CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Raven S. Adams

Project Number
S1301

Project Title
Electricity's Effect on Algae

Abstract

Objectives/Goals
This experiment was conducted to determine the effects the presence of an electromagnetic field has on algae. These effects relate to the real environment in situations where the presence of humans (such as in a power plant) causes an electromagnetic field to form.

Methods/Materials
An electromagnetic field was created using plant light bulbs and electrical wire. Three identical samples of algae were placed in test tubes held in a stand near the light bulbs. Wire wrapped around these tubes carried the force of the electromagnetic field to the samples. The number of coils around each tube created increasing amounts of exposure. Sample #2 was exposed the least with 1 coil, sample #3 had 3 coils, and sample #4 was exposed with 5 coils. The first sample served as the control and was placed in an isolated environment. After two hours of exposure, the samples of algae were observed to determine the effects of their exposure to an electromagnetic field.

Results
While the isolated sample of algae maintained its original status, the exposed samples were damaged by the presence of an electromagnetic field. The temperature rose in each sample, cells were destroyed, and the algae was reduced in weight.

Conclusions/Discussion
The electromagnetic field damaged the algae according to its amount of exposure. These results show the significant amount of damage that even a minimal electromagnetic field can have on algae.

Summary Statement
This project examines the effects of an electromagnetic field on algae.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Angela Beach; Kenneth Takeoka

Project Number

S1302

Project Title

Shedding Light on the E. coli Dilemma

Abstract

Objectives/Goals

To determine non-toxic methods of neutralizing harmful bacteria, such as Escherichia coli, by using titanium dioxide (TiO2) as a photocatalyst.

Methods/Materials

After creating dilutions of Titanium dioxide of 0.000M (control solution)0.0025M, 0.0050M, 0.0075M solutions, put equal amounts in test tubes. Put one loopful (0.1 mL)of E. coli into each and expose to 24 hours of continuous light. After completing the exposure, extract 0.1 mL from test tubes and spread across evenly on agar-filled petri dishes. Incubate for 48 hours and count number of colony forming units (CFU). Record data and use Analysis of Variance (ANOVA) F-Test to prove differences between control and experimental groups.

500ml water bottles, two liter container, 500 grams of TiO2, electronic scale, 250 mL graduated cylinders, 10 mL graduated cylinders, test tube stand, test tubes, incubator, slant tubes with E. coli K-12 strain, inoculating loop/tube, Bunsen burner, Sylvania "Grow-Lux" fluorescent light, trypticase soy agar filled petri plates, distilled water, eye goggles, pairs of non-latex gloves, masks, periodic table of elements, TI-89 calculator, bottle of Clorox bleach, plastic wrap, and microscope.

Results

Null hypothesis = there is no difference between the two groups' Alternative hypothesis = there is a difference between the two groups. Control/Group A (0.0025M TiO2)- accept alt. hyp.; Control/Group B (0.0050M TiO2)- accept alt. hyp.; Control/Group C (0.0075M TiO2)- accept alt. hyp. Group A/Group B- accept Null hyp.; Group A/Group C- accept alt. hyp.; Group B/Group C- accept alt. hyp.

Average number of colony forming units: Control- 155.3 CFUs; Group A- 52.4 CFUs; Group B- 38.6 CFUs; Group C- 8.3 CFUs.

Conclusions/Discussion

The ANOVA F-Test proves that differences between control group and variable groups. Between control group and Group A, E. coli exposed to 0.0025M TiO2 solution, there was an average of 66.3% decrease in formation of CFUs. Between control group and Group B, E. coli exposed to 0.0050M TiO2 solutions, there was an average of 75.1% decrease in formation of CFUs. Between control group and Group C, E. coli exposed to 0.0075M TiO2 solution, there was 94.7% decrease in the formation of CFUs.

The ANOVA F-Test did not reveal a difference between the number of CFUs in variable groups A and B. However, Group A had 6.3 times more CFUs than Group C, and Group B had 4.7 times more CFUs than Group C.

Summary Statement

Titanium dioxide can be used to neutralize E. coli in the presence of light and water.

Help Received

None

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Won T. Choi; Sheen H. Tran

Project Number

S1303

Project Title

Blue-Green Algae in Lake Elsinore: Second Year Study

Abstract

Objectives/Goals

To find out why algae concentration is high in Lake Elsinore and to extricate it.

Methods/Materials

Disolved oxygen concentraton test kit.
Nitrate concentration test kit.
Phosphate concentraton test kit.

Results

Many agricultural and industrial run-offs caused algae to bloom. Copper II sulfate. Cutrine Plus and Barley Straw is used to extricate the algae. Barley straw was the most effective and safe with surrounding environment.

Conclusions/Discussion

Barley Straw takes time to decompose, but once it decomposes, it showed the highest rate of reducing algae while it wasn't harmful to the surrounding environment.

Summary Statement

Reduce algae in Lake Elsinore to the safe level.

Help Received

Test kit provided by La Sierra High School, Mr. Westover. Riverside Water Quality Control Board, Cindy Li, provided much valuable information.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Catherine L. Chu

Project Number

S1304

Project Title

The Synergistic Effect of Hydrogen Peroxide and Ultraviolet Irradiation in Killing Escherichia coli

Abstract

Objectives/Goals

The purpose of this project was to evaluate the synergistic effect of hydrogen peroxide at different concentrations and ultraviolet irradiation at different intensities in killing Escherichia coli.

Methods/Materials

Escherichia coli was cultured in Luria Broth until the bacteria concentration was 10^8 cells/mL. The E. coli was resuspended in distilled water. For the first experiment, nine mL of E. coli was put into an empty pety dish. One mL of hydrogen peroxide (0.01%, 0.1%, 1%, 2%, 3%) was added to the E. coli. The solution was swirled by hand for three seconds. o.1 mL of the solution was taken by a pipet and placed onto a petry dish to be plated. For every concentration, five serial dilutions were made to ensure a platable number of bacteria. In experiment two, instead of putting one mL of hydrogen peroxide, one mL of water was placed into the bacteria. The ultraviolet lamp was held 10 cm, 20 cm, and 40 cm above the E. coli for three seconds. The plating procedures were the same as experiment one. The third experiment included using hydrogen peroxide and ultraviolet light together (e.g. 0.01% H2O2 with 10 cm of UV at 254 nm). The petry dishes were put into an incubator for 24 hours at 37 degrees C. The bacteria colonies were then counted.

Results

Short wave ultraviolet light killed over 99.9% of all the bacteria within three seconds at 10 cm and 20 cm. When hydrogen peroxide was added, the hydrogen peroxide hindered the killing ability of short wave ultraviolet light alone. Long wave ultraviolet light killed only 10-15% of all the bacteria in three seconds when the lamp was 10 cm away from the E. coli. When hydrogen peroxide was added,it helped UV long wave kill E. coli.

Conclusions/Discussion

There was not a synergistic effect with UV short wave, but there was one with UV long wave. UV short wave was a very effective bacteria killer by itself. Hydrogen peroxide could have hindered the killing effect of UV shortwave because at certain concentrations, H2O2 can absorb the UV light. An explanation for the synergistic effect found with UV longwave was the hydrogen peroxide first released hydroxyl radicals that attached to the cell membrane. The ionized cell membrane is denatured; thus, the UV light can easily enter the cell's nucleus, form covalet bonds between the nitrogenous bases in the DNA, and kill the bacteria.

Summary Statement

A synergistic effect was found between ultraviolet long wave and hydrogen peroxide, while a synergistic effect was not found between ultraviolet short wave length and hydrogen peroxide.

Help Received

Lab equipment at the University of Southern California under the supervision of Dr. Casey Chen.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Chanelle N. Delgado

Project Number

S1305

Project Title

The Effect of Seasonal Changes on the Luminescent Time Spans of Dinoflagellates

Abstract

Objectives/Goals

1. Do seasonal changes affect dinoflagellates? How would recreating the events leading up to the winter solstice (during which the days become shorter) affect all dinoflagellates living anywhere except the equator (where the days and nights are 12 hours long all year round)?
2. How would altering the dinoflagellates 12 hour day/night cycle affect them? How would subtracting an hour from the dinoflagellate cycle per day, until they were left with 6 or 8 hours (instead of the regular 12) to photosynthesize, affect the dinoflagellates luminescent time span?

Methods/Materials

For Experiment 1, 3 cultures of dinoflagellates were tested at different times during their night cycle. Group 1 was on a 12/12 (day hours/night hours) cycle, Group 2 was on an 8/16 cycle, Group 3 was on a 6/18 cycle. Experiment 2 consisted of 3 Groups each containing 3 cultures (designed to strengthen data from Experiment 1). These were also tested at 12/12, 8/16, and 6/18 light exposure cycles. The cultures were tested 2 hours into the dark cycle and how long they luminesced was determined when stimulated by movement.

Results

The control group (Group 1) of dinoflagellates, on the 12 hour cycle, luminesced for an overall average of 71 seconds. The 8/16 hour (Group 2) luminesced for an overall average of 46 seconds. This group declined 20 seconds, then evened out and luminesced at around 45 seconds. The 6/18 hour (Group 3) luminesced for an overall average of 27 seconds; the entire Group died.

Conclusions/Discussion

By altering the dinoflagellate groups' 12 hour cycle, a decline in their luminescent time span resulted and all 3 cultures in Group 3 died. Experiments 1 and 2 proved that dinoflagellates are affected by seasonal changes. I have learned that dinoflagellates are strictly dependent on their 12 hour cycle. This is clear because the 6/18 group died after 17 days.

Summary Statement

The dinoflagellates require 12 hours to photosynthesize in order to remain healthy and luminesce when stimulated.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Sierra C. Ford

Project Number

S1306

Project Title

Fecal Coliform: Surprising Levels in a Reservoir

Abstract

Objectives/Goals

To compare fecal coliform bacteria levels in a reservoir with levels at sites upstream and downstream and to determine why such differences in the fecal coliform levels occur.

Methods/Materials

Methods: COLLECT WATER SAMPLE(S). CLEAN & DISINFECT WORKSPACE. PREPARE STERIFIL APPARATUS. CHECK THAT INCUBATOR READS 44.5° (DEGREES) CELSIUS. PREPARE PETRI DISHES WITH MFC MEDIA. FILTER WATER SAMPLE(S) USING THE VACUUM APPARATUS. INCUBATE AT 44.5° C FOR 22-24 HOURS. COUNT FECAL COLIFORM COLONIES. RECORD THE NUMBER OF FECAL COLIFORM COLONIES PER 100 ML. QUALITY CONTROL-OPTIONAL 1. Run a positive control using E. coli. 2. Run a negative control using Streptococcus. CLEAN-UP

Materials: Sterile sample bags; Sterifil apparatus; Vacuum system; Sterile pipettes; Sterile buffer; Forceps; Petri Dishes ; Millipore Type HA 0.45 micron packet; Sharpie pen ; MFC medium; Ethyl alcohol; Bunsen burner; Incubator ; Disinfectant; Anti-bacterial soap; Autoclave; Foil. Optional: E. coli broth-positive control; Streptococcus-negative control; Sterile distilled water.

Results

My data showed that there were higher levels of fecal coliform bacteria found in the reservoir as compared to the inflow creek. The levels of fecal coliform I found further downstream from the reservoir were not stable, as I hypothesized, but rather declining as the distance from the reservoir increased.

Conclusions/Discussion

Understandably, there was no bacteria found in the inflow creek; this water flows out of the ground in an underground aquifer.

The testing site I was using further downstream from the reservoir had very low levels of fecal coliform bacteria as compared to the levels found in the reservoir. I found that the fecal coliform bacteria levels were high at the direct outflow. I also found that there are other creeks that are diluting the direct reservoir outflow water. These other creeks are lowering the number of fecal coliform bacteria colonies found per 100 ml sample. The absence of bacteria tested in the other water sources that are diluting the main stream proves within reasonable doubt that the bacteria are being carried from the reservoir. The only source for the bacteria is from the feces of the animals. I would conclude that the higher fecal coliform bacteria levels in the reservoir are caused by an increase in the number of birds and mammals in the area.

Summary Statement

Fecal coliform bacteria levels in a reservoir are higher than levels both up-stream and further down-stream.

Help Received

Used lab equipment at San Lorenzo Valley High School under Ms. Jane Orbuch.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Phyllis B. Gayda

Project Number

S1307

Project Title

Culturing Strains of Chlamydomonas reinhardtii Acclimated to High Salt Concentrations

Abstract

Objectives/Goals

The objective was to determine if a strain of a freshwater algae, C. reinhardtii, could be cultured over a period of time that was acclimated to seawater if exposed to increasingly elevated concentrations of Instant Ocean-artificial seawater.

Methods/Materials

Wild type C. reinhardtii from Duke University were exposed to a range of Instant Ocean concentration for seven days to observe sensitivity to salt concentrations. Then, algae were exposed to increasingly higher concentrations of Instant Ocean in bubbler tubes with daily cell counts taken for 63 days. The acclimated culture (17.4 g/l) was then compared to freshwater controls. The freshwater controls were abruptly exposed to the same concentration of Instant Ocean and observations were made.

Results

The data show the acclimated strain continued to have elevated cell counts while the freshwater control abruptly exposed had decreased cell counts. Culturing was continued until reaching 30.4 g/l where no algae were present.

Conclusions/Discussion

Discussion: This #endpoint# could have been due to a more aggressive acclimating regement or 30.4 g/l may indeed be the highest concentration of salt that this freshwater algae can tolerate.

Conclusion: It was determined that a strain of C. reinhardtii could be cultured that would reproduce at rates similar to those in freshwater when the salt concentration is as high as 30.4 g/l and possibly higher.

Summary Statement

The freshwater algae Chlamydomonas reinhardtii was cultured over time in increasingly elevated concentrations of Instant Ocean in order to create a strain that was acclimated to very high salt concentrations.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Kirandeep Gill; Kamalpreet Tut

Project Number
S1308

Project Title
The Effect of Glucose on Expression of the Amylase Gene in Bacteria

Abstract

Objectives/Goals
In this context of study, the experiment to be performed is: what effect does maltose have on gene expression of amylase in bacteria? The hypothesis is that glucose will "turn off" the regulator gene for producing amylase because the presence of glucose is a stimulator to turn the gene "off"; therefore, if glucose is already present in the gene, the operon will be turned "off".

Methods/Materials
A 2% starch agar was prepared in the lab. Then, soil samples were obtained and placed on the agar plate with a sterile loop. This agar plate was then placed in the incubator at 37ºC. After a span of 48 hours, the agar plates were examined for bacteria colonies.
The following samples were prepared in the lab: 2% starch, 1% glucose with 2% starch, 2% glucose with 2% starch, and 3% glucose with 3% starch. The plates containing glucose represented the experimental group of bacteria. Once these samples were made, they were set in the autoclave at 121ºC and poured onto agar plates.
Using a patching technique, the bacteria colony that was amylase producing, was introduced to all of the agar plates. Then, all of the plates were incubated at 37ºC for a span of 48 hours. They were removed from the incubator and examined for typical 'halos' that might have appeared. A picture of the samples was taken from a digital camera and using a mapping computer program, the halos were measured. A t-test was then applied to the data.

Results
The results showed that the greater concentration of the glucose present in the agar, the less the halo measured to be.

Conclusions/Discussion
This project is designed to observe what effect glucose has on the expression of the amylase gene. The amylase enzyme is responsible for breaking up starch, and in humans it can be found in the saliva. The enzymes are highly specific, each easily catalyzes only one type of chemical reaction.In order to caryry out this experiment an amylase producing bacterium was isolated. This bacterium was patched on to agars that contained starch and different gradients of glucose. Once, they were incubated the haloes that the bacteria colonies gave off were measured.

Summary Statement
Our project is about the effect of glucose on expression of the amylase gene in bacteria.

Help Received
Mr. Okuda provided us with the lab equipment and facility to carry out our experiment, Mr. Johnson provided us with statistical analysis information and how to apply it, our parents supported us.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Ashley M. Gilroy

Project Number

S1309

Project Title

Garlic: The Wonder Drug?

Abstract

Objectives/Goals

To compare the antibacterial properties of Garlic to the antibiotic Erythromycin against staph aureus bacteria.

Methods/Materials

Tested varied concentrations of each substance (garlic, erythro) on the bacteria and observed growth in test tubes that were put in an incubator for 24 hours. Swabbed resulting growth on agar plates for better observation.

Results

Garlic did not prevent the growth of bacteria as well as the erythromycin (which killed it completely). The highest concentration of garlic fared the best, killing about 75 % of the bacteria.

Conclusions/Discussion

Unless used in large concentrations, garlic is not very effective in killing staphylococcus aureus bacteria.

Summary Statement

Testing the antibacterial properties of garlic against staphylococcus aureus bacteria.

Help Received

Used lab equipment at Lancaster Community Hospital and worked under the supervision of Diane Halaska.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Kate E. Graham

Project Number

S1310

Project Title

Are the Water Fountains at Mater Dei Safe?

Abstract

Objectives/Goals

Hypothesis:The samples taken from the cleaned drinking fountain spouts will not grow as many colonies of bacteria as opposed to the unclean water fountain spouts; and the samples taken during the day when the temperature is hotter will grow more colonies than the samples taken at 7. PROBLEM: Is there any difference in the bacterial levels of water at different fountains throughout the M.D. campus and at different times during the day as temperature rises?

Methods/Materials

1. Collect water and swab samples at 7 and 3. Collect water in sterile collection bags and streak swabs directly onto plate immediately. (controls: one entire cleaned site; pond water; boiled water) 2. Label each sample with the site of collection and time of day collected and take photos of each site. 3.Store samples at 4 degrees Celsius. 4. Pipette 10 mL of water from each bag onto petri dish. Label each plate according to which bag it came from. 5. Spread water onto surface of agar and seal dish. 6. Incubate for 7 days at room temp. After each day, record results. Photo plates after last day of incubation. MATERIALS:nutrient agar petri dishes;sterile pipette tips;sterile pipettor;sterile collection bags;sterile swabs;film

Results

There is a difference in the number of colonies that grow at different sites. The time of day had a dramatic effect on growth. There was more growth in the morning samples.

Conclusions/Discussion

1.There is more groth in water and swabs from fountain 2. This could indicate potential health problems. 2. There is less growth at 3 than at 7. This is contrary to my hypothesis and might indicate that the fountains are cleaned sometime between 7 and 3 or the bacteria is flushed out as more students use the fountains duing the day.

Summary Statement

There is a difference in the concentration of bacteria in the water at different fountains and at different time of the day throughout the Mater Dei campus.

Help Received

My father was my mentor and obtained all the supplies that I neded in my report and my mom helped me with my board.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Elizabeth Howe; Ashley Louderback

Project Number

S1311

Project Title

The Effect of Environmental Stess on Gene Expression in Saccharomyces cerevisiae

Abstract

Objectives/Goals

Our objective was to find out if gene expression in Saccharomyces cerevisiae was altered by the addition of an environmental stress of a heat shock of 39.9 C for one hour. We believed that gene activity rate would alter in the yeast based on the idea that living organisms must adjust their internal mechanisms which are regulated by proteins and therefore genes in order to survive in a changed environment.

Methods/Materials

Yeast samples were harvested and split into a control group kept at 27 C and a heat shocked group at 39.9 C for one hour. The RNeasy Maxi Kit for Isolation of Total RNA using an enzymatic lysis protocol was used to extract RNA from both samples. Then, the processes of linear amplification and dye-incorporation were coupled, producing tagged strands of linearly amplified DNA. The unknown fragments of tagged DNA were washed over fragments of known DNA on a microarray slide allowing for hybridization to occur. The slide was run through a scanner in order to analyze the fluorescence levels of the genes of the yeast.

Results

Our results confirmed that the gene activity rate did change with the addition of a one-hour 39.9 C heat shock based on the results produced by the scanner.

Conclusions/Discussion

We found that many genes activity rates were increased or decreased due to the heat shock. We selected twenty-five genes to focus upon. Based on these genes we found two trends. First, many genes associated with cellular respiration were down-regulated. Second, genes involved with substance transportation across the yeast were up-regulated. For further analysis, we compared our data to that of Pat Brown#s of Stanford who had performed a similar experiment previously. We found many similar alterations in the expression of the same genes.

Summary Statement

We tested the effect of heat shock on gene expression in yeast samples and used a microarray for analysis.

Help Received

Mr. Kucer was our teacher advisor; Mr. Willy McAllister was our mentor and contact at Agilent; Agilent allowed us to use their labs and supplied us with equipment

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Robert D. Huang

Project Number

S1312

Project Title

The Detection of Bacteria Resistant to Ampicillin and Kanamycin in Meat at Tracy Supermarkets

Abstract

Objectives/Goals

The objective of this experiment is to determine if the low levels of antibiotics fed to livestock leads to the presence of antibiotic-resistant bacteria in supermarket meat.

Methods/Materials

Beef, chicken, and pork were obtained from two local supermarkets. The liquid juices found within the containers of those meats were streak plated onto LB agar plates, LB agar plates with ampicillin, and LB agar plates with kanamycin. The plates were allowed to sit untouched for 48 hours (in order to allow bacteria to grow). All bacteria found to be resistant to one type of antibiotic were cross-plated onto a plate with the other type of antibiotic.

Results

The chicken from the Tracy Safeway and the pork from the Tracy Albertsons displayed significant bacterial growth. The chicken had kanamycin-resistant bacteria and the pork had ampicillin-resistant bacteria present.

Conclusions/Discussion

A major cause of the proliferation of antibiotic-resistant bacteria is exposure of bacteria to weak levels of antibiotics. The presence of antibiotic-resistant bacteria in supermarket meat poses a potential health hazard and reveals the problems within the system of raising livestock. The results also underscore the need to reform the before mentioned system.

Summary Statement

This project explores the potential creation of antibiotic-resistant bacteria when livestock are fed low levels of antibiotics.

Help Received

Mr. Kirk Brown oversaw the laboratory procedure and guided the creation of the presentation.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Crystal R. Hucko

Project Number

S1313

Project Title

The Detection of Tenia pedis within the Tracy Community Area

Abstract

Objectives/Goals

The main focus of this experiment was to examine was how prominent the fungus, Tenia pedis, is throughout the communal bathing areas around Tracy, California.

Methods/Materials

This was accomplished by gathering samples from Tracy and West High Schools# locker rooms in Tracy, California. The samples were obtained by running a moistened cotton swab across a possibly infected area and culturing these samples on a Dermatophyte Test Medium. These samples were monitored during growth over a period of two weeks.

Results

Of the seventeen samples taken only one culture proved to test positively for the fungus. This was sample gathered from shower #4 of the Tracy High Boys# locker room. The growth of a white, fluffy hyphae mycelium occurred, while it also produced alkaline causing a change in medium color, from yellow to red. While other dermatophyte growth did appear on the test mediums, it was not the growth of Tenia pedis.

Conclusions/Discussion

This study was completed in order to insure that public showers throughout the Tracy community are not harmful to the many people who use them after swimming, working out, playing sports, and other physical activity. The results produced provided helpful information which can be used to ensure that the Tracy High Boys# facilities are cleaned more properly.

Summary Statement

My project is about testing for the presence of Tenia pedis (athlete's foot) within Tracy, California.

Help Received

Mr. Brown helped in direction of how to create backboard, Lawrence Livermore National Laboratory printed out the backboard for me, and Hardy Diagnostic Co. provided the test medium.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

H. Cindy Ko

Project Number

S1314

Project Title

Genomic Comparison Between Pathogenic A. actinomycetemcomitans and Non-Pathogenic H. aphrophilus

Abstract

Objectives/Goals

The objective of my project was to find the fragments of DNA that were present in A.actinomycetemcomitans (A.a.) and not present in H.aphrophilus (H.a.). A.a. is the bacteria associated with juvenile periodontitis and H.a. is its harmless, phylogenetic cousin.

Methods/Materials

The method of Representational Difference Analysis (RDA) was employed to reveal the differences between A. actinomycetemcomitans and H. aphrophilus. It is essentially a subtraction method that allows only the DNA fragments unique to A.a. to be replicated by Polymerase Chain Reaction (PCR).

Results

Eight fragments of DNA from A. actinomycetemcomitans were found, cloned into competent cells, and sequenced. Those sequences were later compared to other genomes decoded online on such websites as NCBI and Oklahoma University. Homologues to four of these fragments were found and compared, the four others found no homology to either sites' databases. Therefore, these fragments are deemed to be unique to A.a. (concluded from the information on the database) and some of them are even unique to the particular strain used, D-7.

Conclusions/Discussion

These fragments were matched to other pathogenic bacteria (such as: Multocida tuberculosis, and Escherichia coli, for example), leading to the possibility that several of these pathogenic bacteria share similar genes that allow them to be pathogenic. The fragments coded for such things as sensory kinases, methionine aminopeptidases, etc. These functions could be the reason why A.a. causes juvenile periodontitis and H.a. is completely commensal. For example, the sensory kinase could help A.a. sense other bacteria in the mouth, competeing for a similar ecological niche.

Summary Statement

The project focuses on finding the genomic differences between A. actinomyctemcomitans and H. aphrophilus in hopes of finding the genes responsible for making A. actinomyctemcomitans pathogenic and H. aphrophilus merely commensal.

Help Received

Dr. Casey Chen for letting me use the lab in USC and helping me in the project, Dr. Wei-zhen Chen and Dr. Ying Wang for helping me do the project. Mom, Dad, Mabel, and Weikuo for support,

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Audrey E. Landale

Project Number

S1315

Project Title

The Effect of Lead in Gasoline on the Environment Near Major Roadways

Abstract

Objectives/Goals

My objective was to find out if any bacteria in the soil near roadways had developed resistance to lead. I hypothesized that the farther away from the road my samples were, the less lead resistant bacteria they would have.

Methods/Materials

To see if bacteria had developed lead resistance I tested the top 0-5cm of soil at 0.5, 5, 10, 20, and 50m away from a major road. Then I made agar plates with nutrient agar with and without lead nitrate, and diluted the soil samples with sterile deionized water. Then I plated different amounts of different dilutions onto the plates with and without lead, let the bacterial colonies grow, and counted them.

Results

Overall I found that there was a high percentage of lead resistant bacteria closest to the road, then the percent decreased, but at 20 and 50m, percentages rose again.

Conclusions/Discussion

My results partially supported my hypothesis, but I was able to find out that bacteria did grow lead resistance, which was my objective. As far as I know, I am the first person to test for lead resistant bacteria near roadways.

Summary Statement

My project was to test soil samples near roadways for lead resistant bacteria.

Help Received

I used the materials and research facilities of the Harvery Mudd College Biology Department; Nancy V. Hamlett advised me on procedures.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Teresa Lee; Angela Tsai

Project Number

S1316

Project Title

The Myth of T-Cells

Abstract

Objectives/Goals

Varicella-Zoster Virus (VZV) is a human specific virus that commonly causes chicken pox in children. The effects of the virus are seen on the skin with red puffs. It can be deduced that here is something that transports the virus to the skin epidermal layer. T-cells are one of the most mobile cells in the body, earlier research has shown that T-cells can be infected with VZV, and may be associated with the speading of the virus. The purpose of our experiment was to determine whether or not T-cells may be infected with VZV and be the carrier of the virus to the epidermal layer.

Methods/Materials

Since T-cells are mobile and continuously circulate in the body, we hypothesize that virally infected T-cells may be able to transfer the virus to skin through blood circulatin. To explore this possibility, we injected T-cells in a SCID mouse's tail vein that contained grafted human skin tissue implants within its body. Were the hypothesis true, we would expect to observe that the skin graft is infected by the virus. Were it not true, the skin graft would be normal. T-cells infected with VZV were injected into the tail vein of a SCID-hu mouse. Immunofluorescent assay-infected T-cells were stained with antibodies to check the infection of the T-cells. Infectious focus assay was used to determinethe nuber of viral particles there were on the human implant. Also, the tissue section was stained to observe effects of viral infection on the skin and confirm infection.

Results

From the infectous focus assay, we found that the viral particles had replicated in the skin tissue. Also, from the tissue sections, we saw viral particles destroying the tissue. Then, from the immunofluorescent assay, we found the T-cells infected and that T-cells could be the carriers of VZV.

Conclusions/Discussion

We concluded that T-cells could be infected with VZV. After examining the infectious focus assay, the virus had reached its destination and infected the skin, since many viruses have been made in the implants. The way the T-cells found its way to the implant is analogous to the way T-cells infect the skin. VZV kills healthy skin cells in a series of stages that were visible in the tissue sections. After looking at the slides of the tissue sections, it provided more evidence that VZV had replicated in the transplant.

Summary Statement

To determine whether or not T-cells may be infected with Varicella-Zoster virus and be the carrier of the virus to the epidermal layer.

Help Received

Used lab equipment at Stanford University under the supervision of Dr. Ku, mother helped with the design of posterboard, neighbor helped us find a mentor

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Annie Li

Project Number

S1317

Project Title

Retroviral-Mediated Transfer and Expression of Neomycin and Hygromycin B Drug Resistance Genes

Abstract

Objectives/Goals

In this experiment, the Murine Leukemia Virus (MLV) pseudotyped with the Vesicular Stomatitis Virus glycoprotein (VSVg) was used to transfer the neomycin resistance gene and hygromycin B resistance gene within 293 cell line, human embryonic kidney cell line.

Methods/Materials

A 293T cell line, human embryonic kidney cell line, was cultured to package the pseudo-typed virus. 48 hours after transfection, the viral supernatant was harvested for the infection of the 293 cell line. Selection began 48 hours after infection and 500 ug/ml of G418 and 150 ug/ml of hygromycin B was added to 10% Fetal Bovine Serum (FBS) Dulbecco#s modified Eagle#s medium (DMEM). On a weekly basis, the number of cells were counted with the Trypan Blue Exclusion Assay.

Results

One week after selection, there were 46 x 105 cells/ml resistant to neomycin, 43.5 x 105 cells/ml resistant to both neomycin and hygromycin B (cells co-infected), and 6.25 x 105 cells/ml resistant to hygromycin B. Two weeks afterwards, the genes expressing hygromycin B and cells co-infected had become silenced. The neomycin drug resistance expressing cells, however, maintained a growth and had 61 x 105 cells/ml after two weeks, 78 x 105 cells/ml after three weeks, and 109 x 105 cells/ml after four weeks. Thus this system successfully transferred and expressed the drug resistance genes within 293 cells, but was not able to sustain the expression of hygromycin B resistance. Currently, the neomycin resistant cells are still being cultured and experimented with in order to determine the length of time 293 cells are able to express a transferred drug resistance gene before being silenced.

Conclusions/Discussion

In this experiment, the neomycin resistance gene was expressed in more cells than the hygromycin B resistance genes. An explanation for this may be that MND-EGFP-SN, providing resistance to Neomycin, was much smaller in genomic size. While the neomycin resistance gene was only 860 base pairs (bp), the hygromycin B resistance gene was more than twice as large, 1,800 bp. The silencing of the hygromycin drug resistance gene expression could have been caused by several factors: area of site integration, type of gene transferred, type of cell used as a host, an inefficient promoter, and DNA methylation. Since no hygromycin B resistance was found in 293 cells after ten days, the co-infected cells also died due to the application of Hygromycin B, not G418 (Neomycin).

Summary Statement

In this experiment, the MLV-VSVg retroviral vector transfers and expresses the neomycin and hygromycin B drug resistance genes in 293 cells.

Help Received

Used lab equipment at USC Medical School under the supervision of Dr. Michael Lai and Vicky Sung

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Forest R. Monroe

Project Number

S1318

Project Title

Yeast's Food of Choice

Abstract

Objectives/Goals

My objective is to determine what type of carbohydrate will cause bakers yeast to produce the most carbon dioxide.

Methods/Materials

The four carbohydrates I tested were fructose, dextrose, sucrose, and corn starch. A 10% yeast solution was added to a 10% solution of the first type of carbohydrate (giving a 5% solution of each) and 10 mL was put in each of four fermentation tubes. After an hour I checked the level of the CO(2) production. I then repeated that process for each of the other carbohydrates.

Results

The monosaccharides, (dextrose and fructose) produced 6.35 mL and 6.5 mL of CO(2) respectively, while the disaccharide (sucrose) produced 4.25 mL. The polysaccharide (corn starch) produced only .2 mL.

Conclusions/Discussion

Fructose outperformed dextrose by a slim margin, but it is possible this difference would be narrowed with many additional trials. The difference between the mono- and disaccharides was much larger because the yeast had to break the bond between the glucose and the fructose that make up a sucrose molecule. Corn starch produced almost no CO(2), probably because it was too complex to be digested by yeast.

Summary Statement

My project is to determine what type of carbohydrate (fructose, dextrose, sucrose, or corn starch) will cause bakers yeast to produce the most carbon dioxide.

Help Received

Science teachers loaned fermentation tubes; edited project, and gave advice on revisions; Mother helped cut foam core and glue project together.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Chelsea A. Morris

Project Number

S1319

Project Title

Echinacea: Myth or Miracle?

Abstract

Objectives/Goals

Echinacea, the herbal extract that is marketed as a product that boosts your immune system, was used in this experiment to test whether this herb had an effect on pathogens topically, disrupting or slowing their growth or production.

Methods/Materials

Five tomatoes were used in three separate trials. The first tomato was untouched and used as a control. The surfaces of the remaining four tomatoes were exposed to pathogens from a rotting tomato. Echinacea was then applied to the surface of one of the four tomatoes in the trials to determine if it would inhibit the growth of bacteria and mold. Rubbing alcohol was applied to the surface of another tomato, as it is a known substance that destroys bacteria. As the skin of the tomato forms a formidable physical barrier to the entrance of microorganisms, one tomato was dropped from two meters after contact with pathogens to damage its protective coat. The tomatoes were kept in plastic bags and stored in a dark location for seven days.

Results

In two trials the tomatoes treated with rubbing alcohol and Echinacea showed little to no sign of bacterial growth. In the third trial every tomato with the exception of the control tomato showed signs of deterioration by the end of the trial.

Conclusions/Discussion

Echinacea applied topically appeared to slow the growth and spread of pathogens. The nature in which Echinacea is effective is unclear. If effective, when taken orally, it assists the defenses of the immune system. When pathogens metabolize and multiply, tissue that has been invaded is damaged and host cells are destroyed. If Echinacea promotes the development of phagocytes, or white blood cells that destroy pathogens by surrounding and engulfing them, it would not necessarily follow that the substance would effectively destroy bacteria topically. Echinacea is often used to help cure the common cold, sore throats, runny nooses, and sinusitis. The sources of pathogens causing these illnesses are often viral and not effected by phagocytes.

Summary Statement

Echinacea, when applied topically, inhibits the growth of pathogens.

Help Received

Patricia Morris assisted with photography.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Alexa M. Putnam; Rhett I. Putnam

Project Number

S1320

Project Title

Do Ocean Fireball Algae Benefit from the Positive Magnetic Field?

Abstract

Objectives/Goals

In our home we have successfully used magnets as a household remedy for warts. We have also seen other anecdotal evidence of positive effects coming from magnets. It has not been accepted in the scientific world that a specific pole can be beneficial for forms of life. We thought this idea worth testing. Our objective in this project was to rigorously apply the scientific method to test whether positive magnetic fields can have a beneficial effect on plant life.

Methods/Materials

A member of the UCSB biology department provided us with large samples of Pyrocystis Fusiformis, a.k.a. Ocean Fireball Algae, which is an excellent test subject for indications of effects on health and vitality. We used vials of algae, magnets, and microscopes. We used control samples and test samples of algae. For supplemental testing, we used bean seeds and plant containers, also with controls. We kept careful logs to record our observations. We took photographs showing results, as well.

Results

After making timed glow-test observations (length of algae glow upon shaking is an indicator of algae health), and utilizing microscopes to observe the percentage of alive algae per sample, and entering all observations in our log, the quantitative data reflects enhanced vitality of algae exposed to positive magnetic fields. The algae so exposed lived approximately 5% longer than the other samples in the test.

Conclusions/Discussion

These data suggest that magnetic fields do affect the health of biological systems. Our testing was focussed on the health effects of positive magnetic fields with respect to plant samples. We conclude that magnetic fields should be carefully used in proximity to biological systems, and that positive magnetic fields may be applied to certain plant species for life and vitality enhancement purposes.

Summary Statement

This project provides rigorous scientific testing of the idea that magnetic fields can have a positive effect on biological systems, with interesting results.

Help Received

Mother helped Identify mentor, and got some liturature on magnets, she also wrote some of the data that I dictated to her.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Matthew G. Sherman

Project Number

S1321

Project Title

San Elijo Lagoon Water Quality Study

Abstract

Objectives/Goals

What is the water quality of the San Elijo Lagoon, and how is it impacted by the bacteria in the water?

Results

I found that with the increase of bacteria, there was a decrease in the oxygen level in the water in the five-day reading. The bacteria also seemed to do well in the higher air temperatures and water temperatures. The rain before my first collection seemed to not only increase the pH of the water, but also decrease the amount of bacteria in the water greatly. After reviewing the stained lagoon water bacteria, I discovered that the gram positive, or darker bacteria, was only found in the water with the highest oxygen levels and only in water with the pH level of 8.5. However, the gram positive rods did not consumed nearly as much oxygen after five days as the gram positive circles. The gram positive circles consumed almost all of the oxygen in the water by the fifth day. The circle type for a gram negative bacteria was only found in the lower oxygen levels.

Conclusions/Discussion

I concluded that based on the data gathered in this experiment, it is very difficult to find any clear-cut conclusions correlating temperature, turbidity, oxygen levels, pH, and bacteria. Not surprisingly, the more bacteria present in the water, the less oxygen there was in the five-day reading. This is because the bacterium consumes oxygen and in these samples there were no new sources to oxygenate the water. Also the data I have collected indicates that the bacteria level has a correlation with both the air and water temperatures.

Summary Statement

Looking at the Water Qualities of the San Elijo Lagoon and how the effect the Bacteria in the Water.

Help Received

My dad took me to and from my sample sites in the lagoon, Mrs. Gushwa and Mrs. Ramos, my instructors, provided a water quality testing kit, sterol equepment, and there supervision.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Anurag M. Sridharan

Project Number

S1322

Project Title

How Safe Are Our Beaches?

Abstract

Objectives/Goals

My project was to determine the amount of fecal coliform in the beach water. Fecal coliform levels are indicators of how safe the beaches are.

Methods/Materials

This test was conducted at the Edward S. Babcock & Sons Inc. Laboratory with the help of Mr. Tom Gericke. Samples were obtained from the Newport Beach. The test used was the multiple tube fermentation technique, which included using Lauryl Sulfate Broth, Brilliant Green Bile, and EC Medium. The test was conducted three times to ensure its validity.

Results

The results were that during the first test, 240 fecal coliform bacteria per 100ml was present. During the second reading, 11 feacal coliform bacteria per 100ml was present. During the third reading, 50 fecal coliform bacteria per 10ml was present.

Conclusions/Discussion

The test finding fecal coliform bacteria levels proved the hypothesis incorrect. On an average, there were 100 fecal coliform bacteria per 100ml of Newport Beach water. The first trial varied greatly from the second and third trials. Since fecal coliform gets into beach water through agricultural and strom runoff as well as human sewage, this could explain the vast difference between the first trial and the latter trials.

The standards for fecal bacteria levels vary from place to place. In some beaches, the beach will be shut down if the fecal coliform bacteria levels exceed 400 organisms per 100ml of water, while others will close the beach if fecal coliform bacteria levels exceed 200 organisms per100ml of beach water.

Fecal coliform bacteria occurs naturally in our digestive tract and aids in digestion. The reason tests are done to find fecal coliform bacteria levels is because it is an indicator of pathogenic organisms. The more fecal coliform present, the greater chance that pathogenic organisms are also present. A person swimming in water with high fecal coliform levels also ahs a greater chance of getting sick from ingesting pathogenic organisms, or from organisms entering the body through cuts and other bodily openings. The pathogens present in the water can cause many diseases like typhoid fever, hepatitis, gastroenteritis, dysentery, and ear infections.

Summary Statement

The object of my project is to determine how safe the beach is by finding the fecal coliform bacteria levels in the water.

Help Received

Used lab equipment of Edward S. Babco & Sons Inc. laboratory under supervision of Mr. Tom Gericke.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Lucine A. Tarakjian

Project Number

S1323

Project Title

Temperature vs. Growth of Bacteria

Abstract

Objectives/Goals

To see how temperature effects the growth of bacteria normally found on raw chicken.

Methods/Materials

3 small boxes, safety goggles, an apron (or a lab coat if you have one), rubber gloves, 12 plate agar, sterile loops, alcohol swabs, dry marker, scotch tape, dilute solution of clorox (1%), 2 sterile swabs, distilled water, 2 tubes of nutrient broth, a lamp, refrigerator, sponge, lighter, thermometer, raw chicken, dry cloth, Clorox, and a clean plate. I obtained a sample of bacteria from raw chicken and incubated it in a tube of nutrient broth for 2 days, then with that culture, I isolated the colonies on 12 plates placing each group of 3 plates in their designated temperatures (-18, 12, 20,and 25 degrees C).

Results

The plates of bacteria at -18 degrees C had the average scale factor of 1; 12 degrees C grew the average scale factor of 1; 20 degrees C at the average scale factor of 3; 25 degrees C at the average scale factor of 4.7. This shows that bacteria grows better at warm temperatures (25 degrees C) than colder temperatures (20 degrees C, 12 degrees C).

Conclusions/Discussion

My hypothesis was correct. My prediction that the bacteria would grow the fastest at 25 degrees C was supported by my data. The control group was put in the freezer at -18 degrees C and none of the bacteria grew. The bacteria at 20 degrees C achieved the average scale factor of 3, the bacteria at 12 degrees C grew the average scale factor of 1, and the bacteria at 25 degrees C grew the average scale factor of 4.7. This also means that most bacteria found on raw chicken are mesophilic bacteria. Since mesophilic bacteria grow well at warm temperatures (25-40 degrees C) it is very important to keep your foods in the refrigerator.

Summary Statement

To find what temperature would bacteria normally on raw chicken would grow best in.

Help Received

My teacher advised me on how to do the project.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Shavon Thompson

Project Number
S1324

Project Title
Danger: Antibacterial Resistant Bacteria on the Loose!

Abstract

Objectives/Goals
To produce antibacterial or antibiotic resistant bacteria. And to count the number of 'generations' that this takes.

Methods/Materials
Firstly, I swabbed the back of my mouth/throat with a sterile swab, to gather a sample, which I then transferred to a blood agar plate. Then I placed a disk soaked in Amoxicillin in the center of the plate. Then I sealed the plate and placed it in the incubator. Next I repeated this process but soaked the disk in antibacterial soap. After 48 hours, the bacteria had grown and there was a ring that was bacteria free around the disk. Then I took a sterile swab soaked in distilled water and transferred the bacteria on the outskirts of the ring to a new plate, sealed it and put it in the incubator. I repeated this process until there was no longer a zone of inhibition or the antibiotic killed the bacteria.

Results
The amoxicillin killed the bacteria. However the bacteria on the plate with the antibacterial soap became resistant after three 'generations'. The other plate with antibacterial soap bacame resistant after six 'generations'.

Conclusions/Discussion
This experiment i have proven that the number of 'genrations' varies in which it takes to produce resistant bacteria. Because it is possible to produce resistant bacteria it is very important that antibiotivc and antibacterial soap be used correctly by society.

Summary Statement
Producing bacteria that is resistant to antibacterial soap.

Help Received
none

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Citlali H. Villalobos

Project Number
S1325

Project Title
An Important New Strain of Sacchcromyces cerevisiae Created using Biotechnology

Abstract

Objectives/Goals

Since the entire genome of the yeast, Sacchcromyces Cerevisiae, has been sequenced, the next task is to determine the roles of particular genes. Yeast use at least two different methods for pumping out sodium. ENA genes are known to encode sodium pumps that use ATP. The other method uses proton pumps, encoded by the PMA1 gene to create a proton gradient. Proton gradients are then used to pump out sodium through a sodium/proton antiporter. In this project the ENA genes were removed from the yeast Yak2, which already contained a deletion of the PMA1 proton pumps. Eliminating these genes permits the study of new ways in which sodium can be exported. The purpose of this project was to create a strain of Sacchcromyces Cerevisiae where the ENA genes were removed through homologous recombination and replaced with the Kanamycin resistance gene.

Using this method I found deletions of the ENA genes. The new strain was named LAL after myself, Citlali Villalobos. Successful recombination is confirmed when LAL is shown to be resistant to G418, a Kanamycin analog. In total, I found four different deletions of the ENA regions resulting from homologous recombination.

Summary Statement

In this project the ENA genes were removed from the Yak2 strain by homologous recombination in order to creat a brand new strain, LAL, to be used in future studies that will analyze methods by which cells export sodium.

Help Received

The Scripps Research Institute's Harper Lab; I used lab equipment and materials for my project.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Angela Wirsching

Project Number

S1326

Project Title

UV Light and Bacterial Decay

Abstract

Objectives/Goals

To determine whether UV Light has any effect on the bacterial decayof spinach leaves

Methods/Materials

Materials: Short/long wave ultraviolet lights, spinach, protective clothing, sun glasses, electricity, water, dirt/bacteria, Ziploc baggies, cooler.

Procedure:

1. Pick out ninety healthy spinach leaves and dip in a solution of dirt and water.
2. Divide the ninety leaves into three groups of thirty. Place one the groups of thirty under the UV light and expose for one minute. Keep in a plastic baggie and cooler.
3. Take the second group of thirty and place under the UV light for five minutes. Keep in a baggie and cooler.
4. Take the third group and place in the same cooler and a baggie.
5. Each day expose the two groups to the UV light, once the leaves begin to decay remove them and throw away, each day check the leaves in the cooler also.
6. Record data by how many leaves have decayed.

Results

The leaves exposed to UV light for five minutes and the leaves not exposed at all decayed faster than the leaves for one minute exposure. Yet the leaves with no exposure decayed faster than the leaves exposed for five minutes

Conclusions/Discussion

Thus, I concluded that UV light does sterilize. Yet too much light, say five minutes destroys the leaves. While one minute seems to be the right amount for sterilization.

Summary Statement

My project is about UV light slowing bacterial decay.

Help Received

Teacher helped conceive idea; Mother helped design board

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Daniel Zimardi

Project Number

S1327

Project Title

The Effect of Varying Amounts of Calcium on the Bioluminescence Mechanisms of Marine Dinoflagellates

Abstract

Objectives/Goals

My study is on the bioluminescence of Pyrocystis fusiformis. P. fusiformis is a bioluminescent dinoflagellate capable of using chemical reactions to produce a brilliant blue light after receiving a mechanical stimulus. My objective was to find a chemical that when introduced to the dinoflagellate cell would hinder the bioluminescence.

Methods/Materials

In order for the chemical reactions to occur several ions are needed. The most important is calcium. In order for me to hinder the bioluminescence I decided to use a calcium chelator to tie up the calcium in the media. After researching many different chelators, I found that EGTA was the most efficient as well as the least harmful to the dinoflagellates. I used different concentrations of EGTA to vary the amounts of calcium removed. After supplying the EGTA to the dinoflagellates I mechanically tested their bioluminescence.

Results

I noticed that concentrations ranging from .1M up to 1M were capable of reducing the level of bioluminescence produced. In order to make sure that the dinoflagellates were not affected pathologically by the EGTA I observed them under a microscope. I noticed something different between the cells with different concentrations of EGTA. The chemical reactions are housed in specialized structures called scintillons. What I noticed was that higher concentrations of EGTA caused the scintillons to remain around the nucleus instead of throughout the cell.

Conclusions/Discussion

After reviewing my results I noticed that EGTA concentrations of .1M and higher began to hinder the bioluminescence of the dinoflagellates. I also noticed that the specialized bioluminescence structures varied their positions within the cell depending on the amount of EGTA the cells were given. This may be due to a conservation of energy or that calcium is required for these structures to move about the cell (via microtubules).

Summary Statement

I found a way to deprive dinoflagellates of calcium ion and therefore hindering their ability to produce bioluminescence.

Help Received

Sunnyside Sea Farms answered any dinoflagellate culturing questions.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Vanessa E. Cox

Project Number

S1398

Project Title

A Search for Natural Antibiotics using E. coli

Abstract

Objectives/Goals

The objective of my experiment was to determine if plants and fungi growing in the Chico area possessed possible antibiotic properties.

Methods/Materials

Forty-nine samples of plants and fungi were collected. Each sample was ground with distilled water using a mortar and pestle forming an extract. One drop of each extract was placed on agar plates cultured with E. coli. Fresh garlic extract was used as a positive inhibitory control and distilled water was used as a negative control. Duplicate samples were run simultaneously. The plates were incubated at 84 degrees Fahrenheit, observed daily with results recorded. The pH of samples was also taken to determine if it was a variable.

Results

Possible antibiotic activity was noted as a clear space surrounding the sample extract spot, separating it from the E. coli lawn. Five samples exhibited what appeared to be possible antibiotic activity early on, only to be overgrown by the E. coli later. Five other samples showed more definitive results with sustained inhibition. Those that were overgrown from the outset were determined to have no antibiotic potential against E. coli.

Conclusions/Discussion

My results suggest that the five samples which showed possible antibiotic potential early on , only to be overgrown later, may have had a possible inhibitory effect on the growth of E. coli, but not the ability to kill it. The five samples, Manzanita, True Myrtle, India Hawthorne, Madrone, and Coastal Redwood, do seemingly possess antibiotic properties caused by factors other than pH because they had sustained inhibition. At the time of this application, I am running more tests on the ten positive samples in an effort to confirm the data from my original experiment.

Summary Statement

The purpose of my project was to test, using plants and fungi, for naturally occurring antibiotics in vitro.

Help Received

Used lab equipment at CSU, Chico under Dr. Patricia Parker, Microbiology Department. Dr. Kingsley Stern identified the plants/fungi. Ms. Barbara Mudrinich, PV High, provided lab equipment and E. coli. My father helped me collect and attach backboards.

CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)

Stephanie H. Lee

Project Number

S1399

Project Title

Genetic Manipulation of Rhizopus oryzae

Abstract

Objectives/Goals

Rhizopus oryzae is the most common organism isolated from patients infected with mucormycosis. The primary goal of this research project is to determine the genetic tools, needed to study the molecular mechanisms and virulence factors of R. oryzae infections by 1) establishing a growth curve and 2) developing a transformation system.

Methods/Materials

We first executed two experiments involving this organism#s general development patterns. The first involved fungal growth on different medias and temperatures. The second involved comparing the inoculum size and the resulting diameter. We then used dry weight measurements of R. oryzae hyphae to establish a growth curve. We then tried to isolate auxotrophic or spontaneous URA- clones of R. oryzae with the use of 5-FOA but ultimately used chemical mutagenesis. The final part of this research involved transforming R. oryzae via electroporation and then extracting DNA from the transformants for a Southern Blot.

Results

R. oryzae had optimal growth at 30ºC and grew best on YPD and least on YNB. The diameter of the growth was directly proportional to the inoculum size but reached a plateau around the concentration of 105 spores/ml. For the growth curve, R. oryzae developed at a steady rate until attaining a plateau at 24 hours. The doubling time is approximately 4.53 hours. Electroporation is a successful method of transformation. The Southern Blot, however, failed to provide us with any information because no signal appeared on the film.

Conclusions/Discussion

R. oryzae grew best at 30ºC, the closest to human body temperature. YPD, the most nutritious medium, provided the most growth while YNB, the least nutritive, led to the least growth. The growth curve probably reached a plateau because of competition for space and food among the fungi. A spontaneous URA- clone was difficult to obtain because some clones were probably 5-FOA resistant. While, electroporation is a method of transformation, we do not know if it is the most efficient. The Southern Blot experiment probably failed due to the lack of selectivity of PDA. Some other possibilities are the spores# loss of the plasmid containing the cassette or a mutation restoring the URA gene. In the future, we will test the efficiency of electroporation, redo the Southern Blot experiment using a different media, and try an experiment involving enzyme digestion to pinpoint the exact location of cassette integration.

Summary Statement

Due to the current dearth of studies on Rhizopus oryzae#s pathogenesis, this project focused on developing genetic tools that are critical for the study of this fungus by specifically establishing a growth curve and transformation system.

Help Received

Used lab equipment at Harbor-UCLA REI under the supervision of Dr. Ibrahim