toothpaste, and Clean & Clear. My experiment shows that cheaper and simpler home remedies can be more effective than expensive commercial acne treatment products.

Summary Statement
In this experiment, I investigated the effectiveness of a myriad of acne spot treatments, ranging from commercial products to home remedies by measuring how well they inhibit bacterial proliferation.

Help Received
My parents helped me buy all of the supplies. My dad helped me construct an incubator and boil the supplies to sterilize them. Dr. Gott, an infections control doctor helped me better understand the concept of how proliferation is inhibited.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Jesse Daniels; Skylar Johnson

Project Number
S1502

Project Title
Eggshells: Let's Go Defense, Let's Go

Abstract

Objectives/Goals
The objective is to determine which eggs have the highest resiliency to bacteria, and which common bacterial environments harbor the most potentially harmful bacteria.

Methods/Materials
Three different types of eggs were used- store bought white grade AA eggs, store bought brown cage free eggs, and home grown Bantam eggs. Each of the eggs were placed together in five different bacterial environments- chicken coop soil, oat hay, used kitchen sponges, used kitchen paper towels, and the refrigerator. Each environment was in a sealed and sterile container in the refrigerator. After two weeks, the yolk and albumen were tested for bacteria, and identified.

Results
We found that the Bantam egg consistently had the highest bacterial count. Between the cage free and grade AA eggs, the cage free eggs were slightly more resilient to bacteria. The used paper towel environment harbored the most bacteria, and the refrigerator had the least.

Conclusions/Discussion
Although eggs naturally harbor bacteria, our experiment shows the importance of proper storage and cooking of eggs. The most common storage for eggs is the kitchen, which harbors the most bacteria. Because the Bantam eggs did not go through a factory sanitation process, this proves that sanitation makes a difference in the safety of eggs.

Summary Statement
Our project tests the bacterial resiliency of three different eggs in five bacterial environments.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

David K. Eng

Project Number

S1503

Project Title

Role of Septins in the Uptake of the Fungus Candida albicans by Host Cells

Abstract

Objectives/Goals

The fungus Candida albicans normally grows as a harmless commensal on the skin and mucous membranes. In hospitalized patients, C. albicans causes a severe bloodbourne infection associated with greater than 40% mortality. Investigating septin function during the invasion of the fungus C. albicans into endothelial cells may provide insight into how microbial pathogens hijack endocytosis mechanisms to invade these cells. The objectives of this experiment are to determine if septins affect N-cadherin accumulation and if septin depletion decreases C. albicans uptake. Learning more about the basic science of cell membrane dynamics will help in the development of anti-infective drugs to combat candidiasis.

Methods/Materials

Human umbilical vein endothelial cells were infected with C. albicans cells. Septins and actin microfilaments were stained by AlexaFluor immunofluorescence procedures and imaged by confocal microscropy. To establish the role of septin 7 during C. albicans uptake, endothelial cells were transfected with siRNA against septin 7, infected with C. albicans, fixed, stained with anti-septin 7 and anti-N-cadherin (a known C. albicans cell receptor) antibodies, and then imaged by confocal microscopy. In addition, the endocytosis of C. albicans by the transfected cells was quantified via a differential fluorescence assay.

Results

By confocal microscopy, septin 7 co-localized with the actin filaments that also coalesced around the organisms. Confocal microscopy revealed a 72% reduction in septin 7 accumulation around C. albicans in endothelial cells that were transfected with the septin 7 siRNA compared to the control siRNA. Confocal microscopy also revealed a 66% reduction in N-cadherin accumulation around C. albicans in these septin-depleted cells. Septin 7 knockdown by siRNA resulted in a 47±18% decrease in the number of C. albicans cells that were endocytosed by the endothelial cells.

Conclusions/Discussion

Septin 7 is necessary for C. albicans to induce its own endocytosis by endothelial cells. The link between septins and vital cell receptors such as N-cadherin explains why septins are so important for host cells to take up microbial pathogens. Endothelial cell receptors for C. albicans cannot function properly without the presence of septins in this host cell.

Summary Statement

This study focuses on discovering the intracellular processes which facilitate endocytosis of the fungus Candida albicans in order to decrease the mortality rate of the disease it causes.

Help Received

Used lab equipment at Los Angeles Biomedical Research Institute; mentored by Dr. Scott Filler; supervised by Trang Phan.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Eli W. Erlick

Project Number
S1504

Project Title
The Antibacterial Properties of Neural Tissue from Gromphadorhina portentosa

Abstract

Objectives/Goals
The neural tissue of Periplaneta americana has been found to have antibacterial properties against Escherichia coli and Staphylococcus aureus. The object of this experiment was to test the antibacterial properties of neural tissue from a related insectae, Gromphadorhina portentosa (Madagascar Hissing Cockroaches) on Staphylococcus aureus.

Methods/Materials
Neural tissue was extracted from Gromphadorhina portentosa and was placed in a solution of thioglycollate broth and Staphylococcus aureus. This solution, along with a control solution, was incubated for 24 hours. Both solutions were then plated on 10 Luria agar plates and incubated for 24 hours. Pictures were taken of the plates and the percent plate coverage was calculated. The experiment was repeated for a total of 3 trials.

Results
The results of this experiment indicate that neural tissue reduces the growth of Staphylococcus aureus by an average of 48%. Trials one through three resulted in a 41%, 51%, and 53% reduction in growth respectively.

Conclusions/Discussion
The neural tissue from Gromphadorhina portentosa was found to have antibacterial properties. Gromphadorhina portentosa is an easily obtained large insectae that readily reproduces and does not reproduce in the wild in temperate North America. There are 9 compounds that are suspected to contribute to Periplaneta americana#s antibacterial effect, which also may also be present in Gromphadorhina portentosa. This experiment was designed to explore the possibility that Gromphadorhina portentosa has similar antibacterial properties. The results indicate that there is an antibacterial effect of the neural tissue from Gromphadorhina portentosa.

Summary Statement
This experiment examines and supports the hypothesis that neural tissue from Gromphadorhina portentosa (Madagascar Hissing Cockroaches) has antibacterial properties against Staphylococcus aureus.

Help Received
Staphylococcus aureus was obtained from Howard Memorial Hospital Laboratory by Judy Ferlman, lab technician.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Harlan J. Falejczyk

Project Number

S1505

Project Title

An Analysis of False Positives in the Enterolert Test Under Turbid Conditions

Abstract

Objectives/Goals

The objective of this project was to test for the occurrence of false positives in the Enterolert (TM) enterococci test manufactured by IDEXX Laboratories, especially under conditions of high turbidity due to incomplete processing of sewerage.

Methods/Materials

Autoclaved samples of varying mixes of primary and secondary effluent from a water treatment plant were used to create sterile substrates with gradient turbidity. The samples are prepared for the Enterolert (TM) test. The tray is allowed to incubate for 24 hours, and then observed under a UV lamp for fluorescence; cells that fluoresce blue are counted as positive, and the numbers of large and small cells that show positive are compared to the MPN table that is included with the test. Samples of cells that seemed dimmer or fainter than the other positives are transferred to Bile Esculin agar plates, and the plates are allowed to incubate for 24 hours. After 24 hours, colonies on the plates that had turned the surrounding Esculin black were transferred to two tubes of Brain-Heart infusion broth at 6.5% sodium chloride. One tube was incubated for 24 hours at 35 degrees centigrade and the other at 45 degrees. Samples that were positive in both of these tubes at the end of the 24 hour period are confirmed positives; any samples not fulfilling the two-tube Brain-Heart infusion broth positive or that do not blacken the BE agar are false positives and recorded as such.

Results

In approximately 15.9% of the tested, fainter samples, the two-tube Brain-Heart infusion broth test was failed; all tested samples passed the BE agar plate test.

Conclusions/Discussion

The 15.9% false positive rate demonstrates that there is still a significant degree of error or inaccuracy. While still a low percentage of the overall count of positive cells, it can be statistically significant when calculating MPN for tests to pass government regulations. Assuming that all bright cells, large and small, were true positives, the 15.91% faint cell false positive rate represents an error of 4%. An error this large may seem small, but in reality it can still have an impact on agencies that are now being required to test for enterococcus in their effluent waters. This test should be perfected before it is made a mandatory test. If this test is required, organizations will need to buy all of the pertinent equipment, including a machine for sealing the Quanti-trays before incubation.

Summary Statement

This project is about testing whether or not a government standard water quality test is inaccurate, and if so, by what degree.

Help Received

A machine borrowed from the Sausalito-Marin City Sanitary District was used for this test, which took place in the Sewerage Agency of Southern Marin lab, and used many of the lab's facilities and materials. My mother is employed at this lab, and assisted me with lab procedures. I also consulted the Vallejo Flood

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Austin K. Ha

Project Number
S1506

Project Title
Antibiotics: The E. coli Kryptonite

Abstract

Objectives/Goals
The objective of this experiment was to find what types of surfaces E. coli can grow resistant to Kanamycin in. My hypothesis was that the E. coli could grow resistant to Kanamycin in the Rabbit Dung and Luria Broth agar, but would not be able to grow resistant to Kanamycin in Nutrient, Photobacterium, Cornmeal-Glucose-Yeast, or Tryptic Soy agar.

Methods/Materials
Premade Petri dishes of different variations were ordered. Sterile swabs were used to transfer E. coli from a tube slant onto the agar in the Petri dishes. A Kanamycin disc was placed one in each of 60 dishes. The dishes were incubated and the growth of the bacteria was measured and recorded every other day for 15 days.

Results
In the resulting averages, only the E. coli from inside the dishes containing Tryptic Soy was able to grow resistant (within 10 mm of) to the antibiotic. The bacteria was able to grow as close as 8.91 mm to the Kanamycin disc in the Tryptic Soy agar, as close as 12.11 in the Rabbit Dung agar, as close as 12.15 in the Luria Broth agar, as close as 14.23 in the Photobacterium agar, as close as 14.40 in the Cornmeal-Glucose-Yeast agar, and as close as 15.30 in the Nutrient Agar.

Conclusions/Discussion
The main hypothesis was that the E. coli could grow resistant to Kanamycin in Rabbit Dung and Luria Broth agar, but not in Nutrient, Photobacterium, Cornmeal-Glucose-Yeast, or Tryptic Soy agar. The bacteria was able to grow resistant to Kanamycin only in Tryptic Soy, refuting my hypothesis. My experiment shows how dangerous E. coli can be to humans and animals since it can grow resistant to different types of antibiotics, and also how antibiotic resistance can become dangerous.

Summary Statement
My project tested the ability of the bacteria E. coli to grow resistant to the antibiotic Kanamycin on different surfaces, revealing how different environments affect the growth of the bacteria.

Help Received
Dad helped me buy all of my supplies, helped me create an incubator for the bacteria to live in, helped me to properly dispose of the Petri dishes, and helped me design the graphs.; Mom supplied me with tape and helped me to cut construction paper for the board.; Mrs. Patel guided me through the whole process.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Jordan Hamwey; Kevin Zavala-Zimmerer

Project Number

S1507

Project Title

A Salty Snack for E. coli: The Efficacy of the 72-hour Rule

Abstract

Objectives/Goals

The objective of our project was to try and test the efficiency and credibility of the 72-hour rule by growing E.coli in different concentrations of seawater and measuring there growth over time. For those unfamiliar with what the 72-hour rule is, it is a merely a suggestion for how long someone should stay out of the ocean after a rainstorm.

Methods/Materials

To conduct our experiment, an LB Broth solution was made with de-ionized water and sea water to provide nutrients to the bacteria. Two colonies were then added to the 5mL of broth and incubated for 3hrs. The five different concentrations were made using the LB Broth; the broth was split into culture tubes with 5mL each. These tubes were autoclaved. 100 micro-liters of the incubated E. coli was added to each of the culture tubes. The leftover broth was used to make blanks that would be used in the spectrophotometer. After 24hrs the solutions were tested for growth in a spectrophotometer. This process was repeated every 24hrs for 72hrs and again at 120hrs.

Results

Our results show that E.coli was still growing steadily in all concentrations of seawater.

Conclusions/Discussion

Due to the fact that there was still E.coli growth in the seawater, this proves that there is a potential that the 72-hour rule may need to be extended. However, in a real life situation, the E.coli in storm water runoff would be competing with other bacteria and pollutants which may inhibit its growth.

Summary Statement

To test the effectiveness of the 72-hour rule by growing E.coli in different concentrations of seawater and measuring their growth.

Help Received

Dr. Vavra provided guidance as well as lab materials.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Gwendolyn G. Lee

Project Number

S1508

Project Title

Using Cryo-electron Tomography to Elucidate Structure and Budding Mechanisms of the Influenza A Virus

Abstract

Objectives/Goals

Because of the health risk the influenza A virus poses to society, affecting millions of people annually, discovering an antiviral medication to combat the virus is crucial to aid people worldwide. This project aims to elucidate the structure and budding mechanism of this virus using cryo-electron tomography. This project compares budding in mutant strains with that in wild-type viruses in order to highlight budding defects that may serve as potential targets for future antiviral therapy that inhibit viral proliferation.

Methods/Materials

The influenza virus samples were prepared using the WT Influenza A virus strain A/WSN/33 (H1N1) and the WSN H1N1 budding mutants (M1 [R101A] and NA [NA3A2] mutants). The Titan Krios microscope was used to take images of these strains as well as the Udorn strain, which were flash frozen onto a grid. Etomo and Inspect-3D, computer software packages that reconstruct the images, were then used to create 3D reconstructions of the sample displaying the surface glycoproteins and components within the virus particle, such as RNA.

Results

The tomographic reconstructions of the Udorn strain of the influenza A virus studied in this project reveal aberrations in the budding process. The various structures of the particles suggest different flaws in the budding mechanism of the influenza virus. The reconstructions show three different forms of the influenza virus: an elongated, filamentous particle; a chain of viral particles that have budding abnormalities; and the typical spherical particle. Currently, RNA appears to play a role in the budding process.

Conclusions/Discussion

Ultimately, from the tomographic reconstructions, RNA appears to play a role in the budding mechanism of the influenza A virus. Its distribution throughout the virus particle appears to cause aberrations in bud closing, resulting in the various particle shapes observed. If RNA does affect virus budding, this knowledge could result in antiviral drugs targeting RNA specifically to impede the budding process, and consequently viral proliferation. The presence of the long chains suggest there might be particular locations along the membrane that are more favorable to budding, and if this were the case, such information could allow for antiviral medications that target specific components of the virus.

Summary Statement

The purpose of this research is to elucidate the structure and budding mechanisms of the influenza A virus, through the comparison of wild-type and mutant strains, using cryo-electron tomography.

Help Received

lab equipment at CNSI (of UCLA) under the supervision of Dr. Hong Zhou

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Jessica W. Luo

Project Number
S1509

Project Title
The Effect of Ocean Acidification on Ocean Productivity

Abstract

Objectives/Goals
The purpose of my investigation is to study the influence of ocean acidification on growth rates of phytoplankton in Santa Monica seawater through in-situ incubation.

Methods/Materials
To carry out the investigation, I took five seawater samples from Will Rogers State Beach in Los Angeles, added phosphate and nitrate as nutrients to enhance phytoplankton growth, then adjusted the seawater pH to a range between 6.15 to 8.4 using hydrochloric acid and sodium hydroxide. Then, I incubated the five samples in a swimming pool for 2 weeks. During the two weeks, I collected particulate phytoplankton from water samples every other day, at approximately the same time, using a fiber glass filter. The amount of total organic carbon in the particulate material was analyzed by a TOC analyzer. pH in the water samples were monitored using a pH meter.

Results
After analysis, my hypothesis is proved to be correct. Phytoplankton growth is slower in acidic samples (initial pH of 6.15 and 6.63) than that of the neutral and basic samples (initial pH: 7.09, 8.13, and 8.4). The TOC change during the two weeks in acidic samples is 0.4 mg/kg and -0.35 mg/kg (pH 6.15 and 6.63, respectively). As for the non-acidic samples, TOC change is 1.3 mg/kg, 2.26 mg/kg, 2.97 mg/kg (pH 7.09, pH 8.13, and pH 8.4, respectively).

Conclusions/Discussion
Seeing that acidity had drastically slowed growth rates of phytoplankton in the ocean, I conclude that ocean acidification caused by anthropogenic carbon dioxide released to the atmosphere does, in fact, adversely affect the growth of phytoplankton in the surface ocean.

Summary Statement
The study of the influence of ocean acidification on growth rates of phytoplankton in Santa Monica seawater through in-situ incubation.

Help Received
Father helped analyze samples for carbon at his university.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Emmie E. Maglieri

Project Number
S1510

Project Title
Investigating the Inhibition Rate of Cultural Spices on Bacteria

Abstract

Objectives/Goals
The purpose of my science project is to determine which spice is most effective in blocking bacteria growth.After my experiment,I will be able to determine the effectiveness of primary cultural spices and how they affect bacteria growth.
I will test 7 different spices from different countries around the world.I will research the prominent spices from the different countries and test those spices.I will observe Wasabi, Ginger, Cayenne Pepper, Nutmeg, Turmeric, Saffron, and Rosemary to conclude which spice is the most effective at repelling bacteria.I will perform 20 trials per spice. My experiment consists of soaking each spice on a filter paper, streaking Bacillus substillus onto a petri dish, and then placing 5 hole punched filter paper containing the spice onto the petri dish.Finally I will observe and calculate the results by measuring the rings of resistance around each hole punch, after 48 hours.

Methods/Materials
I will determine which spice effectively blocks bacteria. I will then observe if the particular spice is inhibiting bacteria and find which region the spice pertains to.

Results
Wasabi had an average diameter of 6.21 mm Ginger had an average diameter of 5.24 mm Cayenne had an average diameter of 6.67 mm Discussion: It was the most effective in blocking the spread of bacteria. This was the strongest spice that was tested. It has capsaicin and has a strong effect on bacteria.Nutmeg had an average diameter of 6.27 mm Turmeric had an average diameter of 5.04 mm Saffron had an average diameter of 6.30 mm Rosemary had an average diameter of 5.0 mm.

Conclusions/Discussion
After completing my investigation on the inhibition rate of cultural spices on bacteria,I found that my hypothesis was proven correct. My hypothesis stated that Cayenne Pepper would be the most effective at repelling bacteria.When compared to the other cultural spices, Cayenne Pepper had an average diameter of 6.67 mm.Cayenne Pepper had a greater effect on the Bacillus Substillus because it is in the Capsicium family, meaning chili pepper.It has many carteniods such as: vitamins C, E, and B6.Cayenne also contains capsaicin which can reduce pain and also prevent ulcers.Other spices that repelled bacteria were Saffron, Nutmeg, and Wasabi.Turmeric was barely effective and Rosemary had absolutely no effect.

Summary Statement
The investigation of the inhibition rate of spices on bacteria,

Help Received
Mr. Whittington for providing petri-dishes and bacillus substillus.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kathleen R. Maguire

Project Number

S1511

Project Title

Do Beta Lactam Antibiotics Stimulate Non-typeable Haemophilus influenzae Biofilm Formation?

Abstract

Objectives/Goals

The purpose of this study was to analyze the effects of beta- lactam antibiotics on NTHi biofilm formation. Although beta lactam antibiotics are known be bactericidal, it was hypothesized that specific sub-lethal concentrations may enhance biofilm growth.

Methods/Materials

Different NTHi bacterial strains were incubated for 24 hours in 96 well plates in the presence of increasing concentrations of amoxicillin, cefuroxime and ampicillin. Norfloxacin, a non-beta lactam antibiotic, was also tested and was used for comparison. Biofilm formation was assessed using a crystal violet assay. A CLSM and a SEM were used to analyze the effects at the microscopic level.

Results

At specific sub-lethal concentrations of antibiotic the majority of NTHi strains exhibited increased biofilm formation. These antibiotic concentrations were deemed maximum stimulatory concentrations (MSC). At these MSCs, biofilm formation increased while bacterial count decreased. When the antibiotic concentration was increased beyond this point, biofilm mass decreased. CLSM and SEM pictures backed these findings and changes in the biofilm profile and bacteria morphology coincided with a large stress response at the MSC.

Conclusions/Discussion

The antibiotic concentration in the middle ear after systemic or oral administration of an antibiotic is currently unknown. It is conceivable that middle ear antibiotic concentrations fall within the MSC range. Systemic administration, which doesn#t specifically target the middle ear, may encourage biofilm formation in bacterial pathogens. By looking at the local concentration in the ear and the process by which antibiotics are administered, future research can help with the effectiveness of antibiotics for patients with otitis media.

Summary Statement

This is a study of the effects of antibiotics on NTHi biofilm formation.

Help Received

Used lab equipment at House Ear Institute under the supervision of Dr. Paul Webster and Christoph Schaudinn

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Hannah M. Meyers

Project Number
S1512

Project Title
Algae: The Oil Factory

Abstract

Objectives/Goals
The objective of my experiment was to examine the potential of algae in biofuel production based on oil content and growth rate.

Methods/Materials
I cultured four strains of algae including one high oil content / low growth rate, two medium oil content / medium growth rate, and one low oil content / high growth rate. Only two of the strains cultured consistently, so I transferred them into a photobioreactor and continued to grow them. I calculated the theoretical oil mass by measuring optical density of samples in a spectrophotometer and multiplying the total mass by the published percent of oil content. Actual lipid content was measured by preparing controls and samples with Nile red dye, incubating the samples and measuring fluorescence in a fluorometer. Fluorometer Units were converted to mg of lipid to determine actual amount of oil. I also observed the algae under a microscope. The photobioreactor was made with plastic tubing, a 4-way gang valve, motor,and a fluorescent light. The algae was cultured to meet the provider's specifications.

Results
Dunaliella Salina, the low oil content/high growth strain, did not culture in any of 8 attempts and only one sample of the Nannochloropsis cultured.
All starter cultures of Chlamydomonas and Tetraselmis cultured.
Although algal strains of high oil content tend to be slow growing, the Tetraselmis generated 8.5% more mass than Chlamydomonas, the medium oil content strain.
Based on calculated oil content, Tetraselmis produced 136% more oil than the Chlamydomonas.
Based on measured oil content, Tetraselmis produced four times more oil than the Chlamydomonas.
Chlamydomonas settled extensively while Tetraselmis remained buoyant.

Conclusions/Discussion
The selection process of algal strains for biofuel production needs to include the consideration of overall heartiness, physiology of the strain, environment for cultivation, and method of harvesting. While algal strains with high oil content are expected to grow slower than strains with lower oil content, this research project demonstrated that the high oil content strains can grow efficiently. The combination of strong growth and high oil content lead to higher total oil production and is a strong contender for further testing and development.

Summary Statement
This project helps to identify which algal strains can be used for biofuel production based on the combination of oil content and growth rate.

Help Received
Dr. Stephen Lyon explained directions for growing algae and analyzing oil content. I measured fluorescence of the algae at Cal Poly Pomona under the supervision of Dr. Marcia Murray. My mother bought supplies for me and swirled the flasks to minimize settling.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Grace I. Ng

Project Number
S1513

Project Title
Computer Keyboard Hygiene: What Lurks Between the Keys?

Abstract

Objectives/Goals
In a recent study, office workers took samples from their computer keyboards and a toilet seat, discovering that their keyboards carried more germs than the average toilet seat. Researchers from various fields have performed numerous studies that have found pathological agents, which can cause food poisoning, diarrhea, and flu among other illnesses, on computer keyboards used in their facilities. This study attempted to compare the extent of the problem in different locations, also characterizing the usage/user profile, as well as correlating the condition of the keyboards sampled to the amount of bacteria growth.

Methods/Materials
Collect samples from computer keyboards located in a local university, hospital, public library, school library, households and workplaces. Record the location and condition of the computer keyboard at the time of collection. Inoculate samples onto chicken broth agar. Record the number of bacteria colonies and observe the size, shape, and color of the bacteria colonies growing on the surface of the agar over the 3-day incubation period. Properly dispose of the Petri dishes by submerging dishes in household bleach for 30 minutes.

Results
Of the fifty computer keyboards sampled, the number of colonies found in the university, hospital, public library, school library, household and workplaces was 35, 23, 106, 37, 36, and 13 colonies, respectively. The number of bacteria colonies grown on samples from multi-user keyboards was far dirtier than that of a single-user, 65 vs. 23 colonies. The average number of bacteria growth from keyboards in good vs. fair vs. poor conditions was 21 vs. 34 vs. 167 colonies.

Conclusions/Discussion
The results revealed that computer keyboards used by multiple users have far more bacteria growth than that of a single user. The results also suggest that the physical condition of a keyboard plays a key role in bacteria growth as keyboards in good condition had fewer colonies; keyboards in fair or poor conditions had 2 times more bacteria growth in the same setting. Surprisingly, computer keyboards at home were unexpectedly dirty, as they had more bacteria growth than those from school libraries.

Summary Statement
This project examined how dirty computer keyboards are based on location, number of users and condition of the keyboard.

Help Received
Thanks to my parents for helping with the agar and setting aside a room for the sole purpose of growing the bacteria without causing a health hazard; also, thanks to my sister for her advice and guidance and my brother for technical support.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Andrew J. Strachan

Project Number
S1514

Project Title
The Effect of Metallic Conductivity on Microbial Life

Abstract

Objectives/Goals
The goal of this project was to determine if there is a correlation between microbial death and metallic conductivity. This is to extend published research demonstrating anti-microbial properties of copper to other metals.

Methods/Materials
Materials:
Petri dishes with agar, an incubator, various metal strips ranging from higher to lower conductivities than copper, bacteria from my hands, pen, tape, labeling materials and a camera.

Method:
At the start of the experiment, I rubbed each dish with two of my fingers across the agar to introduce common bacteria to the growth mixture. The bacteria was incubated for 10 days at which time numerous bacterial colonies were present. In each dish, a metal strip of different conductivity was placed. In addition, there was a single control dish in which no metal was placed. Over a period of five days, the life of the bacteria was monitored.

Results
I found a direct correlation between conductivity and microbial death rate. Silver, with the highest conductivity, had the highest deat rate while tungsten, with the lowest conductivity, had the least. The objectives of the project were met. We were able to show a correlation between conductivity and microbial death. We were also able to reproduce the published results which claims copper exhibited anti-microbial properties. To our knowledge, the correlation between conductivity and microbial death has never been reported before.

Conclusions/Discussion
This project set out to investigate a speculative claim about why copper exhibits anti-microbial properties. We were able to reproduce the original results and go beyond them by investigating the claims about conductivity. More study is necessary though. In order to effectively kill the bacteria had to make physical contact with it. In some cases, the bacteria was growing on the bottom of the growth media and not in direct contact with the metal. In these cases, it was often difficult to determine if the bacteria was in contact with the metal or not.

In this project, we investigated the correlation between conductivity and microbial death. A closely related

Summary Statement
In order to extend publich research demondstrating the anti-microbial properties of copper, we performed an experiment to investigate the possible correlation between metalic conductivity and microbial death.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Kiran Suryadevara

Project Number

S1515

Project Title

Avoid Foodborne Illness Naturally Using Neem, Guava, Turmeric, and Honey

Abstract

Objectives/Goals

Foodborne illness affects an estimated 48 million people each year in the United States, as well as countless millions all over the world. The most commonly recognized foodborne illnesses are those caused by bacteria such as Salmonella and E. coli. The purpose of this experiment was to determine if neem, guava, turmeric, and honey have an antibacterial effect on raw chicken. In addition, I wanted to find out if these natural substances were effective against E. coli and Salmonella bacteria, so I could determine their possible potential in preventing foodborne illness. It is specifically hypothesized that neem will be the most effective at discouraging bacterial growth on raw chicken since multiple studies have implied its wide uses as an antibacterial.

Methods/Materials

Equally massed chunks of raw chicken meat were treated with the neem, guava, turmeric, and honey for a controlled amount of time. Using appropriate dilutions, bacteria present on the surface of the meat was taken and cultured in petri dishes in order to determine the effectiveness of each "spice". The second part of my experiment included testing of E. coli and Salmonella bacteria; six petri dishes with bacterial lawns were created. Inhibition dots treated with neem, guava, and turmeric were placed on the lawns to observe the inhibition zones.

Results

Of the four substances tested, neem was the most ineffective at inhibiting bacterial growth. The chicken treated with honey had the least amount of bacteria present after treatment. Of the four substances, guava had the least bacteria diversity. Sub experiment 2 yielded no significant results as there were no visible zones of inhibition present on either the Salmonella or E. coli bacterial lawns.

Conclusions/Discussion

It can be conclusively determined that neem, guava, turmeric, and honey reduced the number and variety of bacteria present on raw chicken meat. However, the treatment of the chicken with neem proved to be a largely ineffective method for reducing the bacteria. As far as quantitatively inhibiting bacterial growth, honey would be the most effective natural substance to use. These findings suggest that all four substances have potential in preventing foodborne illness, honey being the most useful. This may address the real-world concern of illnesses due to foodborne pathogens, and lead to conclusive evidence to help people in preventing foodborne illnesses world-wide.

Summary Statement

This project tested the potential of natural substances in the prevention of commonly problematic foodborne illnesses caused by such bacteria as E. coli and Salmonella, as well as the potential benefits in the food industry.

Help Received

Arcata high school chemistry and biology teachers, Mr. Earl Peters and Ms. Cindy Condit, provided oversight and guidance. Additional assisance was provided by Ms. Andrea Yip at Humboldt State University who provided bacteria cultures and advice on experimental design.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
David K. Tang-Quan

Project Number
S1516

Project Title
Evaluating the Role of the HOG1 and ESCRT Pathways in Host/Cell Interaction and Stress Response of Candida albicans

Abstract

Objectives/Goals
The fungus Candida albicans can enter the bloodstream in immunocompromised patients, infecting most organs of the body and resulting in disseminated candidiasis, which has a 50% mortality rate. Since current antifungal treatments are non-specific and ineffective - often hurting the host as much as they help - a more specific and targeted approach toward treating C. albicans infections can provide a much needed medical breakthrough. This project sought specific genes that could be targeted to inhibit C. albicans normal function so that fungal cells can be killed without harming human cells.

Methods/Materials
A forward genetic screen of over 150 kinase insertion mutants found that the HOG1 (High Osmolarity Glycerol) pathway and ESCRT (Endosomal Sorting Complex Required for Transport) pathway were both necessary for stress response. Further research was conducted on the ESCRT pathway in an endocytosis assay as well as a cell damage assay in order to determine its role in host/cell interaction.

Results
Both the HOG1 and ESCRT pathways were implicated in C. albicans normal stress response to the body's defense mechanisms. Furthermore, early or late gene inhibition in the ESCRT pathway severely impaired C. albicans proper interaction with host epithelial cells. Specific subcomplexes within the ESCRT pathway proved to be more important than others.

Conclusions/Discussion
Overall, either of these two biochemical pathways can be inhibited in C. albicans in order to disrupt its normal function and cause it to die. Since these genes are non-homologous in human cells, they provide specific gene targets for future medications. These discoveries will help in significantly decreasing the high mortality rate of disseminated candidiasis as well as other fungal diseases.

Summary Statement
This study determined specific gene pathways within the fungus Candida albicans that can be targeted to kill the fungus but not human cells.

Help Received
Used lab equipment at Los Angeles Biomedical Research Institute; mentored by Dr. Scott Filler; supervised by Norma Solis.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Easter C. Thames

Project Number
S1517

Project Title
The Effects of Oral Antiseptics on Salivary Bacteria

Abstract

Objectives/Goals
The purpose of the investigation is to find which antiseptic [Mouthwash, Hydrogen Peroxide, or Toothpaste] inhibits oral bacterial growth most effectively.

Methods/Materials
The antiseptics used as independent variables were Mouthwash, Hydrogen Peroxide, and Toothpaste. The main bacteria grown were streptococci, as they are the most common species of salivary bacteria. Ten samples of saliva were collected with signed parental consent and diluted. One-half mL each of the diluted sample and antiseptic were mixed to yield a 1mL solution to be plated on Petrifilm. Positive and sterility controls were utilized and trials were run for the purpose of ensuring validity and reliability in the experiment. The positive controls were the samples that did not receive the antiseptic, while the sterility controls were the pure antiseptics and Distilled Water. The samples were incubated at 37 °C in an incubator to simulate the temperature of the bacteria#s living environment (the human body). After 24 hours of incubation, colonies were counted and recorded as CFU/mL.

Results
It was found that Hydrogen peroxide worked most effectively, yielding, on average, a 77% decrease in bacterial growth, compared to the positive control. Toothpaste had a 68% decrease and Mouthwash had a 63% decrease.

Conclusions/Discussion
The results obtained and analyzed support the hypothesis that Hydrogen Peroxide [H(2)O(2)] would be most effective at limiting salivary bacterial growth. The Hydrogen Peroxide product contains an active ingredient of 3% H(2)O(2), which, when coming in contact with organisms that contain the enzyme catalase, is split into H(2)O [water] and O(2) [oxygen gas]. However, some bacteria, including some in the oral cavity like streptococcus, do not contain catalase and, therefore, die in the presence of H(2)O(2).

Summary Statement
This project focuses on the effects, specifically the average decrease in colony count (CFU/mL), of different oral antiseptics on the inhibition of colony growth of bacteria found within the oral cavity.

Help Received
Parents bought material for display; Teacher, school, and 3M provided lab equipment; friend, Lisa, took pictures

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
Hyungjin Kim; Xiaolin Zhu

Project Number
S1518

Project Title
Antimicrobial Brass in Aqueous Medium

Abstract

Objectives/Goals
The purpose of the project is to identify metals that can safely produce clean water for places where accessing uncontaminated water is an issue.

Methods/Materials
We first determined what metals exhibit a antibacterial effect by analyzing their effect on E. coli OP50 in a bacterial lawn. Next, we took the metals that did show an effect and measured each of their relative potency. For this procedure, we put each metal into an inoculated flask of bacterial broth and periodically measured the broth's absorbance in a spectrophotometer. Lastly, we repeated this with different compounds of brass.

Results
In the initial experiment, silver, copper, zinc, and brass displayed "zones of clearing" in the agar. In the flasks, silver had the greatest potency, followed by brass, copper, and zinc. Lastly, Brass 230 had a higher antibacterial effect than Brass 260.

Conclusions/Discussion
Because silver is expensive and also causes skin to turn blue, a disease called argyria, brass is the more optimal metal to employ as a antimicrobial agent in filters and among daily things such as doorknobs, subway handles, etcetera.

Summary Statement
Our project was to determine which antimicrobial metal had the greatest potency in stunting the growth rate of E. coli OP50 and to find practical applications for said metal.

Help Received
Worked in science lab under the supervision of Dr. Wenzel at school.

CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

Neera Shah; Nehaly Shah

Project Number

S1599

Project Title

Saving Citrus Trees: Detecting Bacteria Associated with Citrus Greening Disease in Asian Citrus Psyllids

Abstract

Objectives/Goals

Citrus greening disease (or huanglongbing, HLB) was introduced in the Western hemisphere in 2004, has already destroyed about a third of the industries in both Florida and Brazil, and has spread to several countries including Mexico. Asian citrus psyllid (ACP, Diaphorina citri), the vector of the disease, was introduced in San Diego in 2008, has spread to several counties and is threatening to invade California commercial citrus. This project was aimed at comparing different methods of psyllid DNA extraction and developing a rapid high throughput technique for detection of HLB associated fastidious bacterium, Candidatus Liberibacter asiaticus.

Methods/Materials

Psyllids maintained on HLB infected plants in a containment facility in Florida were shipped in 95% ethanol in accordance with regulations and stored frozen. DNA extractions were made from 48 to 96 single psyllids using three different methods: 1) Qiagen Blood and Tissue kit (QBT, commonly used method), 2) MP BIO kit (MPB, used in the host laboratory) and 3) Qiagen magattract high throughput method (QMAG). The samples were analyzed by standard Taqman-based multiplex real-time PCR assay targeting 16s ribosomal DNA of the HLB bacterium and the wingless gene of the psyllid. Selected samples were tested by conventional PCR and the 1167 bp product was cloned and sequenced for confirmation.

Results

HLB associated bacteria were detected in 23%, 14%, and 7% by QMAG, QBT, and MPB, respectively. Analysis of internal control DNA showed that only QMAG extractions contained psyllid DNA in 100% of the samples, but not those extracted by QBT (23%) and MPB (82%) methods. The first attempt using QMAG method showed cross contamination among samples. The issue was resolved by changing liquid handling methods during extraction. The use of several controls (DNA extraction control, non-target bacterial sample extraction control, no template PCR control and positive plasmid PCR control) helped to validate the assay.

Conclusions/Discussion

There is an intensive effort in California to prevent and monitor the spread of HLB by testing both psyllids and plants. Since a very low percentage of psyllids is known to carry the bacteria, large numbers of psyllids need to be tested to enable early detection and eradication of the pathogen. An improved, sensitive high throughput psyllid DNA extraction method was developed which may be useful for monitoring the HLB associated bacteria.

Summary Statement

An improved high throughput method of DNA extraction from Asian citrus psyllids was developed to facilitate efficient monitoring and early detection of citrus greening disease.

Help Received

Research was done in the United States Department of Agriculture, National Clonal Germplasm Repository for Citrus and Dates, Riverside, CA. Dr. Richard Lee and members of the laboratory generously provided facilities and guidance.