CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Alexandra J. Berger

Project Number
S1301

Project Title
Salinity's Effect on the Ammonia Nitrification Rate of Nitrosomonos sp. Bacteria

Abstract

Objectives/Goals
The scientific question I asked was, "What is the effect of subjecting Nitrosomonos sp. ammonia nitrifying bacteria to increasing salt concentrations? If there is an effect, can it be minimized by reducing the rate of salt addition?"
I hypothesized that the salt would have a negative effect on the ammonia oxidation rate of the Nitrosomonos sp. bacteria, however this affect could be minimized by the slow addition of salt, rather than the sudden addition of it.

Methods/Materials
Materials: Erlenmeyer flasks, an Imhoff Settling Cone, a refractometer, Instant Ocean salt, plastic vials, syringes, Flow Injection Anaylsis machines, Nitrosomonos sp. bacteria, and ammonium chloride.

Procedure: I added salt to Nitrosomonos samples to reach their varying salinities immediately. I added .59 grams of salt each day to different samples to reach these salinities and 1.19 grams of salt each day to reach these salinities. After each sample had reached its desired salinity, I added ammonia and took samples at 0, 2, and 4 hours. I measured the ammonia concentrations in Flow Injection Analysis machines.

Results
Fast addition: The bacteria at 5ppt oxidized 52% slower then the control at 0ppt, the 10ppt oxidized 40% slower, the 15ppt oxidized 41% slower, the 20ppt oxidized 42% slower, the 25ppt oxidized 50% slower, and the 30ppt oxidized 60% slower.
Medium Addition: The 5ppt oxidized 29% slower, the 10ppt oxidized 9% faster, the 15ppt oxidized 66% slower, the 20ppt oxidized 82% faster, and the 25 and 30ppt oxidized 88% faster.
Slow Addition: The 5ppt oxidized 19% slower, the 10ppt oxidized 38% slower, the 15ppt oxidized 49% slower, the 20ppt oxidized 47% slower, the 25ppt oxidized 63% slower, and the 30ppt oxidized 77% slower.

Conclusions/Discussion
I have concluded that my hypothesis is partially correct. Although the addition of salt did have a negative affect on the bacteria, the bacteria were least affected by the salinity when the salt was added all at once, rather then over a period of time. Because the bacteria were only exposed to the salt for a short amount of time, they did not go through the shock of having to deal with the extra salt.

Summary Statement
My project is about the effect of varying salinities on Nitrosomonos sp. bacteria, an essential part of the nitrification cycle in aquariums.

Help Received
Used lab at Aquaria Inc.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Thallia R. Bird

Project Number
S1302

Project Title
Essential Killers

Abstract

Objectives/Goals
My objective is to find how effective essential oils are at killing e.coli bacteria. I used dilutions of five different essential oils to test the effectiveness of essential oils. I will continue to dilute until the dilutions stop killing the e.coli bacteria.

Methods/Materials
I spread e.coli bacteria in a solution of beef broth onto sterile sheep's blood agar petri plates. I diluted the 100% pure essential oil with distilled water. I used dilutions 1:1, 1:2, 1:4, and 1:6. I placed drops of the dilutions on the innoculated petri plate and the incubated the petri plates at thirty-seven degrees centigrade or body temperature.

Results
Essential oils killed e.coli bacteria in all dilutions. Clove essential oil 1:4 dilution killed the best of all five essential oils I tested. Undiluted pine essential oil killed almost as well as the clove dilution. Mountain savory essential oil killed much less then the pine essential oil in all dilutions, but it killed a little more than the marjoran essential oil in all dilutions. Lemon essential oil hardly killed any bacteria at all.

Conclusions/Discussion
Essential oils are effective at killing bacteria but with varying levels of effectiveness.To be more accurate, I would need more definitive colonies to count the colonies of bacteria. The zones of inhibition are very large in these dilutions. I have a experiment in progress using smaller dilutions.

Summary Statement
Discovering how effective essential oils are at killing bacteria.

Help Received
Mom took a few pictures.Judy Ferelman helped me to get petri plates. Science teacher suggested using dilutions.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Lea Bond; Carynn Milne

Project Number
S1303

Project Title
Is Santa Cruz Harbor Safe? Phytoplankton Monitoring

Abstract

Objectives/Goals
To identify, study, and document the fluctuations of the toxic phytoplankton, Pseudo-nitzschia spp., Alexandrium catenella, and Dinophysis in the Santa Cruz harbor over the course of several months (September to June) to see if the Santa Cruz area is safe from Domoic Acid Poisoning (Shellfish poisoning). Does abiotic factors have an effect?

Methods/Materials
Samples were taken from the Santa Cruz harbor biweekly, unless there was unsafe conditions. One sample was sent to the California Department of Health Services and the other was taken to our science lab to observe. Using identification books and a powerful microscope, the sample was observed and phytoplankton found were classified and photographed and/or sketched. Qualitative analysis of the samples was recorded to see if there was any presence of harmful phytoplankton in the Santa Cruz harbor. We quantified our sample with relative abundance.

Results
There was Psuedo-nitzschia blooms in the final months of winter and beginning months of spring (February to April/May) resulting in samples containing over a 1000 specimens per 2 mL of Psuedo-nitzschia. This was to be expected because of upwelling but as of April 7, 2003, no Alexandrium was ever found and only on specimen of Dinophysis was encountered (January 28, 2003). Sense the first storm of the year in Santa Cruz, Psuedo-nitzschia was a constant species found in samples. In times before, it was not.

Conclusions/Discussion
It was found that the harbor was relatively safe from dangerous phytoplankton up until the late winter where Psuedo-nitzschia populations exploded. This supports our hypothesis that the harbor and Santa Cruz area are safe from the toxins released by such phytoplankton until late winter where upwelling of colder waters and nutrients are ideal for such species. No Alexandrium was found and Dinophysis never was of much concern. Our conclusion is that abiotic affects such as temperature and upwelling does, in fact, effect phytoplankton numbers but not necessarily all three deadly phytoplankton.

Summary Statement
To collect and monitor toxic phytoplankton and environmental factors in the Santa Cruz Harbor, in specific such species as Psuedo-nitzschia, Alexandrium and Dinophysis

Help Received
1)San Lorenzo Valley High School - Jane Orbuch- Camera, computer and lab access, 2) UCSC Marine Biology Department - Susan Coale - Microscope, 3) California Department of Health Services - Gregg L.- collection net and confirmations on species, and 4) Apri

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Darcy E. Bradley

Project Number

S1304

Project Title

Folate-Yeast Project: A Novel Solution to the World's Malnutrition Problem

Abstract

Objectives/Goals

The objective is to develop a strain of yeast high in folate through a process of selective mutation.

Methods/Materials

SAF yeast was streaked onto PDA media. A folate analog, methotrexate, was obtained and analog disks were prepared. A single yeast colony was collected and spread onto a PDA plate containing analog disks. The methotrexate inhibited growth in the regions surrounding the disks; however, a few mutant colonies were observed growing. Mutant colonies were collected and plated on a PDA media with three methotrexate disks in the center of the plate. This process was repeated several times to obtain pure mutant colonies. Next, a folate-dependent lactobacillus, 7469, was obtained to be used as an indicator bacteria. Colonies of 7469 were added to a solution of Folic Acid Minus media. Single mutant yeast colonies were collected from the plate containing the analog disks and re-plated on Folic Acid Minus media with 7469. Excretion growth surrounding the colonies was observed as an indication of which yeast colonies were over producing folate. Four colonies with most excretion plus a wild type colony were collected and placed in a solution of Folic AOAC Medium plus varying levels of methotrexate (0-12 drops, respectively) in order to eradicate any non-over producing folate colonies.

Results

Growth from methotrexate solutions will be collected and assayed by placing mutant colonies in a serial dilution array to eliminate the toxin. The analog-free mutant yeast colonies will then be re-plated and grown. Colonies will then be added to a sourdough starter, which will, in turn, be used to make bread. The amount of folate will be quantified using a mass spectrometer. Folate content of the bread produced from this experiment will optimally contain 400-800 micrograms in two slices (thus providing the U.S. Public Health Service recommended daily allowance of folate).

Conclusions/Discussion

The process of selective mutation effectively created a strain of yeast containing elevated levels of folate. Isolation and verification of a high folate producing strain of yeast that could be used in many food products would profoundly improve the human condition. Such a folate supplement would greatly reduce the prevalence of neural tube defects among infants and lower the occurrence of diseases related to elevated homocysteine levels including heart disease and cancer.

Summary Statement

An experiment was developed to create a yeast strain high in folate through a process of selective mutation.

Help Received

Research was performed in AgBioSciences Bldg. at Montana State University, supervised by Dr. David Sands, and at Cate School, supervised by Ms. Cheryl Powers.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Kirsti A. Burr

Project Number
S1305

Project Title
What Is the Effect of Exposure to an Electrical Current on the Growth of Escherichia coli?

Abstract

Objectives/Goals
This experiment is designed to test a theory of Dr. Hulda Regehr Clark, Ph.D., N. D., who believes that a battery may be used to destroy parasites within the human body. She states that by eliminating these parasites, a person can be rid of such ailments as the common cold, chicken pox, HIV, and even cancer. Her seemingly elementary invention, "The Zapper," is constructed mainly from a shoebox, wires, some capacitors, and a 9-volt battery. The procedure in this experiment challenges Dr. Clark's zapper in a more controlled environment.

Methods/Materials
Colonies of Escherichia coli will be incubated in sterilized agar plates. Groups of four plates will be "zapped" for one, four, seven, and ten minutes. ("Zapping" constitutes connecting alligator clips from the zapper's bolts to the steel grids in each plate and turning the apparatus "on" for the allotted time. This frees the flow of electricity through the circuit, including the bacteria.) A control group will not be zapped. The experiment employs steel grids as conductors to ensure that the current flows through as many bacteria as possible.

Results
Partial success of the zapper is supported by retardation in colonial growth in size and number after the zapping period.

Conclusions/Discussion
The voltage "kills" the bacteria, it is hypothesized, by breaking the hydrogen bonds in the bacterial chromosome. Gel electrophoresis will be used to support or refute this idea. A second conjecture is that the electrical current breaks up the proteins of the plasma membrane, causing the bacteria to lyse and expire. Observations will be made under a microscope to determine if this is or is not the case.

Summary Statement
The effects of the voltage of a 9-volt battery are observed on growth of Escherichia coli.

Help Received
Mother very supportive in editing abstract drafts, helping build zapper. Mrs. Houseman KEY in giving advice, providing classroom, materials, knowledge. Mr. Beach expert in physics, gave counsel, made plates. Hoping to obtain enzymes from La Sierra University. Mrs. Bera also helpful in board design. Dr.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Vanessa E. Cox

Project Number

S1306

Project Title

A Two Year Study: Isolation of the Antibiotic Fraction of Arctostaphylus Using the Extraction of Eugenol as a Model

Abstract

Objectives/Goals

The objective of the experiment was to isolate the chemical fraction in which the bioactive ingredient of Arctostaphylus was located.

Methods/Materials

In the preliminary tests, eight different species of plants were tested for antibiotic activity. An extract of each sample was obtained by grinding the plant with distilled water using a mortar and pestle. A concentration disk was then soaked in the extract and placed on an agar plate inoculated with E. coli. Duplicate tests were run for each plate. Fresh garlic was used as a positive inhibitory control, while distilled water was used as a negative control. These plates were incubated at 84 degrees F. After establishing Arctostaphylus as the best inhibitor of E. coli, the fractions were separated using the method for extracting eugenol. I crushed 32.13 grams of Arctostaphylus, added 200 mL of water and steam distilled it according to the procedure for extracting eugenol.

Results

In the preliminary experiment, Arctostaphylus had the largest rings off inhibition surrounding the concentration disks, 3mm and 5mm. After distillation, the boiled Arctostaphylus fraction showed inhibition as did the raw fraction, my control for this second part of the experiment. The clear, colorless distillate did not show any inhibition.

Conclusions/Discussion

My results show that the bioactive agent in Arctostaphylus is water-soluble as it remained in the boiled fraction and was not carried over into the distillate fraction as it would have had it been water-insoluble. My results also show that the bioactive agent was not destroyed by the boiling involved in the steam distillation process.

Summary Statement

The purpose of my project was to isolate the fraction through stream distillation of Arctostaphylus that contained the bioactive ingredient, which inhibited the growth of E. coli.

Help Received

Used lab equipment at CSU, Chico under Dr. Don Alger, Chem. Dept. Dr. Patricia Parker, Microbiology Dept., CSU, Chico, for initial plant extraction procedure. Ms. Barbara Mudrinich, Science Dept., PV High, provided lab equipment and E. coli. My mother corrected my write up. My father edited my write

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Bonnie Diep; Leneve Ong; Willie Phan

Project Number

S1307

Project Title

Microbial Components of the Byproducts from the Transesterification of Soybean Oil

Abstract

Objectives/Goals

The objective of this project is to determine whether microorganisms thrive in an environment consisting of the by-products of the transesterification of soybean oil.

Methods/Materials

One year old samples and recently synthesized samples of biodiesel by-products were analyzed for microbial content. For comparison, sealed and opened flasks of both aged and recent biodiesel by-products were placed in outdoor and indoor conditions where there was a difference in light and temperature. In order to culture the microorganisms, samples were inoculated into Spirit Blue Agar Petri dishes. Gram stained and unstained specimens were examined under a microscope to assist in the identification of the unknown microorganisms. Tests for acidity were done to determine if it is a factor for growth and for comparison purposes.

Results

Some of the organisms inhabiting biodiesel by-products consist of gram-negative bacilli and cocci. Colonies of microbes appeared and began growing in the Spirit Blue Agar Petri Dishes after eleven days. More changes occurred in the flask of samples exposed to outdoor conditions compared to samples placed indoors.

Conclusions/Discussion

Through our analysis of the by-products from the process of synthesizing biodiesel, we found that there are microorganisms thriving. Exposure to the conditions of an outdoor environment seems to enhance the growth of the bacteria because the increased growth was observed in both the sealed and open flasks. Through microscopy, we discovered that one of the possible organisms present is yeast, in which certain species use lipid (present in the by-products) as a carbon source. For further studies, we plan to determine the effects these microorganisms have on the biodegradability of biodiesel.

Summary Statement

This project focuses on the microbial components of biodiesel by-products and the environmental factors that promote the growth of the microorganisms.

Help Received

Used lab equipment at PCC under supervision of Kathy Talaro, student at PCC helped helped revise report

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Wendy M. Eseau

Project Number
S1308

Project Title
Which Antibiotic Is Most Effective Against Escherichia coli?

Abstract

Objectives/Goals
My objective is to study the effects of different antibiotics on the bacteria Escherichia coli, and to determine which antibiotic is most effective against inhibiting its growth.

Methods/Materials
Materials: 1. 1 slant of E.coli bacteria (aquired with permission from the microbiology lab at Cuesta College) 2. 4 deeps of tryptic soy agar 3. 4 sterile petri dishes 4. innoculate loop 5. Bunsen burner 6. incubator 7. antibiotic disks. 8. metric measuring tape 9. digital camera 10. disk for digital camera 11. use of microbiology lab at Cuesta College.

4 sterile petri dishes were innoculated with E.coli. Antibiotic disks were then added to two of the petri dishes. One was left without antibiotics as a control. The other one was a streak plate to ensure a sterile culture. All petri dishes were incubated at 37 degrees celcius for 48 hours. The petri dishes were then removed from teh incubator and growth or lack of growth were observed and measured.

Results
Of the antibiotics tested, the inhibition zones (if any), were measured.
Ampicillin (10mm) Tetracycline (30mm) Tobramycine (20mm) Sulfisoxazole (45mm) Genamycine (25mm) Penicillin (0mm) Kanomyocin (26mm) Streptomyacin (22mm) Chloramphenicol (40mm) Bacitracin (0mm) Crythromyasin (18mm)
The areas of inhibition around the antibiotic discs are in the () with the measurements signifying the inhibition of bacteria growth around the antibiotic discs. The larger the inhibition zones the more effective the antibiotic is at inhibiting the growth of the bacteria.

Conclusions/Discussion
Sulfisoxazole is the most effective against E.coli bacteria, however Sulfisoxazole is a sulfa drug and therefore synthetic and not technically a true antibiotic. Chloramphenical was a close second, however it too is a synthetic drug. Tetracycline was the most effective true antibiotic tested against E.coli.
In science, however, nothing is ever proven. There is always the possibility that results happened by chance. My hypotheses, however, was supported by this particular experiment.

Summary Statement
My project is about the effectiveness of different antibiotics on the bacteria Escherichia coli.

Help Received
Mother helped type report; Used lab and equipment at Cuesta College under the supervision of Mrs Cheatham;Glen Lubak let me borrow the digital camera and printer; Dan Foss helped me learn how to make a graph on the computer;Mr Bartel helped me with the grand idea .

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Neil Gehlawat; Sean Matthews; Ryan Newbrough

Project Number

S1309

Project Title

A Study of MRSA

Abstract

Objectives/Goals

The purpose of our experiment was to determine the percentage of MRSA carriers in the general, non-hospital, population and to compare the general population frequency with the frequency of MRSA carriers in hospital populations.

Methods/Materials

Materials- methicillin infused agar plates, regular agar plates, test tubes, .85 saline solution, toothpicks, sterile swabs, 21 human subjects, access to microbiology lab- includes incubator, colorimeter, and reference books.

Procedure- First, we swabbed the nasal passages of 21 human subjects. We then determined which of the 21 were carriers of the bacteria Staphylococcus. After that, we recultured the subjects who had Staph and let the cultures grow. From there, we determined which human subjects were carriers of MRSA by swabbing parts of the staphylococcus and rubbing it onto different sections of a methicillin infused agar plate.

Results

One out of 21 subjects was MRSA positive.

Conclusions/Discussion

THROUGH EXPERIMENTATION, WE HAVE DISPROVED OUR HYPOTHESIS. ALTHOUGH WE PREDICTED THAT WE WOULD DISCOVER NO MRSA IN THE GENERAL POPULATION, IN ACTUALITY, ONE OUT OF TWENTY-ONE NON-HOSPITAL SUBJECTS TESTED POSITIVE FOR MRSA, A FIGURE THAT WOULD CORRELATE TO 4.76% OF THE GENERAL POPULATION. THESE RESULTS ARE QUITE SIGNIFICANT, FOR IT IS WIDELY HELD THAT MRSA IS PREVALENT IN HOSPITAL POPULATIONS, BUT IS NEARLY NONEXISTENT IN THE GENERAL POPULATION. OUR RESULTS CONTRADICT THIS WIDELY HELD ASSUMPTION AND SHED NEW LIGHT ON THE GROWING THREAT THAT ANTIBIOTIC- RESISTANT BACTERIA POSE. IN ADDITION, ALTHOUGH THE RANGE OF OUR TEST MAY NOT HAVE BEEN AS WIDE AS THOSE WE READ ABOUT IN OUR RESEARCH, OUR RESULTS ON THE NUMBER OF PEOPLE IN THE GENERAL POPUALTION WHO CARRY STAPHYLOCOCCUS AUREUS VARIED SIGNIFICANTLY FROM THOSE WE READ ABOUT. ACCORDING TO OUR RESEARCH, ABOUT 20-30% OF THE GENERAL POPULATION ARE STAPHYLOCOCCUS AUREUS CARRIERS, BUT BASED ON OUR EXPERIMENT, ALMOST 45% OF THE GENERAL POPLUATION ARE CARRIERS.

Summary Statement

We determined the amount of MRSA carriers in the community- based population.

Help Received

Tracy Langenfeld of Memorial Hospital helped us in lab work.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Sarah J. Giffin

Project Number
S1310

Project Title
Do Bees Know Something that We Don't?

Abstract

Objectives/Goals
The goal of this project was to see if honey and royal jelly effected the growth of E.coli, B.subtilis and S.aureus.

Methods/Materials
On the first day, a preliminary experiment was done where each type of bacteria was grown for 8 hours, then spread onto agar plates where a disc containing each type of dilluted honey was placed. On the second day, the bacteria were spread across more agar plates and pure honey and royal jelly was placed in wells made in agar. On the final day, a growth curve was done on the royal jelly and sugar water to see how much of an effect on the growth of the bacteria they really had.

Results
From the preliminary experiment I found that the honey had no effect on any of the bacteria, while on the second day the honey had a foggy zone of inhibition around them. The royal jelly had a very clear zone of inhibition so a growth curve was done to see how effectual it was, along with sugar as a control. In the growth curve, the royal jelly essentially stopped the growth of B.subtilis and S.aureus but not as much in E.coli. The sugar was also found to have an effect on the growth of bacteria, too.

Conclusions/Discussion
I have concluded that the reason why honey has such an effect on the growth of the bacteria is because of its extremely high sugar content (78-84%). Royal jelly has a protein in it called royalisin that affects only the growth of bacteria in Gram-positive bacteria, but my experiment showed that the royal jelly had some effect on the Gram-negative bacteria.

Summary Statement
The effects of honey and royal jelly on the growth of B.subtilis, S.aureus and E.coli.

Help Received
Dr. Srinivas Kothakota supplied me with bacteria strains, and other necessary supplies. Protein Pathways allowed me to use their laboratory. My father helped me with the procedure. Jim and Carolyn Wingate supplied me with the honey and royal jelly.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Hippolyte Goux

Project Number

S1311

Project Title

Cutaneous Microbial Antibiosis in the Salamander Ensatina e. klauberi

Abstract

Objectives/Goals

The objective is to determine if bacteria on the skin of the salamander Ensatina eschscholtzii klauberi produce compounds (antibiotics) that inhibit the growth of microbes from the soil and leaf litter found in the salamander's terrestrial habitat.

Methods/Materials

Bacterial flora was sampled from 4 wild Ensatina found at two sites on Mt. Palomar (San Diego Co Calif.). Three of the samples came from specimens found at Cedar Creek. The fourth sample came from a specimen found in Doane Valley. The leaf and soil sample was also taken from Doane Valley. The resulting mixed samples where grown in sterilized Petri Dishes. Morphologically distinct bacteria colonies where then isolated so that pure cultures were obtained. Using a microscope, the cellular morphology of each isolate was noted. Ensatina skin bacteria were tested for inhibitory activity against soil bacteria in Inhibition Trials. Inhibition was measured as a zone of unobservable growth adjacent to the bacterial streak.

Results

The inhibition trials did not demonstrate the presence of bacteria from the skin of Ensatina capable of inhibiting microbial growth from the soil and leaf litter. Unexpectedly, one of the soil bacteria from Doane Valley produced antibiotics that killed off 79% of the bacteria isolated from Cedar Creek Ensatina. However, 100% of the "native" Ensatina bacteria from Doane Valley where unaffected when exposed.

Conclusions/Discussion

More work is necessary to understand the relation of bacteria to the salamander Ensatina e. klauberi. The study neither refutes nor confirms the presence of cutaneous microbial antibiosis in the salamander Ensatina e. klauberi. Work in the area is vitally and rapidly important because if the role of symbiotic bacteria is found to be significant, removal of them due to pollution may account for many of the current amphibian declines. An "error" in sampling of soil and Ensatina bacteria between two sites on Mount Palomar led to the discovery that the microbial communities of the mountain have evolved a "finely tuned system" of relative stasis. In each case, bacteria have evolved a resistance to antibiotics produce by forms in their native area.

Summary Statement

The project is concerned with the symbiotic relationship between bacteria and the salamander Ensatina e. klauberi, in the form cutaneous microbial antibiosis.

Help Received

I used laboratory equipment at John W. High School under the supervision of Dr. K. Atkinson, who also provided assistance during microscope analysis.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Olivia Griffin; Nirayl Kuba

Project Number
S1312

Project Title
Stayin' Alive

Abstract

Objectives/Goals
Exposing E. coli bacteria to increasing increments of short-wave ultraviolet light to observe the effect on their mortality rate.

Methods/Materials
Our information was obtained by first exposing 10 plates of E. coli bacteria to ultraviolet light at different times starting with 0 seconds and ending with 300 seconds, using 30 second time intervals. Each plate was divided in half and each half was exposed to two different times with a difference of 30 seconds. After exposure, we compared the amount of living bacteria between each half and came up with a percentage change in bacteria survival. We did this by comparing dark and light areas on the plates of bacteria with a computer program which made a histogram of pixel brightness.

Results
After comparing the percentage we got on each plate, we found that the average decrease in bacterial survival was 10%. This means that every additional 30 seconds bacteria were exposed to ultraviolet light approximately 10% of the bacteria died.

Conclusions/Discussion
Our hypothesis was that the longer bacteria is exposed, the more insignificant an effect an additional 30 seconds would have on the bacteria. We found that whatever time the bacteria was expose to the U.V. light the percentage of bacteria killed remained approximately the same.

Summary Statement
The effect of ultraviolet light on E. coli bacteria

Help Received
Sunny LeMoine and Colin Matheson helped edit and provided some supplies

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Jacqueline M. Havens

Project Number

S1313

Project Title

Microbial Population Dynamics During Composting

Abstract

Objectives/Goals

To observe the change in bacteria species in a compost heap exposed to genetically engineered corn over a period of time.

Methods/Materials

I extracted DNA from a compost heap and amplified the 16S rRNA gene for actinomycetes and bacteria. After a series of gel electrophoresis experiments, DNA purifications, amplifications with the PCR machine, and picking bacterial colonies, I sequenced ten samples of bacteria from two different time periods. The sequences were logged into the computer and the NCBI was able to idntify the different species.

Results

Out of ten colonies being sequenced, each colony was a different species, showing incredible species diversity in this compost heap.

Conclusions/Discussion

I identified species of bacteria in a compost heap at different time periods. The species were not identical, but to see if they really evolved (my next year's science project), I am going to test for ampicillin resistance. If bacteria can evolve like this in the presence of genetically engineered corn, there is a chance that plants may develop pesticides resistance.

Summary Statement

I am identifying species of bacteria at different points in time in a compost heap exposed to genetically engineered DNA.

Help Received

Used lab equipment at UCI under the supervision of Dr. David Gardiner

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Natasha N. Jundt

Project Number
S1314

Project Title
Mold Transference: Does Mold Transfer from One Building Material to Another When Subjected to Varied Conditions?

Abstract

Objectives/Goals
The objective of my experiment is to determine whether or not mold will transfer from one building material to another, and if it will, what conditions will create the best climate for transference. I believe that mold will transfer, however only when there is a sufficient amount of moisture (water) and air movement.

Methods/Materials
Before beginning my experiment I built ten separate test boxes, each which would include three samples separated by dividers. Next, in order to meet the required safety precautions I constructed a pressurized, two-roomed test chamber. Finally, I tested the samples in a variety of different conditions, which included each of the following, both with and without air movement: 1) raised humidity, 2) dry, 3) water added to drywall, 4) water added to wood, and 5) water draining from wood onto drywall. Through observations and studying patterns of analyzed tape lifts I was able to draw several conclusions.

Results
The project results demonstrated that mold does transfer primarily by moisture and secondarily by air movement mainly when dry conditions are present.

Conclusions/Discussion
My hypothesis was confirmed, "I believe that mold will transfer, however only when there is a sufficient amount of moisture (water) and air movement." One unexpected result was that when excess moisture (standing water) was present mold did not grow under the water; instead it grew at the perimeter edge. This is important because it helps define that if there is too little or to much moisture, mold growth can be reduced or controlled.

Summary Statement
My project demonstrates that mold transfers primarily within a limited range and by controlling the moisture source, mold growth can be reduced or eliminated on building materials.

Help Received
Forensic Analytical analyzed tape lifts and cultured swab samples; Dad helped with power tools

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Maira Martinez

Project Number
S1315

Project Title
How Much Honey Is Needed to Inhibit Bacterial Growth?

Abstract

Objectives/Goals
The objective is to determine if different amounts of honey

Methods/Materials
Bacteria from my fingers were grown over night in nutrient agar. One colony was transferred into 250ml of water to create a bacterial suspension. 7.5g, 15g, 30g, and 60g of honey was added respectively to 200ml of nutrient agar to create 3.75%, 7.5%, 15%, and 30% plates. 1ml of the bacterial suspension was transferred to three sets of seven plates each. Each set was held for two days at 4¢ªC, 20¢ªC, and 35¢ªC. Two Petri-dishes containing nutrient agar only were used as controls. After two days, observations were taken and colonies of bacteria were measured and counted.

Results
At 20¢ªC and 35¢ªC, more bacteria grew on Petri-dishes containing 3.75% and 7.5% honey. Some colonies were observed at 15¢ªC while no colonies were observed on Petri-dishes with 30% honey.

Conclusions/Discussion
The hypothesis of this experiment was supported. That is, bacterial growth was inhibited with the increasing addition of honey. 30% honey was able to prevent any bacterial growth.

Summary Statement
A quantitative analyisis of the percentage needed to inhibit bacterial growth.

Help Received
With preperation of Petri-dishes, help was received fro Mr. Rober Cobb, current bilogy teacher.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Corey J. Maynard

Project Number
S1316

Project Title
The Effect of Bread Type on Mold Growth

Abstract

Objectives/Goals
The objective is to determine the type of bread that grows mold best.

Methods/Materials
Using five slices of three different types of bread, Wonder Bread, Alvardo Street Sourdough Bread, and Alfaro's Bakery California Style Bread the experiment was begun. Each slice was sealed in a plastic bag. Then the bags were numbered form one to five. After that the breads were carefully monitored each day to see if mold grew. When mold was seen the amount of total mold on that slice of bread was recorded on a sheet.

Results
By the end of the testing, the Alvardo St. breads had the most mold as a total on them, followed by Alfaro's Bakery and Wonder Bread.

Conclusions/Discussion
The data shows that Alvardo St. Sourdough has the least immunity to mold spores, as it grew the most mold. It was no suprise that Wonder Bread had the least mold, as it is full of preservitives. It was suprising, though, that Alfaro's Bakery didn't have the most mold. Since it is entirely natural, it had been predictied that it would have the most mold by the time the experiment drew to an end.

Summary Statement
This project is about how different breads have different resistances to mold growth.

Help Received
None

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Aletheia Y. Miyake

Project Number
S1317

Project Title
Comparing the Effectiveness of Natural and Pharmaceutical Antibiotics

Abstract

Objectives/Goals
My objective was to investigate whether dandelions, a natural antibiotic, are as effective as commonly prescribed antibiotics, Erythromycin, Ciprofloxacin and Amoxicillin, in combating disease causing bacteria.

Methods/Materials
Materials included dandelion extract, Amoxicillin, Erythromycin, Ciprofloxacin tablets, pond water, 18 petri dishes, filter paper disks and an incubator. After I assembled all my materials, I prepared the petri dishes by applying agar and dividing them into four sections. I put 50 micro liters of pond water on each plate. Then I made three antibiotic solutions by crushing one Ciprofloxacin, Erythromycin and Amoxicillin tablets and adding the appropriate amount of water to bring them to the same concentration. On the petri dishes I placed 4 filter paper disks on each plate, one in each of the sections and applied a certain amount of antibiotic solution on every filter paper disk. All plates were incubated for 72 and every 24 hours I measured the diameter of clearing around the paper disks which indicated antibiotic effectiveness.

Results
The natural antibiotic dandelion proved to be completely ineffective in fighting the propagation of the bacteria cells while all antibiotics were able to resist bacteria growth. Ciprofloxacin was the most effective pharmaceutical antibiotic in combating bacteria both in amount for a longer duration.

Conclusions/Discussion
: Pharmaceutical antibiotics are specialized to combat bacteria and therefore are more effective than natural antibiotics. Ciprofloxacin was the most effective because it was developed to attack the production of a cells proteins and nucleic acids which is the most efficient way to destroy the enumeration of bacteria.

Summary Statement
I compared the effectiveness of dandelion as a natural antibiotic and three types of pharmaceutical antibiotics.

Help Received
Dr. Stephen Lyon of the Orange County Water District allowed me to use the equipment and supplies at his lab and also provided assistance during the course of my experiment.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Ashley M. Morris

Project Number
S1318

Project Title
Culturing Strains of Chlamydomonas reinhardtii Resistant to Polyethylene Dichloride

Abstract

Objectives/Goals
The goal of this experiment was to determine whether strains of Chlamydomonas reinhardtii, a freshwater green algae, could be developed with a resistance to the herbicide polyethylene dichloride.

Methods/Materials
Wild type + cultures were obtained from Duke University for use in this study. Cells were cultured in bubbler tubes to begin the experimental process. The LC50 was then determined by recording cell counts after 24 hours of exposure to various concentrations of polyethylene dichloride. After the LC50 was confirmed, the strains were exposed to increasing concentrations to slowly increase the polyethylene dichloride toxicity resistance.

Results
Chi Squared calculations determined that the developed strains of Chlamydomonas reinhardtii were significantly more resistant to the effects of polyethylene dichloride in comparison to previously unexposed strains suddenly exposed to equal concentrations of polyethylene dichloride.

Conclusions/Discussion
When exposed to polyethylene dichloride over a period of time, Chlamydomonas reinhardtii developed a resistance to the toxic effects of the chemical.

Summary Statement
Strains of Chlamydomonas reinhardtii were exposed to increasing concentrations of the herbicide polyethylene dichloride over a period of time as a method of increasing the resistance in Chlamydomonas reinhardtii to the herbicide.

Help Received
Advisor assisted with autoclaving; science department aide assisted with initial use of hemacytometer; aide assited with use of the Bunsen burner; classmate helped take photographs.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Cecilia T. Ong

Project Number
S1319

Project Title
Alchemy or Remedy?

Abstract

Objectives/Goals
This experiment sought to find whether herbal medications had any medicinal affect against bacteria as western medicines did and whether there were any similarities in protein structure between the two.

Methods/Materials
Methods:
High Pressure Liquid Chromatography to fractionate components according to solubility and hydrophobicity to isolate active component in medication
Sodium Dodecyl Sulfate and Acid Urea Gels to identify components and to compare similarities in protein structure
Bicinchonic Acid to quantify the amount of protein in substance
Radial Diffusion Assay to assess anti-microbial properties of each medication
Mass Absorption Laser Desorption/Ionization-Time of Flight to analyze mass of components in medication

Materials:
garlic pills
niu tablets
aloe vera
grape/grapeseed extract
PG-1
ampicillin
dau phong
dau xanh
turmeric

Results
The grapeseed extract was found to contain a component that had similar biological properties to the control, ampicillin. Compared to the PG-1, another control medication and a known antimicrobial peptide, the grapeseed extract worked very well against the Staph aureus bacteria. Its zone of clearance, or a relative measure of effectiveness against a certain bacteria, was 7.5 mm while the zone for PG-1 at the same concentration was only 7 mm. The ampicillin worked equally well against the Staph aureus bacteria but showed no results in the ampicillin-resistant E. coli strain. Also, there were similarities in protein

Summary Statement
This project evaluated the effectiveness of herbal antibiotics versus known western medications, and also to find any possible similarities in protein structure between these medications for future application to defend against pathogens.

Help Received
Tung Nguyen was the researcher who granted me access to the Host Defense Lab at the University of California in Los Angeles. My parents provided transportation to UCLA and also the cultural knowledge that included that of herbal medicines and traditional remedies.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Su F. Ong

Project Number
S1320

Project Title
Global Warming: Can Bacteria Really Help Stop It?

Abstract

Objectives/Goals
The objectives were to find optimal conditions for nitogen-fixation in the oceanic cyanobacteria Trichodesmium, with respect to irradiance and to determine if phosphorous is a limiting factor in the nitrogen-fixation process.

Methods/Materials
2 cultures of Trichodesmium with different phosphorous concentrations (5uM and 50uM) were used. For each batch, 22 vials were used and 10 mL of culture was transferred into each vial. Each vial was sealed, injected with 1.5 mL of acetylene gas and placed into a photosynthetron, one vial per well. Each well contained a different light intensity. Nitrogen-fixation was stopped by injecting .5 mL of NaOH into each vial after 2 hours. The rate of acetylene fixation was determine using gas measurements. Acetylene fixation in Trichodesmium is four times faster than nitrogen fixation.

Results
The culture containing 5 uM concentrations of phosphorous had an average peak irradiance level (level which nitrogen-fixation was greatest) of 106.88 Quanta and an average peak nitrogen fixation rate of 19.5 pmol fixed nitrogen.
The culture containing 50 uM concentrations of phosphorous had a peak irradiance level at an average of 83.13 Quanta and a peak nitrogen fixation rate at 46.29 pmol of fixed nitrogen.

Conclusions/Discussion
Phosphorous is indeed a limiting factor of Trichodesmium. The effects of iron and phosphorous as limiting factors on Trichodesmium in the ocean is being currently debated. The culture containing a greater concentration of phosphorous was able to reach a lower peak irradiance level and had a higher peak nitrogen fixation rate. One thoery is the bacteria do not need to consume extra energy to make up for a lack in phosphorous, and can instead use it for nitrogen fixation.
Recent studies have shown that there is a major correlation between oceanic nitrogen-fixing bacteria and the reduction of atmospheric carbon.
This experiment will lay down the foundation in the understandment of Trichodesmium, future lab research, and its effects of reducing global warming.

Summary Statement
Optimal conditions for nitrogen-fixation in Trichodesmium, in respect to irradiance and phosphorous levels.

Help Received
Used lab equipment at USC under the supervision of Juliette Finzi and Dr. Douglas Capone. Mentor (Juliette Finzi) advised, proof-read, supervised and helped design experimental procedure.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

Lenny Pekelis; Jonathan Vinea

Project Number

S1321

Project Title

The Feasibility of Transforming E. coli Utilizing High Voltage Electroporation

Abstract

Objectives/Goals

DNA can be inserted into cells to achieve desired characteristics previously unexpressed. It is challenging to insert a DNA sequence through the cell membrane. Furthermore, a researcher typically needs to transform (change the genetic makeup of) many cells at a time to have observable results. In this experiment, the two techniques of heat-shock (0ºC-42ºC) and a novel method of electroporation are compared to determine the feasibility of high voltage in transforming Escherichia coli. Electroporation disrupts the insulating matrix, forming aqueous pores by which DNA can enter. To test the global hypothesis that high voltage electroporation would be more efficient, both techniques are performed, using a Tesla coil to supply the needed high voltage.

Methods/Materials

The trait applied to the E. coli is the gene for making green flourecent protein (GFP), which glows under ultraviolet radiation. The Tesla method involves a heat-sink, which allows electrocution for longer periods of time without an increase in temperature. Time periods from 1-4 seconds as well as longer controls are observed. The E. coli cells are plated on Petri dishes (agar) with arabinose (a simple sugar) and ampicillin antibiotic. Arabinose switches on the operon that makes GFP. Under ultraviolet light, transformed cells supplied with arabinose will glow.

Results

Outcomes supported the practicality of the novel take on electroporation. The hypothesis was supported by the data in that there was a greater amount of electrically-shocked cells than heat-shocked ones. A benefit of this new method is that Tesla Coil pulses were observed to negligibly increase the temperature of the bacterial suspension due to the water bath heat sink. In addition, a consistent, exponentially greater amount of satellite colonies emerged from the electrically shocked bacteria.

Conclusions/Discussion

Each bacterial suspension contained millions of cells and could not be counted, however the mass of the pGLO was known in advance. Hence, the efficiency could be related back to how much pGLO originally was in each suspension. The results indicated that electroporation is more effective in opening pores in the cell membrane than heat-shock. If more cells transform initially, more colonies can be grown and more of the desired trait harvested before the cells lose potency from lack of telomeres. Efficiency in transformation is crucial to biotechnology.

Summary Statement

A new method of high voltage electroporation is compared to heat shock in transforming (changing the genetic makeup of) E. coli.

Help Received

Thanks to Nancy Cannon for her advice and our parents for their money.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Eric M. Sefton

Project Number
S1322

Project Title
Can Doubly-Resistant Strains of Bacteria Be Produced by Incubating Singly-Resistant Bacteria Together?

Abstract

Objectives/Goals
The objective is to discover whether bacteria are able acquire resistances to two antibiotics, and if so, how much time does this process require.

Methods/Materials
E. coli bacteria, which had been treated so that it would acquire DNA, was incubated in one test tube with ampicillin, and in another with kanamycin. The contents of each tube was then spread on a plate containing the anitbiotic that the E.coli was supposed to be resistant to. A colony from each plate was sampled and placed in a test tube with its respective antibiotic. Next colonies from each plate were put in the same test tube, which had both antibiotics. After overnight incubation, the contents of each test tube was spread in serial dilution on a gridded plate containing both antibiotics, so that the samples remained seperate.

Results
After a night of incubation, there was growth on the plate with both anitbiotics, as well as in the test tubes containing the sampled colonies. In the test tubes with the sample colonies there was visible proof of doubly-resistant bacteria. On the gridded plate, 20 doubly-resistant colonies grew at the highest concentration of solution. At all lower concentrations, there was no growth. Further incubation did not yield greater growth.

Conclusions/Discussion
The results prove that the creation of doubly-resistant bacteria happens at an alarmingly rapid rate, but yields many fewer colonies than when singly-resistant bacteria is created. With only one night of incubation in a test tube, and then another night of incubation on a plate, twenty colonies grew in one grid. Compared to the hundreds of colonies grown with one night of incubation of singly-resistant colonies on a whole plate. These results support the startling danger that we as a society put ourselves in when we misuse antibiotics. There needs to be a shift in the attitude that doctors, patients, and famers have about antibiotics, in order to safegaurd our society from bacteria that cannot be killed.

Summary Statement
My project concerns the speed and ease with which bacteria are able to acquire multiple resistances to antibiotics.

Help Received
Father helped supervise experiment and provided materials and work space, in addition to advice on procedure.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Tamara N. Shamlian

Project Number
S1323

Project Title
Does Exposure to a Magnetic Field Affect the Transformation Rate of Escherichia coli? Second Year Study

Abstract

Objectives/Goals
The objective of my experiment is to determine whether or not a rotating magnet affects the transformation of E. coli in becoming resistant to ampicillin. Based on my previous study, a stationary magnet inhibits the transformation of the bacteria (to a degree). I believe the rotation of the magnet around the E. Coli cells will increase the inhibition of the transformation and growth rates.

Methods/Materials
I constructed a device out of wood blocks and PVC pipe that held up the magnet and a counterweight on opposite sides of a beaker containing vials of pGAL/Control buffer and cells. I set up 3 controls and 3 experimental groups. The first control group included 5 agar plates containing merely X-GAL and no E. coli cells. There was also an experimental group of 5 that had this type of plate exposed to a magnet. The second control was a group of 5 agar plates, containing X-GAL and ampicillin, plated with E. coli and control buffer. This too had an experimental counterpart which was 5 plates containing agar and magnetized cells and control buffer. The last control was 5 agar plates containing X-GAL and Ampicillin with E. coli cells and pGAL DNA, while the experimental group being compared to this contained 10 agar plates containing X-GAL and ampicillin with magnetized E. coli cells and pGAL DNA. I later placed them in the incubator at 37 C for about 20 hrs. Then I counted the number of white and blue colonies on each plate.

Results
There was a significant decrease in the transformation of E. Coli on the plates that had Cells exposed to the magnet. On average, the plates that contained cells that had been exposed to the magnet produced a yield of 556 transformed blue colonies, while the plates containing cells that had not been exposed to the magnet reduced an average of 681 transformed cells. All the plates used as the control 2 batch that were exposed to the magnet contained white colonies averaging 151. All the plates in the control 2 batch not exposed to the magnet contained white colonies averaging 190.

Conclusions/Discussion
My data proved to support my hypothesis. I think that the metal ions found in the calcium chloride (the E. coli was treated with calcium chloride and temperature changes to increase the permeability of the cell membrane) were attracted to the magnet. This may have made it harder for the DNA to enter the cells, lowering the rate of transformation.

Summary Statement
My project is about the effect of a rotating magnet on the transformation and growth rate of E. coli, providing evidence that the magnet does affect both factors.

Help Received
My project advisor supervised me as I conducted my experiment.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Sonia Singhal

Project Number
S1324

Project Title
The Effect of Ultraviolet Radiation on the Tetracycline-Resistant Gene in XL1-Blue Bacteria

Abstract

Objectives/Goals
Many bacteria have become antibiotic-resistant, making bacterial diseases harder to treat. The purpose of my experiment was to test if ultraviolet radiation could disrupt the antibiotic-resistant gene in bacteria.

Methods/Materials
I used a strain of XL1-Blue bacteria that has been genetically modified to be tetracycline-resistant. I exposed a saturated culture of the bacteria to ultraviolet radiation for increasing lengths of time ranging from 0 seconds (control) to 3.5 minutes at 30 second intervals. After each exposure, a small amount of the culture was diluted (500,000X # 1X) and plated on 4 LB-agar plates: 2 plates with tetracycline and 2 plates without tetracycline. After incubating the plates overnight, I counted the number of bacterial colonies on them and calculated the bacterial density in the culture. The experiment was repeated with a second culture. Negative controls (plates without bacteria) were included to ensure that contamination was not present. The dilution and exposure time required were determined in preliminary experiments.

Results
I found that the bacterial density in the culture decreased exponentially with exposure time in all cases. Regression analysis showed that the average bacterial density followed the model log10(d) = 9.433-0.0366t where d is the bacterial density in bacteria/ml and t is the exposure time in seconds. The models for bacteria plated with tetracycline and the bacteria plated without tetracycline were log10(d) = 9.429-0.0372t and log10(d) = 9.436-0.0361t respectively. R^2 values for all three models were greater than 0.98, showing an excellent fit to data. An analysis of variance showed that the null hypothesis (decay rates of the two models are equal) could be rejected with p=0.06.

Conclusions/Discussion
My hypothesis was that if UV radiation disrupted the tetracycline-resistant gene, then the exposed XL1-Blue bacteria would die at a faster rate in the presence of tetracycline. My experiment validated this hypothesis: UV radiation reduced the resistance of bacteria to tetracycline by a small but statistically significant amount. Further research is needed, however, to identify mutagens that are more effective than ultraviolet radiation.

Summary Statement
When a tetracycline-resistant strain of XL1-Blue bacteria is exposed to ultraviolet radiation, it becomes slightly less resistant to tetracycline.

Help Received
Dr. Julia Prescott gave me the bacteria and tetracycline for my experiment and checked my procedures. Ms. Seawell and Mr. Rodriguez of Gene Connections supplied me with the materials and equipment for my experiment and Ms. Seawell gave me suggestions for improving my project.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Robin E. Stallard

Project Number
S1325

Project Title
Comparison of Antimicrobial Activity in Soils

Abstract

Objectives/Goals
The objective is to test different soils to determine frequency, type and activity of antimicrobial organisms.
Hypothesis: the organisms from the slough will have the most antimicrobial activity because the soil environment is the most competitive, being the richest in nutrients and water.

Methods/Materials
Soil samples were obtained from the back yard, Elkhorn Slough and Moss Landing State Beach and were incubated in nutrient broth. Samples were then streaked on nutrient agar plates to identify individual colonies. These were tested for killing of a bacterial tester strain. They were then purified, idenitified by staining, and then tested for killing of a variety of microbes. Tests were also performed to determine how these products actually prevented growth of bacteria.

Results
Antimicrobial organisms were obtained from all three sources. The organisms obtained from the beach had broad spectrum activity, killing both bacteria and yeast. The four isolates were Gram positive rods. Microbes from the yard and the beach tended to kill Gram-positive bacteria only, and did not seem to have as much killing activity as those from the beach.

Conclusions/Discussion
Antimicrobial organisms can be found in a variety of soil environments. These organisms have an advantage because they can kill off other microbes in that environment. My original hypothesis was incorrect. Perhaps the beach soil, which is scarce in nutrients and fresh water, is the most competitive. Most of the microbes isolated from the beach soil had antimicrobial activity. Furhtermore,the substance produced by these beach organisms microbes killed a wide range of other microbes.

Summary Statement
The project compared microbes isolated from different soils for the frequency and type of antimicrobial activity that they produced.

Help Received
Mother helped with report and supervised handling bacteria. Hartnell College provided incubators, staining kits and sterile facilities.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Ryan S. Steinberg

Project Number
S1326

Project Title
Bacterial Resistance to Multiple Generations of Ophthalmic Antibiotics

Abstract

Objectives/Goals
The objective of my experiment is to compare the bacteriostatic and bactericidal effectiveness of first, second and third generation antibiotics on Staphylococcus epidermidis in order to examine and test the development of bacterial resistance.

Methods/Materials
40 petri dishes with agar were inoculated with Staphylococcus epidermidis using a sterile loop. 4 dishes was damaged omitted from testing. The dishes were then separated into 2 groups; one group for bacteriostatic tests and the other group for bactericidal testing.

In the bacteriostatic dishes were divided into 5 groups of 4 dishes each. Each received one drop of Ocuflox, Tobrex, Sulfacetamide, or Saline, with one group left to grow as a control. The dishes were left for 7 days at 37° C, then were removed and analyzed.

In the bactericidal test group dishes were first placed in an incubator for 5 days to grow. After 5 days they were removed and divided into 5 groups of 4 dishes, and one drop of Ocuflox, Tobrex, Sulfacetamide, or Saline was added, leaving the last group to continue growing as a control.

Results
In the bacteriostatic test group Ocuflox was effective at stoping bacterial growth. Tobrex was partially effective. Sulfacetamide had little effect on preventing bacterial growth. The saline control group proved inconclusive.

In the bactericidal test group Ocuflox was again the most effective antibiotic. The Tobrex and Sulfacetamide experienced similar results. The Saline control group showed similar growth to the control group with no drop.

Conclusions/Discussion
Ocuflox, the newest drug, was the most effective and Sulfacetamide, the oldest, was the least effective. Tobrex was partially effective. One explanation is that it was assumed that the culture was a pure strain of bacteria. If the strain was impure some may have been resistant while others were not.

One result of the bactericidal test was that the only area effected by the antibiotic was the area covered by the drop. This suggests that instead of time of exposure, quantity of the drop was the main factor in the

Summary Statement
This project is to examine and test for the development of bacterial resistance to common antibiotics and see if newer second and third generation antibiotics are more effective than older first generation antibiotics.

Help Received
My father helped me organize my procedures and obtain the drugs and my science teacher helped me organize and prepare my report.

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
January N. Swiderski

Project Number
S1327

Project Title
Don't Sweat It

Abstract

Objectives/Goals
The purpose of this experiment is to test if sweat is a natural antibacterial.

Methods/Materials
In order to conduct this project, I collected skin flora samples and grew bacteri, which I then separated into colonies and labeled for identification purposes. I then suspended the bacteria along with .5ml of sweat in test tubes an measured the density of each. After one week's growth, I then measured the density of the tubes again to determine if it had become greater. If in fact the substance did become denser, tis wouild indicate bacterial growth.

Results
After measuring the density of each test tube before and after one week, I found that the densities of the tubes did become much higher.

Conclusions/Discussion
Due to the results of this experiment, myhypothesis was incorrect. Because the density of the tubes rose a considerable amount, there was obvious bacterial growth within the tubes. This illustrates the fact that the sweat added to the bacteriadid not stop this growth.

Summary Statement
Testing the idea that sweat acts as a natural antibacterial for the skin.

Help Received
Diane Halaska from Lancaster Community Hospital helped collect specimen (qualified microbiologist)

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Lisa N. Tran

Project Number
S1328

Project Title
Fungi: From Sneezing to Wheezing

Abstract

Objectives/Goals
To determine how fungal allergens form respirable aerosols by: investigating whether fungal cultures release respirable-sized allergens, examining the conditions that lead to this release, and understanding the amount of this fungi in the outdoor air.

Methods/Materials
Fungal culture plates were placed in a controlled emission chamber and the release of sub-micron sized particles and spores were recorded. Particles were captured in the Sierra cascade impactor and counted and sized with an Aerodynamic Particle Sizer.

Results
Fungal fragments are released from Alternaria and other allergenic molds and these are small enough (less than 1.5 micron) to deposit in the airways.

Conclusions/Discussion
Many fungal spores are too large to be inhaled into the airways. However, molds release fine particles into the air. These particles are aerodynamically small enough to deposit in the lower airways. Whether the presence of allergenic mold particles in the air is linked to the increasing prevalence of asthma remains to be explored.

Summary Statement
The aim of this project was to determine whether molds could release an aerosol of particles that have the potential to trigger asthma in susceptible people and to monitor the Alternaria in the air.

Help Received
used lab equipment at Caltech under the supervision of Dr. Taylor

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Angela Tsai

Project Number
S1329

Project Title
The Apoptotic Trends in Immune Cells

Abstract

Objectives/Goals
The purpose of my project is to investigate the life and death of Varicella Zoster Virus infected immune cells and possible mechanism(s) that maintain immune cell survival after VZV infection. I hypothesized that CD4 T cells are the carriers of the virus to our skin. Also, I believed that the virus takes over a pathway in a cell for replication or survival purposes.

Methods/Materials
I used flow cytometry and microscopy to determine which specific sub-population of immune cells are the most viable after VZV infection. I started out processing human tonsils to obtain the immune cells. I then purified and separated the cells using magnetic beads and conjugated monoclonal antibodies over a steel mesh column. The co-cultured VZV infected monolayer was stained with anti VZV immune serum and anti Annexin V. I counted various fields of vision to get the percentage of cells that were infected and had gone through apoptosis. To verify my results, I compared it with the results from flow cytometry. I then used column purified cells and incubated them with MAP Kinase inhibitors (U0126 and SB203580) or capase inhibitors in concentrations of 25ìM and 100ìM before adding them to a VZV infected monolayer. I analyzed these cells also through microscopy and flow cytometry.

Results
The majority, 73-100%, of CD8 and CD19 infected cells died within 48 hours post infection which eliminates them for carrying Varicella Zoster Virus to our skin layer. The percentages of T cells that were VZV infected was reduced with MAP kinase inhibitors from 30.9% (untreated) to 2.7% (U0126 treated) or 6.5% (SB203580 treated). However, the percentages of VZV infected T cells that expressed AnnexinV did not change. Inhibition of VZV infected T cells with caspases inhibitor did not rescue the cells from apoptosis.

Conclusions/Discussion
I concluded that all CD4+, CD8+ T cells, and CD19+ B cells can be infected with VZV. Although 50% of infected CD4 cells died within 48 hours, there are enough infected cells and time to infect our skin layer making them the primary carrier. After analyzing the results from the MAP kinase pathway,it can be seen that this pathway may be involved in viral replication but not in cell death. Also, I discovered that the virus does not use caspase pathways for survival or replication.

Summary Statement
To discover which specific subpopulation of immune cells are the most likely carriers of Varicella Zoster Virus and which cell pathway the virus uses to survive.

Help Received
Used lab equipment at Stanford University under the supervision of Dr. Chia-Chi Ku

CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)
Mariah R. Erlick

Project Number
S1399

Project Title
Dark and Light Repair Effectiveness in Liquid Holding Recovery

Abstract

Objectives/Goals
To determine whether Liquid Holding Recovery (LHR), a phenomena which increases cell growth after UV damage by holding E. coli cells in nutrient-free buffer, increases effectiveness of light or dark DNA repair more.

Methods/Materials
Equivalent amounts of RecA- (a necessary deletion to observe LHR) E. coli were placed in either a nutrient-free buffer or a nutrient broth. All E. coli were exposed to 30 minutes of ultraviolet light. One half of plates in each group were exposed to an additional 60 minutes of florescent light. Plates were then incubated for six hours and cultured to a nutrient agar. They were incubated for another 29 hours and data was obtained using a digital camera and a histogram computer program to determine plate coverage. Procedure was repeated several times, for a total of 15 plates in each group: LHR light exposure, LHR no light exposure, No LHR light exposure, and No LHR no light exposure.

Results
My hypothesis was proven correct. Light DNA repair increased by an average of 3.3% plate coverage, while dark DNA repair increased by 26.2% plate coverage. My data was consistent, with only two outliers. Both outliers were in the first trial, and all percentages excluded them.

Conclusions/Discussion
Liquid Holding Recovery, discovered in 1949, was the first evidence of DNA's ability to repair itself after ultraviolet light damage. Little is yet known about this phenomena. My data shows that it increases dark DNA repair's ability to excise dimers caused by UV light nearly eight times the amount it increases light repair's effectiveness. It can be hypothesized that this is because LHR needs RecA negative bacteria to work, and RecA is a system within light repair. It isn't logical for a phenomena to function through the handicapped system of light repair, so therefore it must increase the other system: dark DNA repair.

Summary Statement
Dark DNA repair is more enhanced by the Liquid Holding Recovery phenomena than light DNA repair.

Help Received
My science teachers, Colin Matheson and Sunny LeMoine, helped edit and advised me on my project design. Microbiologists at Howard Memorial Hospital instructed me on culturing techniques and donated the use of an incubator. Professor Kendric C. Smith also gave me feedback on project design.