CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Angela Abma; Vanessa Kumar

Project Number
J1601

Project Title
Fungi Busters

Abstract

Objectives/Goals
To determine how much & which antifungal medication is required to slow down growth of fungus.

Methods/Materials
We made CO2 collection apparatus by drilling a hole in an empty 500ml water bottle cap inserting two inches of tubing & sealing it into cap using epoxy glue to make it airtight. Attached cap onto bottle placing other end of tubing in water filled graduated cylinder inside bucket of water. Next we dissolved 1/2tsp sugar into 1/4 cup water that is 115 degrees F. Once sugar is dissolved, 1tsp of yeast is added & Solution is poured in bottle & capped with tubing in place. Tubing from bottle is inserted into the cylinder. Data is collected next making a note of when bubbles foamed, time of CO2 production and its level at 15 minutes. This was control test. Same method was used by adding 1/4 & 1/8tsps of medications to the similarly prepared solutions.

Results
Our goal for this research project was to test independent variable which are three antifungals in different amounts & their effects on dependent/constant variable which is same amount of water, sugar & yeast. Noted pattern was that higher amount of antifungal medication was more effective in controlling fungal growth for one of the medication. Only comparable average was with lower amount of Lamisil & higher amount of Lotrimin produced somewhat similar outcomes. We did not feel there were any errors of uncertainties that had affected validity of our results but we conducted repeat trials to rule out potential errors but our results for Lamisil were same. Our hypothesis proved to be partially correct which can be explained in conclusion. Changing the independent variable which is antifungal medication amount did cause change in dependent variable which is growth of fungus.

Conclusions/Discussion
Our research trial proved to be partially correct as one medication in high dose and another in low dose produced similar results. One medication proved to be completely ineffective. We were unable to compare our findings with another research as no other comparison was made using three medications we used. We could do further experiment by adding higher controlled variable which is yeast as well as expired vs. non-expired medications. We recommend using Lamisil as it had the most effective outcome against the growth of fungus with lower dose compared with other medication. This may benefit patients from buying less effective medications to save money & time

Summary Statement
To determine which and dosage of antifungal medication is best to treat toe nail fungus.

Help Received
Vanessa's mother overlooked our project for safety reasons with hot water.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Jenna E. Beausang

Project Number
J1602

Project Title
Natural Born Killers: Essential Oils as Inhibitors of Bacterial Growth

Abstract

Objectives/Goals
To determine which essential oil (oregano, eucalyptus, or tea tree oil) was most effective in killing or inhibiting the growth of E. coli bacteria. To find out if essential oils are good alternatives to harsh prescription medicines to treat infections.

Methods/Materials
Identical agar solutions were prepared in three Petri dishes. E. coli bacteria from a science store was spread in a #lawn# pattern on all dishes and allowed to develop. Once colonies developed, they were measured with calipers and growth was logged. Next, three drops of essential oil were placed on half the colony in each dish (1-oregano oil, 2-eucalyptus oil, 3-tea tree oil). One-half of the bacterial colony in each dish was kept clear of oil to act as a control to see if the oil stopped growth on the other half of the colony. After two days, colonies were re-measured to determine if the oils were effective in stopping the growth of or killing the bacteria.

Results
Of the three oils, oregano was the most effective at stopping the growth of the E. coli bacteria. The surface area of the E. coli bacteria in the Petri dish with oregano oil was smaller than the that of the bacteria in the dishes with the other oils.

Conclusions/Discussion
The experiment proved my hypothesis: of the three essential oils (oregano, eucalyptus and tea tree), oregano is the most effective in stopping the growth of or killing E. coli bacteria. Essential oils made from plants contain phenols, which have antibiotic and anti-inflammatory properties. The main phenol in oregano oil is carvacrol, which has been proven to be one of the most effective antibiotics known to science. Hopefully in the future, natural methods, such as essential oils, can be used to treat illnesses instead of harsh prescription medicines.

This experiment meant a lot to me, since I have Crohn#s Disease and I take strong medications to fight infections. The prescription medications makes me feel bad, so I want to find natural alternatives. I hope more experiments can show that essential oils can help kids fighting illness. Then they wouldn#t have to use prescription medications that make them even sicker than they already are.

Summary Statement
My experiment tried to determine which essential oil (between oregano, eucalyptus, and tea tree oil) was most effective at killing or inhibiting the growth of E. coli bacteria

Help Received
My parents purchased the materials. My Science teacher helped me decide how to perform my experiment. Local high school students helped prepare me for interviews.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

James C. Bowden

Project Number

J1603

Project Title

Antibiotic Resistance by Repeated Exposure

Abstract

Objectives/Goals

This study investigated the development of antibiotic resistance in the bacteria E.coli and S.epidermidis from natural mutation caused by repeated exposure.

Methods/Materials

Of the many materials used to conduct this study, the key materials used for this experiment were TSA, nutrient agar, E.coli culture and S.epidermidis culture (screened for contamination), ampicillin, Ultrapure water, and sterilization tools such as 70% isopropyl alcohol.

After all of the materials had been gathered, the TSA was mixed with water and autoclaved to kill any bacteria, and a quality control was run on the cultures of E.coli and S.epidermidis along with the agarose itself. Media was poured into the plates, and after the gel had solidified, the bacteria were inoculated along with Luria broth into the plates and labeled. Ampicillin solution-soaked filter paper disks were put into the plates and the plates were incubated for 24 hours, and then refrigerated until next use. The inhibition zones were measured and recorded, and then bacteria from the edges of the inhibition zones were picked up with a swab, and inoculated on a new plate. This process was repeated for each of 5 exposures. At the end of the experimental process, everything used was either thrown out in the bio-hazard trash or autoclaved.

Results

Over the course of 5 exposures to ampicillin, both bacteria did indeed gain resistance to the antibiotic gradually. However, the S.epidermidis gained resistance faster than the E.coli. The inhibition zones of the E.coli plates on average were reduced by 10.9 mm from exposure 1 to 5, while the inhibition zones of the S.epidermidis plates on average fell by 20.5 mm from exposure 1 to 5. The E.coli did not reach full resistance, while about 78% of the S.epidermidis cultures were fully resistant by exposure 5.

Conclusions/Discussion

The data supported the hypothesis in that it confirmed that repeated exposure does lead to antibiotic resistance in E.coli and S.epidermidis, but opposed the prediction that E.coli would develop resistance first. The results propose that lower concentrations of antibiotic make it easier for bacteria to develop resistance, and that an unknown factor such as the resistance methods or capability to produce biofilms of S.epidermidis in turn made it more resistant.

Summary Statement

This project studied the effects of repeated exposure to ampicillin on the antibiotic resistance of bacteria E.coli and S.epidermidis, and determined that repeated exposure does cause an increase in antibiotic resistant bacteria.

Help Received

Used lab equiment at Pierce College under the supervision of Karin Steinhauer

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Hannah O. Cevasco

Project Number

J1604

Project Title

Honey, I Found A Cure! Nature's Healing Agent/ Anti-inflammatory

Abstract

Objectives/Goals

A scratch wound heal assay using primary human dermal fibroblasts was conducted to determine if using Manuka honey as a topical healing agent promotes faster in vitro wound closure compared to a wound that is left untreated.

Methods/Materials

All work was conducted in a biosafety hood to prevent contamination. Dual-chambered silicon culture inserts were placed in each well on two 12-well microplates using sterile forceps. Then, 70µl of primary human dermal fibroblasts suspended in DMEM liquid media were dispensed into each well at a concentration of 500,000 cells per chamber. The cells were allowed to grow to confluency in a 37 °C incubator, 5% CO2 for 24 hours. After the incubation period, the culture inserts were removed and specific wells were flooded with Manuka honey solutions at concentrations of .5%, 1% and 2% as well as a control solution, a sugar solution, and a 1% Manuka honey solution that was extracted and replenished at each time interval. Images of each well were taken using an inverted microscope at a 5x magnification at 0,2,4,6,8,12, 24, and 32 hours.

Results

The results of this experiment show that Manuka honey (MH) at a 1% concentration has a significant effect on cell migration while the 0.5% and 2% concentrations have a minimal effect. The process of cell migration was photographed using a 5x inverted microscope and the images were uploaded to Wimasis Image Analysis software for data quantification. Several T tests were conducted at the time points where there was a significant difference between the cell covered area in trials with the 1% MH and the control. Statistical analysis shows that the 1% MH solution was significantly more effective than the control at the 12 and 24-hour time point. The p-values for these T tests were .0344 and .0157 respectively, which indicates that the superior performance of MH at a 1% concentration in comparison to the control can be confirmed with a 95% confidence interval.

Conclusions/Discussion

The use of Manuka honey as a topical healing agent promotes faster in vitro cell migration. This study is a continuation of an experiment conducted last year that proved that Manuka honey is also a powerful antibiotic. Further studies will continue to explore the antibacterial and anti-inflammatory properties of Manuka honey as well as its potential for cancer treatment.

Summary Statement

This study proved that the use of Manuka honey as a topical healing agent promotes faster cell migration in an in vitro scratch wound heal assay.

Help Received

Butte Lab at Stanford University graciously allowed me to conduct my experiment in their lab, Kevin Meng (a graduate student) monitored my activities in the lab, and of course, my mom was always there for me and shuttled me to and from the lab at any hour. :-)

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Rene M. Chavez

Project Number

J1605

Project Title

Is It Safe to Place Your Mouth on the Water Fountains at Local Parks?

Abstract

Objectives/Goals

The objective is to determine if it is safe for people to place their mouths on the mouthpieces of water fountains located at six of the busiest parks in the Ukiah area; Todd Grove Park, Low Gap Park, Alex Thomas Plaza, Oak Manor Park, Vinewood Park, and West Fork Estates.

Methods/Materials

Sterile swabs circled a mouthpiece clockwise three times on eight water fountains. The fountains were from six of the busiest parks in the Ukiah Area-while both fountains were sampled in the parks that had an adult-height and kid-height fountain. Each was placed in a sterile container and plated on agar plates at 37 degrees Celsius for a 24-hour period. At the end of this time period, the colonies were counted and compared with four controls.

Results

75% of the sampled mouthpieces of water fountains grew bacterial colonies. Todd Grove Park grew one colony, Low Gap Park-adult fountain grew two colonies, Low Gap Park-kid fountain grew two colonies, Alex Thomas Plaza-adult fountain grew zero colonies, Alex Thomas Plaza-kid fountain grew three colonies, Oak Manor Park grew one colony, Vinewood Park grew one colony, and West Fork Estates Park grew zero colonies of bacteria. For the controls, the air-exposed plate grew two colonies, the plain agar plate grew one colony, the positive control grew 64 colonies of Enterobacter Aerogenes, and the negative control grew zero colonies of bacteria.

Conclusions/Discussion

The results of my experiment showed more colonies grew from the Alex Thomas Plaza-kid fountain. However, my agar-only control grew one colony and my air-exposed control grew two colonies. So, it is not certain whether my swabbed specimens produced bacterial colonies or whether this was due to air or agar contamination. But, I had three plates that produced zero bacterial growth-West Fork Park, Alex Thomas Plaza-adult fountain, and my negative control. If the agar or air was contaminated, there should have been growth on every plate. Therefore, I believe that my bacterial colonies may have been have produced by my swabbed specimens.

Summary Statement

My project is addressing whether there is too much bacteria to place your mouth on the mouthpieces of water fountains at six of the busiest parks in the Ukiah area.

Help Received

My mother helped drive me to locations and take pictures of me with specimens. Zee Hopper of Alpha Analytical Labs let me use her incubator, agar plates, sterile specimen bottles, colony counter, and facilities.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Liam N. FitzGerald

Project Number
J1606

Project Title
More Water, Please?

Abstract

Objectives/Goals
My experiment tests if solar water disinfection (SODIS) can be improved by changing roof-types, bottle condition, or adding salt.

Methods/Materials
I collected water from Averill Park, filtered the solids, and poured it into 7 properly-labeled PET bottles using roof-types, bottle condition, and adding salt as variables. I performed both chemical and coliform tests on each. I used Waterworks test strips to check hardness, chlorine, alkalinity, pH, nitrate, nitrite, and chromium. To check for E. coli, I used MicrologyLabs Easygel by dropping 5 ml samples from each bottle into the appropriate medium and subsequently pouring each into labeled petri-dishes. I later analyzed the petri-dishes after being left in a home-made incubator for twenty-four hours. I exposed six bottles to direct sunlight and put one in a dark closet. I had 2 controls, one for temperature and one in the closet. I checked the temperature of the control on the roof hourly. After 6 hours of sunlight exposure, I performed both tests again. I did the experiment twice.

Results
SODIS worked both times. The first was on a very hot day; all petri-dishes were completely disinfected except for the control in the dark closet. The second time was on a foggy day; the scratched bottle still had few E coli left. The chemicals upon collection were within the allowed levels except for hardness and chromium. Hardness only affects taste but chromium may be harmful. After SODIS, the chemical levels remained the same.

Conclusions/Discussion
SODIS removed the bacteria regardless of roof-types, bottle condition, or adding salt. But it left chemicals behind that could make the water taste bad or worse, harmful. Next time, I will test if SODIS combined with ion-exchange treatment will work better.

Summary Statement
SODIS is proven to be an effective method of making water accessible to people without it -- but can it be improved, potentially saving more lives?

Help Received
Work at school lab supervised by Ms. Lindsay Martin and Dr. Hanan Sedik, a medical doctor; Parents funded the experiment; and Father drove me everywhere I needed to go

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Sydney S. Gamble

Project Number
J1607

Project Title
Ebola: Treating the Terror of Our Time

Abstract

Objectives/Goals
The objective of this experiment was to determine if a treatment for the Ebola virus could be derived from a common over the counter enzyme.

Methods/Materials
The Ebola virus triggers a dramatic overproduction of glycoprotein. Oyster mushrooms (Pleurotus ostreatus) were determined to be very high in glycoprotein and therefore used to emulate the effects of the Ebola virus on the human body. Enzymes were also identified by the scientist as a means to break down proteins. Thus, the Alpha-galactosidase enzyme (an over the counter anti-indigestion remedy) was administered to ten oyster mushroom solution beakers (or test subjects). Four intervals of enzyme dosing (900GaIU each) at 12-hour increments were applied across a 48 hour period. Glycoprotein levels were measured using protein test strips before and after each dosing interval. A control test was also conducted as well as testing for the denaturation variable (unintended protein reduction due to outside stress such as heat/blending).

Results
The glycoprotein content in the mushroom solution beakers where the Alpha-galactosidase enzyme was administered decreased dramatically signifying the eradication of harmful glycoprotein levels as manifested by the Ebola virus. The most notable decline was after the first dosing interval where the glycoprotein content across all ten beakers dropped from an average start reading of 217.5mg/dL units to an average of 39.3mg/dL units or an 81.9% decrease. After all four dosing intervals, the glycoprotein content declined to an average of 8.5mg/dL units across all beakers. In total, 96.2% of the original glycoprotein content was eradicated. Conversely, glycoprotein in the control test where no enzyme was administered remained high, averaging 203.7mg/dL units across the same 48 hour testing period.

Conclusions/Discussion
The Alpha-galactosidase enzyme therapy proved extremely effective in reducing harmful glycoprotein content levels in the mushroom solution beakers by 96.2%. The greatest reduction rate of 81.9% was after the first interval or dosage, indicating the proposed enzyme treatment would be most effective in the early stages of infection.

Summary Statement
The focus of this project was to determine if the Alpha-galactosidase enzyme is an effective treatment for the Ebola virus, as such a breakthrough could contribute to the prevention of an Ebola pandemic.

Help Received
Obtained supplies from school (balance scale and beakers).

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Mandy L. Greene

Project Number
J1608

Project Title
Wash Your Hands

Abstract

Objectives/Goals
My hypothesis is to prove which drying method, towel or air drying, works better to remove bacteria after washing your hands. I think drying your hands with a paper towel would produce fewer bacteria spores, because you can dry your hands instantly instead of blowing the water away with air. Research claims that air drying your hands produces less bacteria spores because it blows all the bacteria away, which I have a hard time believing.

Methods/Materials
First, I acquired my materials for my experiment and headed to the kitchen to start the process. I started by washing my hands and towel drying them. Then I riffled through my school backpack, touching books, pencils and other items within my backpack. Then I washed my hands with soap and water then dried my hands with paper towels. After drying my hands, I swabbed them with the cotton swab to get samples of any bacteria that was present. I then took the cotton swab and rubbed it around the inside of the petri dish and closed the lid. I repeated this process two more times, drying by paper towels and three times drying with air.
6 Petri dishes, my school backpack, bargain brand soap & paper towels, blow dryer/air, water/sink and cotton swabs

Results
After washing my hands I swabbed my hands and placed the bacteria into the petri dishes. At this point nothing was visible in the dishes and then within one month I started to see a hazy cream coloring within the dishes. This haze started covering the bottom of the dishes in one degree or another. Then within the next two weeks black bacteria spores became visible on the surface of the haze. Apparently these spores are called fructo-oligsaccharides which are a type of pathogen. In one of the dishes I saw strange long swirl shapes like a sea creature, and in other dishes some resembled worms on the move or slugs leaving a trial of slim behind them. Near the end of the experiment I started to smell a putrid odor around the area of the dishes. The smell was like an old pair of socks soaked in sweat that haven#t been washed in a long time.

Conclusions/Discussion
My hypothesis was correct; drying your hands with paper towels produced fewer amounts of bacteria than by drying your hands with air, as visible in the pictures of the petri dishes on display. So, remember in order to have fewer bacteria growing on your hands, wash them and dry them with a paper towel regularly.

Summary Statement
My project is to prove which drying method, towel or air drying, works better to remove bacteria from your hands after washing.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Saachi K. Grewal

Project Number
J1609

Project Title
Nature's Defenses

Abstract

Objectives/Goals
The objective of this project was to test my hypothesis that tea tree oil will prove to be the most effective on the bacteria specimens that are commonly found on hands because of its common use in disinfectants. My goal was to find the most effective natural antimicrobial (I tested tea tree oil, garlic, turmeric, and raw honey) that could kill common skin flora.

Methods/Materials
To test tea tree oil, raw honey, turmeric and garlic, I used Bacillus Cereus and Staphylococcus Epidermidis and flora from hand. I first cultured the bacteria on agar plates by streaking. After the bacteria was cultured, I applied the antimicrobials and measured the area around where the antimicrobial was placed (zone of inhibition). I recorded each step and the observations about the growth of the bacteria and the effect of each antimicrobial on the specimen. A variation of the Kirby Bauer method to measure the effect of the antibacterial on the bacteria was used. I used sterilized petri dishes, nutrient agar, the bacteria specimens, the antimicrobials, and the inoculating loops.

Results
The results of my experiment proved that raw honey was the most effective against the bacteria specimen. Honey had an average of 93 millimeters zone of inhibition. The average area the garlic affected was about 46 millimeters. Turmeric was not as successful, having an average of 37 millimeters. Tea tree oil proved to be extremely inefficient against the bacteria, not causing significant inhibition of the bacteria, however, under a microscope, it was evident that the tea tree oil had made an impact on the bacteria only where it had been placed, but the impact could not have been seen with the naked eye.

Conclusions/Discussion
The results did not support my hypothesis that tea tree oil would be the most effective. My findings show that natural antimicrobials could be used to treat both pathogenic and nonpathogenic bacteria and infections. In order to tell whether raw honey could be used in the hospital, further research would have to be done. Antimicrobial resistance is becoming more common, and these findings of natural ways to expel bacteria could be a possible solution to this problem.

Summary Statement
I examined the effect of four antimicrobials against different skin flora, (bacteria found on hands

Help Received
The materials for the project were supplied by my dad, and he assisted me with the culturing of the bacteria

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Michelle J. He

Project Number
J1610

Project Title
Understanding the Oligodynamic Effect: Can Metals Kill Bacteria?

Abstract

Objectives/Goals
The purpose of this experiment was to look for correlations of the properties of metals and their antibacterial strength. This experiment looks into the oligodynamic effect. This effect is little studied and relates to how certain metals kill bacteria on contact. Certain metals such as copper are more oligodynamic than others, and this may be due to an oxidation process. Finding trends between the properties of the metals such as conductivity and reactivity may help understand the mechanisms of the effect.

Methods/Materials
Two types of bacteria, E.coli, and S. epidermidis, were tested. They were grown on agar plates in an incubator. Eight types of metals were tested. They were titanium, aluminum, zinc, nickel, tin, copper, and silver. The metals were cut into 2.5 cm squares.

Results
In order from most to least effective, the metals were copper, silver, tin, titanium, nickel, aluminum, and zinc. The kill rate of copper was much higher than any other metal. The copper removed over 90% of the bacteria growing under the plate. Zinc apparently encouraged growth the most. Between the two bacteria, neither was majorly more susceptible to the metal.

Conclusions/Discussion
There were not obvious patterns among the properties of the metals in both conductivity and reactivity. Much of the data for all the metals was similar. Only copper and zinc stood out distinctly, the two outliers. This data from this experiment reinforces evidence about the antibacterial properties of copper. Information is added of bacteria interaction with zinc.

Summary Statement
This project involved testing the reaction of different metals when placed on bacteria in order to study the oligodynamic effect.

Help Received
Parents helped conceive idea and make board. Mentor Dr. Tai Wei Ly provided the lab to test in and equipment to test with as well as invaluable guidance.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Samantha M. Lieberg

Project Number

J1611

Project Title

Book Worms: Determining the Effectiveness of the Standard Practice of Cleaning Library Books

Abstract

Objectives/Goals

The Objective is to determine the effectiveness of the standard library cleaning method and the average amount of bacteria on library books. It also explores if there is a correlation between the books# genre, age, and number of checkouts to the amount of bacteria.

Methods/Materials

Twelve library books from each age genre (three separate genres) were swabbed for bacteria on a cleaned and uncleaned section on the front and back covers. The bacteria was grown in a petri dish, and LB Agar was the medium. The colonies were counted after five and eight days. New books and new Ziploc Bags were also tested.

Results

It was found that the standard library book cleaning method only reduced the amount of bacteria growing on library books by 10 percent. The genre with the most bacteria was juvenile, with an average of 42.22 Colony Forming Units.

Conclusions/Discussion

The conclusion that has been made states that the library book cleaning method is not effective enough to use. It also has been stated in the conclusion that juvenile books have the most bacteria.

Summary Statement

Bacteria from library books was grown to determine the effectiveness of library book cleaner and to see if there is a correlation between a book#s genre, age, and number of checkouts to the amount of bacteria.

Help Received

Ms. Erin McKay, a bio-tech professional, helped supervise my project as well as teach me many new things about bio-tech protocols. My mother, Christina Orsi, helped me organize the board and supplied funds for purchasing materials.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Tai L. Michaels

Project Number

J1612

Project Title

Which Bacteriophage Is Better at Killing Bacteria?

Abstract

Objectives/Goals

This experiment studied which bacteriophage strain (T4r+, phiX174, or P1) would lyse a larger area of various Escherichia coli strains (B, C, K-12, and K-12 pilus forming) when compared to the titer of the phage in the solution added.

Methods/Materials

0.25-mL of the bacterial culture was micropipetted into a vial containing 3-mL of soft agar and 0.1-mL of a dilution of a strain of bacteriophage. The mixture was distributed evenly on an agar plate and the process was repeated for all of the other combinations of bacterial strain, phage strain, and phage dilution. The number of plaques was recorded at 12 and 36 hours for all of the plates.

Results

P1 lysed less area of the bacterial lawn than phiX174, but it also had a lower titer and was therefore slightly more efficient. T4r+ did far better than either of them in virtually all of the trials.

Conclusions/Discussion

The results indicate that T4r+ would be most efficient at lysing E. coli. Also, it would appear that the accuracy of the phage is not as important as its speed in lysing the cell since the way the different strains performed directly correlated to their speed in lysing their host cell.

Summary Statement

This experiment tested which bacteriophage was more efficient at lysing E. coli cells.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Bianca L. Nurnberger

Project Number

J1613

Project Title

Effects of Colloidal Silver on Bacteria

Abstract

Objectives/Goals

This project is directed to find natural alternatives for prescription medication. Colloidal silver is a suspension of submicroscopic metallic silver particles in a colloidal base, it#s known to naturally kill harmful bacteria while strengthening the helpful kinds, and bacteria cannot become immune to it because it attacks them in different ways.

Methods/Materials

This project was tested was by applying 0, 10, and 40 drops of 15-PPM colloidal silver water on shower door bacteria and pepper mold with 2 of each sample for accuracy and reproducibility. According to the measure of drops on the colony, the growth time will be affected.Over 9 days, the mold and bacteria colonies slowed down growth while the controlled sample with less silver continued to expand. The mold colonies with 40 drops grew on average coverage up to 65%, 10 was 85%, and the controlled was 94%. As for the shower colonies 40 drops grew to 85%, 10 to 96%, and controlled was 157% because the colony grew, it grew taller. As predicted, the samples with more drops halted growth.

Results

These results were somewhat what expected, the colonies with more drops stopped growing while the ones with less expanded. If colloidal silver treats all infections the way it treated this experiment, drugs may be replaced by something natural. Adding more drops to get more dramatic results could change this project.

Conclusions/Discussion

All in all this test found that colloidal silver does treat bacteria according to the amount of silver applied and the silver saturation level. This project can later be studied with more samples and different substances. As stated before, more drops added, the more dramatic results will be found.

Summary Statement

This project is to test the efficacy of home made colloidal silver solution in retarding the growth of established bacterial colonies.

Help Received

Dieter Nurnberger (father) supplied materials and helped carry out the project ; Mrs. Dawn Jacobson walked me through the process of making a science fair project.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Jaclyn R. Schwartz

Project Number
J1614

Project Title
Can Water Be Disinfected Using Only Sunlight?

Abstract

Objectives/Goals
My goal was to see if I could disinfect water using the SODIS method. SODIS is a type of water disinfection process using sunlight. You put the contaminated water in a PET (water) bottle and leave in the sun to be disinfected.

Methods/Materials
The SODIS method to disinfect the contaminated water
PET bottles
Watercheck Test (Water color changing test)
Coliscan Easygel Test (Growth test with petri dishes)
Aluminum pan
A location with sunlight for at least 9 hours
Black light
Distilled water
Contaminated water

Results
My results were that it only took six hours for water to be disinfected. Water disinfection is defined as removal, deactivation, or killing of pathogenic microorganisms. Checking at three hour intervals, six and nine hours were completely disinfected of coliform and more specifically E. coli. We used E. coli as our indicator organism because it is the hardest pathogen to kill. But at three hours, the water was still contaminated. My positive and negative controls for the project turned out as expected.

Conclusions/Discussion
In conclusion, my hypothesis was both correct and incorrect. It was correct because I was able to disinfect the water. My hypothesis was also incorrect because it took only 6 hours for the water to be disinfected, not 9 hours that I hypothesized. I will conclude that for people who cannot boil water or afforded to buy chlorine, they can use this SODIS method, but they would only have to leave it in the sunlight for 6 hours to be fully disinfected.

Summary Statement
I wanted to see if it was possible to disinfect water by only using sunlight in the SODIS method.

Help Received
My grandmother helped me by suppling me with materials and a location to do my project. My mother helped me edit my report. My dad helped me find a contaminated water source.

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
Shruti Sridhar

Project Number
J1615

Project Title
The Antimicrobial Effect of Different Essential Oils on Staphylococcus

Abstract

Objectives/Goals
The purpose of this experiment was to determine whether common essential oils found in facial and skin products, clove oil, eucalyptus oil, and aloe vera, would have any effect on Staphylococcus. Eucalyptus oil was hypothesized to have the greatest bacterial inhibition.

Methods/Materials
The three oils were diffused into three filter disks each and placed in three agar plates with one colony of cultured Staphylococcus. After standard incubation, the plates were taken out and the diameter of the zone of inhibition, which is the circle of clear media around each filter disk, was measured. The oil with the greatest zone of inhibition was then used in the remaining tests of this three-part project. The minimum inhibitory concentration was found by dropping that oil into nine tubes, diluting the amount dropped by two for each tube. Staphylococcus was placed in all tubes, and after sufficient incubation, the first tube with inhibited bacterial growth was recorded as the MIC. The minimum bactericidal concentration was determined by plating the tubes, incubating the agar plates, and recording the first tube to kill the bacteria, starting from least oil concentration to greatest.

Results
The hypothesis was not supported at the end. The first experiment showed that clove oil had the largest zone of inhibition, the average diameter being 14mm. For the next two tests, clove oil was used and 0.0662 grams was found to be the MIC and the MBC in the first trial. In the second trial, 0.00414 grams of clove oil was the MIC, and 0.53 grams was the MIC. In conclusion, the hypothesis was not supported.

Conclusions/Discussion
In conclusion, the hypothesis was not supported. Clove oil was the most effective antibiotic. The MIC and MBC test results were very different, therefore inconclusive. Further testing would have to be conducted in order to gather more reliable data.

Summary Statement
My project aims to find the essential oil that has the best antimicrobial effect on Staphylococcus

Help Received
I want to thank my mentor, Mr. Carroll for all his guidance throughout the project

CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

Alexander C. Young

Project Number

J1616

Project Title

Investigating the Rate at which Bacteria Develop Resistance to Antibiotics under Different Conditions

Abstract

Objectives/Goals

Antibiotic resistance is becoming an increasingly serious threat to public health in nearly every region of the world, as resistant strains of bacteria force patients to resort to higher-risk procedures and further shorten the list of effective drugs. The objective of this project was to determine if the misuse of antibiotics led to the accelerated development of antibiotic resistance over the course of several applications. I originally hypothesized that incomplete or incorrect dosages would not necessarily lead to accelerated selection, as suboptimal levels of antibiotic in the bloodstream would place less selective pressure on the population.

Methods/Materials

Mixed suspension of B. subtilis, M. luteus, and R. rubrum, nutrient agar plates, nutrient broth tubes, inoculating loops, cotton swabs, incubator, ampicillin solution, blank antibiotic disks, micropipettes, forceps, rulers

I began by streaking nutrient agar plates with mixed bacterial strains (B. subtilis, M. luteus, R. rubrum), placing down antibiotic disks impregnated with full strength ampicillin (simulated correct dosages), 1:10 serial dilution, 1:100 serial dilution, 1:1000 serial dilution (dilutions simulated incomplete dosages), and pure water (the control), and incubating the plates. After measuring the diameters of the zones of inhibition produced by the Kirby Bauer Disk Susceptibility tests, I subcultured the bacteria from around the edges of the zones of inhibition in nutrient broth, incubated them, and plated them. I repeated the process two more times to produce three generations with two rounds of selection.

Results

For each case and generation, I took the averages of the three replicates and compared the Generation 1 diameters to the Generation 3 diameters. The full strength case had a 31% decrease in diameter, the 1:10 dilution case had a 50% decrease in diameter, the 1:100 dilution case had a 53% decrease in diameter, and the 1:1000 dilution case had a 67% decrease in diameter.

Conclusions/Discussion

This evidence did not support my hypothesis; clearly, bacteria exposed to lower concentrations of antibiotic develop resistance at a faster rate over the course of several generations compared to those exposed to higher concentrations of antibiotic. Thus, patients taking antibiotics must be careful not to take incomplete or incorrect dosages, as the misuse of such drugs can accelerate the development of resistance.

Summary Statement

This project examines the rate at which populations of bacteria develop resistance over the course of several generations when exposed to different concentrations of antibiotic.

Help Received

My advisor, Dr. Thomas Artiss, provided advice and guidance throughout the process.