CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Ian J. Bennett

Project Number

S1701

Project Title

Microbial Fuel Cell, Year Three: Measuring the Percentage of Anode Electrode Colonization by Geobacter sulfurreducens

Abstract

Objectives/Goals

To determine the percentage of aluminum anode electrode surface area that will be colonized by biofilm produced by metal reducing microorganism Geobacter sulfurreducens in an anaerobic, batch system, at the end of 700 hours.

Methods/Materials

A small amount of Geobacter sulfurreducens was introduced into an anode in the presence of an aluminum electrode, electrically disconnected from the cathode, preventing electron transfer. Fumarate was the alternative electron acceptor. Microscopy provided magnified images of biofilm growth on the electrodes. A 700 hour time series of pictures, taken at six intervals, enabled the percentage of electrode surface area colonized to be estimated.

Results

A highly differentiated biofilm was observed colonizing 80.0% of the surface area at each of the anode electrode quadrants, and middle on the three aluminum anode electrodes, at time interval hour 700. The fluorescent images at the six intervals showed a steady increase in the percentage of the electrode surface area colonized by biofilm, in the anodes inoculated with Geobacter sulfurreducens. The findings at 20X magnification indicated that biofilm colonization did not reach a maximum plateau during the 700 hours.

Conclusions/Discussion

The data does support my hypothesis that at least 50.0% of the anode electrode surface area will be colonized by biofilm produced by Geobacter sulfurreducens at the end of 700 hours. Images of three electrodes at hour 700 showed 80.0% surface area colonization. Results showed Geobacter sulfurreducens produced high colonization levels on aluminum anode electrodes, with fumarate as the electron acceptor, while electrically disconnected from the cathode. Horizontal biofilm growth on the anode electrode reduces the time it takes to transfer each electron to the anode. These findings may be useful in contributing to research in bacterial behavior that selects for horizontal growth on the anode electrode. Benefits from these advancements may be a more efficient microbial fuel cell with increased power output.

Summary Statement

Quantify the percent colonization on an aluminum anode electrode by biofilm produced by Geobacter sulfurreducens, with the cathode disconnected, contributing to bacterial behavior research that leads to a more efficient microbial fuel cell.

Help Received

My parents drove me to the University of California, Berkeley. Ms. Erika Parra, Ph.D. candidate in Mechanical Engineering at the University of California, Berkeley, provided a culture of Geobacter sulfurreducens, access to lab space and the microscope, and answers to my questions during the research.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Deepika C. Bodapati

Project Number
S1702

Project Title
A Novel Use of Diatoms for Endotoxin Detection

Abstract

Objectives/Goals
Goal 1 - Grow the diatoms
Goal 2 - Get the diatom to engulf the LAL molecule - to create packaging for LAL
Goal 3 - The LAL engulfed diatom must detect endotoxin consistently and accurately
Goal 4 - Create standard curve of the test
Goal 5 - Manipulate the diatoms to grow on a flat surface - to create a prototype of the home test kit

Methods/Materials
Materials: Diatoms, LAL test, CR1-S/CR1-SD, TSB, flat objects (slides), Antibiotic cocktail.
Methods:
Melt soft agar and add diatom culture in it. Perform Pasteur Pipette Method. Observe for growth. Add TSB and Antibiotic Cocktail. Aspirate and discard. Perform LAL Test. Read at photospec at 410 nm. Grow diatoms on flat surface. Perform LAL test. Incubate. Observe. Create a 3 times dilution series of the LAL test
Read on the photospec at 410 nm. Add diatoms and wait for the diatom to absorb LAL molecule. Read under photospec at 410 nm. Grow diatoms in a solution. Add flat surface to the solution. Observe results.

Results
Goal 1 # The diatoms grew successfully in the TSB solution
Goal 2 # From the readings of the photo spectrometer, the LAL was engulfed by the diatom, thus successfully using the diatom to create packaging for the LAL
Goal 3 - The LAL engulfed diatom changed color accurately in the presence of endotoxin.
Goal 4 # A standard curve was made to allow for toxic levels of endotoxin be determined
Goal 5 # Through the starvation of silica, the diatoms grew consistently on the flat glass surface, thus creating a prototype for an endotoxin detection home test kit.

Conclusions/Discussion
Though I reached my intended goals, I am working on the following experiments to fine tune my test.

Develop a method to uniformly grow diatoms on a surface
Test with other types of diatoms

Look for other uses of test in water and food industry

Summary Statement
Diatoms are mainly used as efficiency enhancers on solar cells; I will marry the commercial Limulus Amebocyte Lysate test to the absorptive and reflective properties of diatoms to essentially create an endotoxin detection test.

Help Received
My mentor, Sarah Perry, supervised my experiments to ensure that I was using safe lab technique.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Daryl L. Chang

Project Number

S1703

Project Title

Modeling Transformed E. coli Growth at Different Ampicillin Concentrations

Abstract

Objectives/Goals

This experiment aimed to a) determine the ampicillin concentration at which maximum transformed colony growth occurs; b) develop a model relating ampicillin concentration and transformed bacteria growth; and c) develop a model relating ampicillin concentration and satellite growth.

Methods/Materials

The experiment involved three separate trials. First, I poured culture plates of 10, 50, 100, and 200 ug/mL ampicillin. After transforming E. coli with pGLO plasmids, I spread 20 uL of the bacteria onto each plate and incubated them at 70ºF for 72 hours. I then took pictures of each plate and used Photoshop to analyze the area of the transformed colonies and satellite colonies. Finally, I calculated the ratios and used regressional analysis to produce the mathematical models.

Results

Maximum transformed colony growth occurred at 100 ug/mL ampicillin, with the average colony occupying 0.4% of the plate. The growth of transformed bacteria growth varied linearly with ampicillin concentration up to 100 ug/mL and was modeled by the equation T=0.004[amp]-0.001. Satellite growth was modeled by the equation y = -11.8 ln[amp] + 122.3, with satellites occupying 97% of the plate at 10 ug/mL and 59% at 200 ug/mL.

Conclusions/Discussion

The mathematical relationships determined in this experiment can be generalized for all transformed bacteria. These models can determine the optimum antibiotic concentration quickly and accurately, and thus maximize transformed colony growth. They can be used in science research when growing new kinds of recombinant bacteria, or in industrial production of transformed bacteria to maximize secretion of products like insulin or human growth hormone. In all cases, larger and faster-growing transformed colonies will be the result.

Summary Statement

Modeling and determining the ampicillin concentration at which transformed E. coli attains a maximum growth rate.

Help Received

Poured agar culture plates with the help of Dr. Starr of the Tech Museum of Innovation. Used lab equipment at the Tech Museum.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Cameron M. Crook

Project Number
S1704

Project Title
Cloud Ships: Destruction of the Ocean Rainforest: How Do Different Light Intensities Affect Phytoplankton?

Abstract

Objectives/Goals
A proposal to mitigate global warming calls for cooling the earth by placing manmade clouds over our oceans, reflecting a portion of the light from the sun into space. Because phytoplankton are the foundation of the ocean's foodchain and the rainforest of the ocean, the purpose of this experiment is to determine whether phytoplankton are affected by a decrease in light.

Methods/Materials
The experiment was conducted over 4 days and utilized four bottles as culturing vessels: one as a control and 3 bottles shielded by screens which absorbed 40%, 80%, and 90% of light respectively. After innoculating the phytoplankton aquacultures into the bottles, the phytoplankton cultured for 2 days. To assess the growth of the phytoplankton, their biomass was measured each day by taking samples from each bottle. The biomass was measured by pouring the 25 ml samples through a glass fiber filter. A vacuum flask was used to remove water from the filter and then the filters were dried. The change in filter's mass was used to determine the biomass.

Results
Phytoplankton exposed to lower light levels showed a decrease in their overall biomass growth rate. The control had the highest overall biomass growth rate and the 90% absorbent screen had the lowest overall biomass growth rate.

Conclusions/Discussion
The experiment demonstrates phytoplankton grown with decreased light levels produces less biomass. Therefore, manmade cloud cover used to reduce global warming's effects by reflecting sunlight into space could affect phytoplankton's ability to convert carbon dioxide by means of photosynthesis, mitigating the cloud ship's benefits and potentially destablizing local ecosystems. I plan to assess in further experiments whether additonal nutrients and a larger habit resulting from nutrient upwellings can offset diminshed growth due to decreased light.

Summary Statement
Phytoplankton's ability to absorb carbon dioxide could be adversely affected by the use of manmade cloud cover to counteract global warming.

Help Received
Contacted a number of experts during the research phase of my project: Tracy Riggins, Dr. Mike Cohen, Keith Redfield, Elizabeth Falecjyzk, and Stephen Salter, PhD. Elizabeth Falecjyzk provided the laboratory equipment for sterilization and measuring. Parents provided financial and logistical support.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Jillian A. Drake

Project Number

S1705

Project Title

A New Rapid Processing Method for the Detection of Candidatus lieberibacter Bacteria in Psyllid Vectors

Abstract

Objectives/Goals

Greening (citrus), Psyllid Yellows (tomato) and Zebra Chip (potato) are diseases caused by 'Candidatus Lieberibacter' bacteria. Symptoms include yellow leaves, poor growth and unusable fruit. Vectored by psyllids and non-culturable, there is no treatment for infected plants which must be destroyed. Bacteria detection is done by DNA testing of the psyllid vector since bacteria in the plant is hard to detect. Currently, DNA analysis of the psyllid is labor intensive. This project's objective is to validate a new method for rapid processing of psyllid samples for the detection of the bacteria.

Methods/Materials

Three psyllid collection and DNA extraction protocols were tested for the amount of 'Ca. L. psyllaurous' DNA extracted from infected psyllids. In Exp. 1 (Standard method), psyllids were collected in ethanol and DNA was extracted using a MP kit Bio protocol. In Exp. 2, psyllids were collected in ethanol and DNA was extracted using a direct boil method. In Exp. 3, psyllids were smashed into Whatman #1 papers, the paper with the psyllid remains was boiled in the extraction buffer. Presence of 'Ca. L. psyllaurous' was tested by a Taqman based real time PCR and the results were confirmed by conventional PCR. The PCR product was cloned in TOPO TA vector and sequenced at UC Riverside. The serial dilutions from the plasmid were used for preparing a standard curve in real time PCR.

Results

Based on cycle threshold values psyllids collected on Whatman #1 paper with the direct boil DNA extraction had similar amounts of initial DNA as that of the standard protocol. Psyllids collected in ethanol and direct boiled, without lysing, in the extraction buffer yielded less DNA than the other two methods. The sequence of the conventional PCR product was 99% similar to the sequences of 'Ca. L. psyllaurous' from the Genbank database.

Conclusions/Discussion

A new method of sample processing using filter paper and DNA extracted by boiling was compared to a standard method. The new method of psyllid collection was found as efficient as the standard, less expensive and less complicated to use. The direct boil method of DNA extraction greatly reduces the labor and material cost. This study demonstrates an improved method of handling psyllid samples and extraction of bacteria, enabling efficient processing of samples reducing both time and cost of processing without compromising the sensitivity of the test results.

Summary Statement

A new rapid process for the detection of 'Candidatus Liberibacter' was validated quantitatively using real time qPCR in the psyllid vector which transmits the bacteria causing severe grove damage in citrus and loss of solanceaous crops.

Help Received

Used lab equipment at United States Department of Agriculture, Agriculture Research Service (USDA-ARS), National Clonal Germplasm Repository for Citrus and Dates in Riverside, under the supervision of Dr. Manjunath Keremane and Dr. Chandrika Ramadugu.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Eli W. Erlick

Project Number
S1706

Project Title
Bioluminescence and Ultraviolet Resistance

Abstract

Objectives/Goals
The objective of this experiment was to determine if LuxR genes that allow for bioluminescent properties would confer ultraviolet resistance in E. coli. This may suggest another function light emission has in luminescent organisms.

Methods/Materials
Utilizing plasmids containing bioluminescent LuxR genes, which are all of the genes required for light product ion in the bacteria Vibrio fisheri. E. coli was transformed into a bioluminescent bacteria. These bacteria were exposed to increasing minutes of ultraviolet light. Unexposed E. coli and untransformed E. coli were used as controls. The growth was quantified by calculating percent coverage of growth on culture media-containing Petri dishes. Growth rates were compared to determine if LuxR-containing E. coli were more resistant to ultraviolet radiation.

Results
The average percent decrease in growth compared to controls in all 3 trials were consistently higher in the non-transformed E. coli than the transformed LuxR bacteria. In all trials combined, the LuxR transformed E. coli had an average of 31.2% more growth than non-transformed E. coli after being exposed to UV light.

Conclusions/Discussion
In this experiment, evidence was generated that pVib bioluminescent plasmids confer resistance to ultraviolet light#s harmful effects on E. coli. The purpose of bioluminescence in terms of survival has been the subject of much discussion, as light emission requires 10% or more of the E. coli cell#s energy. In light of the experimental evidence, it seems plausible that bioluminescence provides energy to photolyase, allowing for nocturnal light dependant repair of DNA.

Summary Statement
Plasmids containing bioluminescent genes were inserted into E. coli and exposed to UV light resulting in evidence that this luminescence protects bacteria from UV light by providing energy for light-dependant repair of DNA.

Help Received
Erin Vaccaro, my science teacher, helped with experimental design; Carla Longchamp, M.D. assisted with ordering supplies and bacterial disposal.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Kathleen Estrella; Jason Nettleton

Project Number

S1707

Project Title

Investigating Bacteria on Oil Spots by Developing Bioremediation Measurement Methods

Abstract

Objectives/Goals

The objective of the study was to investigate bacteria found on oil spots by examining the effect of the presence of motor oil on the microbes and eventually determine if they possess bioremediation capability. In addition our project aimed to develop simpler methods for measuring possible bioremediation.

Methods/Materials

Bacteria were collected from oil spots in four different locations around High Tech High School in Point Loma by swabbing each location twice for a total of eight samples. The bacteria were isolated and six of the samples were subjected to three different developed Methods. Method One used surface application of used and unused motor oil on Nutrient agar plates with streaked bacteria. Method Two utilized a mixture of concentrations used motor oil and Nutrient Agar with bacteria broth culture (.5 %, 1% and 5%). Method Three combined bacteria broth culture and used motor oil in a 1 ml serological pipette. The Kirby Bauer-method was also applied to investigate the effect of presence of oil on bacteria by applying amounts of used and unused motor oil on sterile discs which were placed on top of plates with streaked bacteria.

Results

In all three methods, active growth of environmentally-isolated bacteria in the presence of used motor oil was found. Within Method One it was discovered that the samples had an approximately 200% more growth in terms of surface area in the used motor oil as opposed to the unused motor oil. Method Two did not yield very many results due to the difficulty of measuring any growth. Method Three also did not have conclusive results. The Kirby Bauer-Method however was consistent with the results of the other findings, because the zones of inhibition for used motor oil as opposed to unused motor oil were much lower.

Conclusions/Discussion

The data and results from this study show that the bacteria that was isolated can survive in the presence of used motor oil. However, the methods used do not show that the bacteria depleted the motor oil; used or unused. Most samples could survive, although in higher amounts, used motor oil seemed to impede the growth of the bacteria. Overall, the results from the study show some of the samples found have the potential to degrade motor oil. Through further investigation and experimentation, these species may perform bioremediation and be used to combat urban runoff pollution.

Summary Statement

This project investigated the possible bioremediation capability and effect of motor oil on bacteria found on oil spots by developing methods of simpler bioremediation measurement.

Help Received

Teacher supplied lab equipment

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Trevor J. Fobel

Project Number

S1708

Project Title

To Grow or (NO)t to Grow: A Study of the Effects of Exogenous (NO) on the Proliferation of Three Marine Algae Species

Abstract

Objectives/Goals

The objective of this project is to compare the effects of Nitric oxide (NO) on three different algae species: Spirulina major, Gymnodinium sp. and Dunaliella salina. These three species were selected because they are related to algae species that are used for food, bio-fuel, or produce toxic "Red Tides." The question this experiment is designed to answer is as follows: Can Nitric oxide (NO) be utilized to accelerate the growth of algae used for food or bio-fuel, and hinder the growth of "Red Tide" algae?

Methods/Materials

Culturing station was assembled. DETA (NONO)ate utilized as (NO) donor. Three algae species (Spirulina major, Gymnodinium sp and Dunaliella salina) were used. Each specimen was divided into one control and four variable groups. Cultures were grown under the same conditions. Distribution of the 0.18 mg sample of DETA (NONO)ate into one liter of polished water, yielded a highly concentrated solution. Dilution of this solution yielded four decreasingly conc. secondary solutions. The solutions were applied to the four test cultures of the three algae species, excluding the control cultures. Photographs of the microscopic algae were taken before and after application of the (NO) solution to document the effects on the growth of each species. Conducted a "point count", or approximate counting of individual algae cells on the Gymnodinium sp. and Dunaliella salina cultures from microscope pictures. A growth% was calculated for each culture and results recorded. Growth changes of the Spirulina cultures were observed by visual inspection. An approximate natural threshold to (NO) concentration of each species was determined.

Results

Gymnodinium sp. experienced the highest growth rate of the three cultured species. The Dunaliella salina cultures experienced an unpatternized growth. Results with the Spirulina major cultures were inconclusive.

Conclusions/Discussion

Though a lack of data exists to confirm similar results in Spirulina major, results from the other cultures show that if sufficient (NO) is applied to algae cultures, growth will be affected, with toleration levels to (NO) concentration dictating whether the growth rate will be greatly accelerated or severely inhibited when compared to untreated cultures.

Summary Statement

This project exposes three types of algae (Spirulina major, Gymnodinium sp and Dunaliella salina) to four different concentrations of Nitric Oxide to determine whether growth is inhibited or stimulated by the chemical.

Help Received

Brett Wight helped make DETA (NONO)ate measurement at AFRL. Dad helped build light stand. Mom helped with MS Word/Powerpoint; verified amount of DETA (NONO)ate needed for experiment. Teachers Ms. Debbie Lewis/Mr. Mark Grubb supplied materials and helped finalize idea for experiment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Christopher W. Gardner; Enoch Yang

Project Number

S1709

Project Title

The Effect of Ampicillin, Penicillin, Tetracycline, and Erythromycin, on the Growth of E. coli in Playground Soil

Abstract

Objectives/Goals

The purpose of this experiment was to compare the zones of inhibition of playground soil bacteria, Ampicillin, Penicillin, Tetracycline, and Erythromycin, with E. coli. Bacteria was extracted from the playground soil by immersing a small quantity in Tryptic Soy Broth(TSB). This solution was then spread unto 10 petri dishes containing nutrient agar and a disk of each antibiotic was placed in labeled quadrants of the dish. E. coli was transferred to nutrient agar plates, and the previous process was repeated. The dishes were placed in an incubator at 35°C for 48 hours. The zones of inhibition were measured, and a common bacteria from the soil plates was extracted. The antibiotic disk with the largest zone of inhibition, Tetracycline, was placed in the center of 10 new plates. These were placed in the incubator for 72 hours and the zones of inhibition were measured. On average the zones of inhibition from the soil were smaller than the E. coli, therefore the soil bacteria have some resistance to common antibiotics. Due to manufacturing of playground, toxins that leach from rubbers may affect the resistance bacteria in the soil have to antibiotics.

Methods/Materials

1.Acquire a beaker with 50 mL of TSB and 10 sterile swabs. Label beaker.
2.Add 5g of playground soil to the TSB.
3.Mix solution for 30 seconds. Allow the beaker to sit for 30 minutes at room temperature.
4.Dip the tip of the sterile swab and press against beaker to remove excess solution.
5.T-streak 10 nutrient agar plates. Label each plate.
6.Divide the Petri dishes into four quadrants, and add one disk of Ampicilin, Penicillin, Tetracycline, and Erythromycin individually into the quadrants.
7.Label each quadrant with the corresponding antibiotic disk.
8.Place dishes in 36°C incubator for 48 hours.
9.Measure zones of inhibition after 48 hours and record the data.
10.Obtain 10 more nutrient agar Petri dishes.
11.Identify a common bacterial colony closest to the Tetracycline disks, throughout the plates.
12.Use sterile loops to t-streak new plates with the bacterial colonies closest to the tetracycline.
13.Using forceps, place one tetracycline disk in the center of each plate.
14. Label plates and place in 36°C incubator for 72 hours.
15.Measure the zones of inhibition after 72 hours and record the data.
16.Dispose of plates by spraying bleach on the agar and place in specified waste bag.

Summary Statement

The purpose of this experiment is to determine whether or not there is E. coli resistant to Ampicillin, Penicillin, Tetracycline, or Erythromycin in playground sand.

Help Received

Used lab equipment at the California Academy of Mathematics and Science under the supervision of Mr. Gonzales.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Stacey A. Huang

Project Number
S1710

Project Title
Green Oil

Abstract

Objectives/Goals
Diatoms produce within their cell membranes fatty lipids and triglycerides from which an abundant amount of oil may be extracted. A large number of factors affect fatty acid production; notably, NaCl concentration of the growth medium. A higher salinity content of the water may force the cells to produce more fatty acid material in the membranes as to counter the pressure from influx of water from osmosis. The purpose of this experiment was to test the hypothesis that higher salt concentration in the growth medium would yield a higher lipid concentration in the diatom mixture.

Methods/Materials
Marine diatom mixtures were obtained and separated into 15 identical beakers, each which contained 100 mL of distilled water. Every 5 beakers were classified into one saline level: 1.5%, 3.5%, 5.5%. Diatoms were allowed to grow for a period of 3 weeks, then beakers were filled with 500 mL of distilled water in an attempt to induce osmotic shock. Then the liquid in 3 of 5 beakers in every saline level was mixed with sand and blended. All liquid was then filtered. Subsequently 100 mL of every mixture was placed into glass containers and 3 drops of the Sudan IV stain were added. Every liquid was then analyzed under a microscope.

Results
The marine diatom mixture showed a higher count of red lipid stains in the higher concentration of NaCl. Mixtures from 1.5% saline content had the lowest average lipid count and those of the 5.5% saline content had the highest average lipid count, despite several discrepancies within individual groups. Lipid stains were generally higher in count for mixtures that had been blended in the blender.

Conclusions/Discussion
Though a generally positive correlation was spotted between lipid count and concentration of NaCl, uncontrollable factors such as light intensity, pH level of water, etc. may be the reason for discrepancies within every saline group. However the hypothesis was thus proved with the large experimenation group. The Sudan IV, which stains lipid cells in liquids red, were higher in number for the liquids that had been growing diatoms in higher NaCl concentration. The practicality of this experiment is self-explanatory. The scramble for clean oil as alternatives to fossil fuels grows ever higher as speculation of global warming continues to mount. Any alternative fuel source is seen as a boon to both economy and environment.

Summary Statement
The purpose of this project was to test whether a higher salt concentration in the growth medium of marine diatoms would yield a higher lipid production within the cells of the diatoms.

Help Received
Teacher helped me obtain all necessary materials.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Kevin R. Kaufmann

Project Number
S1711

Project Title
Engineering Phage to Treat Bacterial Infections

Abstract

Objectives/Goals
This project was done to test the viability of using bacteriophages as delivery mechanisms for organic materials to fight bacterial infections, and compare the results to currently used antibiotics.

Methods/Materials
A bacteriophage (a virus that specifically infects bacteria) that has a negative expression is used as the delivery mechanism. Materials that carry a positive charge can be bound to E4 phage. The materials that will be tested include perforin and a small range of polysaccharide degrading enzymes. The polysaccharide degrading enzymes ability to bind will be tested for the treatment of bacteria that have a cell wall. After the materials are bound, 30 micrograms will be applied to Petri dishes fully inoculated with E. coli. The Petri dishes will be allowed to grow for 48-72 hours and then observed for a zone of inhibition.

The results of the tests with bacteriophage as a delivery mechanism will be compared with results of common wide range antibiotics Tetracycline and Chloramphenicol. Thirty microgram dosages will be applied to Petri dishes fully inoculated with E. coli. The Petri dishes will be allowed to grow for 48-72 hours and then observed for a zone of inhibition.

Conclusions/Discussion
If the bacteriophage creates a larger zone of inhibition, it will open a new less toxic form of treatment for bacterial infections. This form of treatment will be less stressful on the body compared to antibiotics that can have very dangerous side effects and stress the liver.

Summary Statement
The purpose of this project was to create an alternate and more effective form of treatment for bacterial infections.

Help Received
Used lab equipment at Center for Advanced Research and Technology (CART) under Mrs. Hayes.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Taylor M. Krilanovich

Project Number

S1712

Project Title

Effects of Ammonium Phosphate in Checkmate Spray on Dinoflagellate Blooms

Abstract

Objectives/Goals

The objective of this investigation is to test the effects of small concentrations of ammonium phosphate when introduced into cultures of the dinoflagellate prorocentrum.By introducing small quantities of ammonium phosphate into cultured dinoflagellate populations,I hope to be able to determine the minimum concentrations that will result in an unnaturally elevated bloom

Methods/Materials

II:Introducing Ammonium Phosphate:1/26/10
Calibrate the digital scale. Measure out 1 gram of ammonium phosphate crystals. Fill the 250 ml flask,sitting it on the stirrer/hot plate,with 160 ml of deionized water. To the last flask,add 1 ml of the ammonium phosphate. Place the three flasks on the rocker table and set the table to oscillate at a 20 degree angle for two days.
IV:Measuring turbidity
four sterile glass tubes. Fill one with 30 ml of deionized water; Shake the cultures vigorously, then put 30 ml of each culture into tube. Read turbidity for each sample.
Dinoflagellates; culture flasks; 1Liter bottle of medium.
II:Introduction of A. Phosphate
Ammonium phosphate; electronic balance; stirrer/hot plate; 250 ml glass flask; magnetic stir stick; small plastic cup; sterile pipets,1 ml.; mechanical rocker table; original culture flasks; culture flasks.
III:Measuring Turbidity
spectrophotometer; 30 ml sterile glass tubes; deionized water; the control,1g/100ml,and 10g/100 ml flasked cultures.

Results

I:Visible blooms
Trial One:1/28/10,at 12:55 noon: 0.0 g. Concentration:No visible bloom; 1.0 g. Concentration:Light bloom; 10.0 g. Concentration:Visible heavy bloom.
II:Measuring Turbidity
3/5/10, at 11:35 am.: 0.0 g Concentration:36 absorbency; 1.0 g Concentration:48 absorbency; 10.0 g Concentration:55 absorbency; Deionized water:0 absorbency.

Conclusions/Discussion

In conclusion,the introduction of ammonium phosphate into dinoflagellate cultures shows a consistent elevated growth curve.The data supports my hypothesis in that small quantities of ammonium

Summary Statement

This project examines the enviromental impact of Checkmate spray on our local marine biomes,focusing on the detramental effects of Ammonium Phosphate,a carrier in the spray.

Help Received

School's equipment including rocker table,spectrophotometer,and digital scale and disection scopes where used with consent of tacher and advisor Lisa Catteral.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Dennis B. Lui

Project Number
S1714

Project Title
Inhibiting the Growth of Aspergillus

Abstract

Objectives/Goals
This investigation aimed to examine the relationship between the amount of growth of mold on a piece of paper and the pH of the water used to saturate the paper. Specifically, this investigation sought to find what pH would inhibit the growth of mold.

Methods/Materials
The key materials in this investigation were a glass tank, a humidifier, Hydrochloric acid (HCl), Sodium Hydroxide (NaOH) and standard computer paper. The preparation for the trials had two parts. The first involved creating 5 solutions with a pH 4, 6, 7, 8, and 10 by diluting appropriate amounts of HCl and NaOH into distilled water. The second involved growing an initial mold sample by saturating a sheet of paper, putting it in a glass tank, humidifying the tank and sealing it. The trials were conducted by saturating several pieces of gridded paper in the various solutions, placing them in the glass tanking, putting an initial mold sample with the paper, humidifying the glass tank and sealing it. The growth of mold was recorded over a 20 day period.

Results
Overall, the paper saturated with water of a lower pH generally had more growth than the paper saturated with water of a neutral or basic pH. In general, the most growth was found on the paper that was saturated with water whose pH was 4, with the second most on the paper saturated with water whose pH was 6. The trials where the paper was saturated with water of pH 7 and 8 had similar amounts of growth. The least growth was found on the paper saturated with water of pH 10.

Conclusions/Discussion
The data from this investigation seems to show that as the pH of the water used to saturate the paper increased, the amount of mold growth decreased. This supports the idea that the mold examined thrives in more acidic conditions. Thus, it would seem that basic pHs inhibit mold growth.

Summary Statement
This investigation focuses on finding whether one could inhibiting the growth of mold by varying the pH of the water that saturated the paper on which mold grows.

Help Received
Teachers helped obtain materials

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Raman V. Nelakanti

Project Number

S1716

Project Title

A Novel Approach to Sustained Hydrogen Production by Cycling Photosynthetic Stages in Chlamydomonas reinhardtii

Abstract

Objectives/Goals

Chlamydomonas reinhardtii algae are a potential means for producing renewable hydrogen gas. However, current methods to produce hydrogen using these algae are inefficient, costly, and unsustainable. Hydrogen production will either occur only in the light or the dark depending on the initial media conditions. The purpose of this project is to determine the effect of sulfur deprivation on light and dark cycles of hydrogen production. The objective is to produce hydrogen for sustained amounts of time in changing dark and light conditions. It is hypothesized that the dark phase will induce anaerobic conditions, but hydrogen production in the light will be low due to adverse effects of sulfur deprivation in dark anaerobic conditions.

Methods/Materials

Algae were cultured in TAP media with varying low concentrations of sulfur and sealed. They were grown in the light for a 48 hour growth phase. Then, they were placed in the dark for 24 hours. Hydrogen and oxygen concentrations were measured at the end of the dark phase. They were then placed in the light for 72 hours and gases were measured once again. Throughout the experiment, chlorophyll density and sulfur deprivation were measured spectrophotometrically.

Results

Hydrogen production in the dark phase was significantly greater in sulfur concentrations of 60.7 and 80.9 uM, with 80.9 uM producing the greatest concentration of hydrogen. There was no dark hydrogen production in the sulfur-free and 20.2 uM groups. Significant amounts of hydrogen were produced in the light for all groups except the sulfur-free group.

Conclusions/Discussion

Under sulfur stress, hydrogen is still produced in both the dark and the light. Extended dark and light phases in only the 40.4-60.7 uM sulfur range enable optimal hydrogen production. Additionally, algae survive for at least 120 hours after the initiation of the light phase, which gives a total of at least 144 hours of potential hydrogen production. This project proposes an efficient means of producing hydrogen gas using sulfur limitation with dark and light phases. Additionally, an application of this project would produce hydrogen in both the night and day, essential for sustained energy production.

Summary Statement

This project developed a novel method for producing significant amounts of hydrogen in both the dark and the light using algae, enabling sustained hydrogen production for large scale energy purposes.

Help Received

Used lab space and equipment of Dr. Arthur Grossman of the Carnegie Plant Biology Department at Stanford under the supervision of Dr. Wenqiang Yang.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Phoebe G. Ng

Project Number
S1717

Project Title
What Are You Eating?

Abstract

Objectives/Goals
When people get a case of the "munchies," they go foraging in their refrigerator for last night's (or last week's!) leftovers. Although much research has been done on the longevity of a leftover, there is not much research on the most effective manner of reducing bacterial growth in a food item. This project explores the most effective treatments of leftover food items to minimize bacteria colonies grown

Methods/Materials
Prepare petri dishes (nutrition agar with chicken broth) and "leftover" simulator food dishes: one being a "leftover" soup[a liquid food source] and the other being a "leftover" pasta [a solid food source]; take samples of the leftover simulators immediately after preparation for a control. Set aside another petri dish for a control for the agar dishes. Take samples of the different methods of eliminating bacteria colonies (no treatment, refrigeration, reheating by microwave with the addition of refrigerating, reheating by stove top with the addition of refrigerating) at 3, 5, 12, 24,48, and 72 hours on both of the simulators. Count the number of bacteria colonies grown per sample within the method.

Results
"No treatment" produced the most bacteria colonies. The method that produced the least bacteria colonies was reheating by stove top(for both simulators); the method that produced the second smallest number of bacteria colonies was reheating by microwaving, it was bested by reheating by the stove top by only a small margin. Refrigeration produced the third least number of bacteria colonies.

Conclusions/Discussion
While leaving both types of leftovers at room temperature (no treatment)was certainly least effective, the real comparison was between the reheating by microwave and the reheating by stove top. While for both methods, the reheating by stove top was slightly more effective, reheating by microwave seems to be the more practical application as it is more convenient and less troublesome to implement [the treatment]. Also, with the solid food sample, the logistics of keeping the food from drying/burning further complicated the process. Simple refrigerating was adequate, but not recommended in the long run.

Summary Statement
This project examines effective treatments of leftover food items in order to minimize growth of bacteria colonies.

Help Received
Sister provided moral support and assistance on the board.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
So Hyun Park

Project Number
S1718

Project Title
Anti-Bacterial Effect of Korean Traditional Food, Kimchi

Abstract

Objectives/Goals
The initial idea was to determine the reasons for Korea to have the strictly low rate of flu affects such as SARS, AI, and SI compare to other countries such as the United States or China. Koreans have unique eating habit and food such as kimchi or pepper paste. Since examining virus is too complicated and dangerous to treat directly, it was decided to focus on bacteria, which is more common and easier to treat than virus.

Methods/Materials
1)prepare nine kinds of mixtures of garlic, ginger, and red pepper with H2O. Put test papers on those mixtures and move those papers on agar plates. Put those agar plates in the incubator and incubate.
2)grind garlic, red pepper, and ginger, and squeeze to make 100% juice. By adding water, make juice of 0% through 100%. Put 100 microliter of e-coli in the juice, and put all of those juice containers in water bath. After that, smear each juice(+E-coli) on Agar plates. Put those agar plate in the incubator and incubate.
3) Everything is same as 2) except I boiled the materials.

Results
Ex 1)for the ingredients that are not mixed, garlic has the largest clear zone. Meanwhile, red pepper powder and ginger powder has no anti-bacterial effect. There is nothing better about the mixture of the ingredient than the single ones each.
Ex 2) Comparing with the control, all three of the ingredients have anti-bacterial effect, from those three; garlic is the most effective anti-bacterial ingredient.
Ex 3) both raw and boiled ingredients have anti-bacterial effect compare to the control. However, in the case of garlic, raw ingredients were much more effective than boiled ingredient. However for the red pepper¡#s case, both raw and boiled ingredients had similar effect, but raw ingredient was still more effective.

Conclusions/Discussion
1) each of them individually had anti-bacterial effects, but no effect when they were mixed. But I was able to confirm they have anti-bacterial effect.
2)For the concentration, anti-bacterial effects on garlic and red pepper depended on concentration. Although ginger was not depends on concentration, I could be able to see that ginger itself has the anti-bacterial effect.
3)For the heat treatment, ginger and garlic had better anti-bacterial effects on raw materials, and red

Summary Statement
This is the experiment of confirming the anti-bacterial effects of three representative ingredients of Kimchi, which are garlic, ginger, and red pepper.

Help Received
Used incubator and clean bench from science academy under the supervision of the teacher.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Cody A. Peterson

Project Number
S1719

Project Title
Are Plants Producing Methane?

Abstract

Objectives/Goals
There are currently three scientific studies in contention over whether or not plants are producing the potent greenhouse gas methane; this experiment aims to find a possible explanation for the methane dilemma. It is my belief that if wooded plants are producing methane, then it may be coming from bacteria living in and around the bark eating the accumulated dead cells.

Methods/Materials
Using 19 sterile cotton swabs, 19 clear labels, 19 sterile petri dishes, 1 digital camera, and 1 liter of Tryptic Soy Agar, I swabbed 5 trees 3 times each at the same height and location, prepared petri dishes and let them cool, then I smeared the dishes with the swabs, labeled and sealed the dishes, photographing them daily for five days and then took the data and made it into something tangible.

Results
It was found that the standard and three other samples had an extremely high growth rate. The control remained pristine and the two samples with the least growth release an antibacterial which leads to the implication that the growth on the other three are in fact bacterial. This data was found by calculating the area of the bacterial growth and dividing it by the total area of the dish in order to find the total percent of growth.

Conclusions/Discussion
I have concluded that there are in fact bacteria decomposing the bark and they are a likely source of the methane production due to the concentrations of growth I found in my data.

Summary Statement
My experiment was designed to test whether or not there are methanogens living on the bark of live trees releasing methane through decomposition of the accumulated dead cells which make up a plants bark.

Help Received
Used lab equipment at Chapman University under the supervision of Professor Frank Frisch

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Aisha Prasad

Project Number
S1720

Project Title
DNA Transformed!

Abstract

Objectives/Goals
The purpose of my experiment was to check whether size of a plasmid affects how easily it is accepted into E Coli cells. I believe that a plasmid with a fewer number of base pairs will be more easily accepted into E Coli cells than a plasmid with a larger number of base pairs.

Methods/Materials
Competent E Coli cells were given a shock treatment and then treated with plasmids of different sizes and antibiotic resistant genes. They were then placed in agar dishes with the corresponding antibiotic and observed on how well they grew. The more the growth, the more efficiently the plasmids were accepted by the E Coli cells.

Results
In the first year of my experiment, E Coli cells with the larger plasmid (Fmini) had a lower rate of resistance to the antibiotic and therefore, had fewer bacterial colonies than the E Coli cells with the smaller plasmid (pUC19). In my second year of experiment, none of my organisms grew, because of an error in the process of my experiment. Errors include overheating, incorrect application of bacteria, lack of precision, and lack of sterilization.

Conclusions/Discussion
Overall, I discovered the size of a plasmid does affect how efficiently it is accepted by E Coli cells. Although my second experiment was a failure as it was fruitless, I learned much from my first experiment and strive to continue my experiment. This information can be applied into the field of cancer and other types of research. For example, in genetically mutating cells to program them to destroy cancerous cells, with my research, a scientist will know to give preference to the plasmids with the fewer base pairs, because they will be more easily accepted into the cells.

Summary Statement
My project is about whether size affects how well a plasmid is accepted into a bacterial cell.

Help Received
Used lab equipment at California Baptist University under the supervision of Dr. Dennis Bideshi.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Marissa A. Salinas

Project Number
S1721

Project Title
The Effects of Seasonings on the Control of Escherichia coli in Hamburger

Abstract

Objectives/Goals
Part 1: How much E.coli is found in Hamburger?
Part 2: Which spice affects E.coli the best?

Methods/Materials
I will be using EMB agar to test the E.coli. The reason I am using EMB is because it is known best for showing E.coli bacteria. In addition, I will also be using four different types of spices: Cinnamon, Garlic, Oregano, and Sage. One other item I will be using is five different meat sources. They vary from fast food chains, to top of the line meat stores, to little corner stores.

Results
Average of Non E.coli Coliform and E.coli in Hamburger Meat
My results were that Meat from Store WM had the least bacteria growth and that Processed at X Slaughter House had the most bacteria growth.
Average Number of Non E.coli Coliform and E.coli in Meats with Spices
My results in this section showed me that Garlic, Oregano, and Sage had a really good positive effect towards the meats when compared to Cinnamon that did change the amount of bacteria but not as well as the others.
Average Non E.coli Coliform and E.coli in Hamburger Meat Mixed With Cinnamon
My results were that Meat From Store WM had the least amount of bacteria change even after the spices were added and Processes at x Slaughter House had the most amount of bacteria change when the spices were added.
Average Non E.coli Coliform and E.coli in Hamburger Meat Mixed with Sage
My results were that Meat From Store WM had the least amount of bacteria change even after the spices were added and Processes at x Slaughter House had the most amount of bacteria change when the spices were added.
Average Non E.coli Coliform and E.coli in Hamburger Meat Mixed with Oregano
My results were that Meat From Store WM had the least amount of bacteria change even after the spices were added and Meat From Store LC had the most amount of bacteria change when the spices were added.
Average Non E.coli Coliform And E.coli in Hamburger Mixed with Garlic
My results were that Meat from Store WM had the least amount of bacteria change even after the spices were added and Processes at x Slaughter House had the most amount of bacteria change when the spices

Summary Statement
My project is about finding how much E.coli is found in meat and what spice effects ti the best.

Help Received
mother helped cut papers and used lab equipment at Sanger High School

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Aradhana Sinha

Project Number
S1722

Project Title
LNSV vs. TBSV: Effect of Virus Competition and Dominance in Different Host Types

Abstract

Objectives/Goals
The goal of this experiment is to find out which virus, LNSV or TBSV, is dominant in different plant species, and to study if the symptom severity correlates to the amt of virus. Finding the dominant virus will help researchers predict what the next major destructive virus will be, so that they can prepare for it in advance.

Methods/Materials
I used Nicotiana clevelandii, Lettuce, Tomato, and Spinach. 1 group was infected with just TBSV. The 2nd group was infected with LNSV. A 3rd group was infected with both viruses. The fourth group was the control. It was not infected. Lambsquarters (indicator plant) was infected with the LNSV and TBSV single infections, to make sure I inoculated the plants with equal amts of virus.
I extracted the nucleic acid from .1g tissue sample. Then I used RT-PCR, & gel electrophoresis to find the virus concentrations in each plant. To compare the symptoms I developed a symptom severity scale from 0(healthy) -5(dead).

Results
LNSV was dominant in the Spinach, and both viruses were equally dominant in the Nicotiana clevelandii. Spinach showed more LNSV in the single and co-infections. Nicotiana clevelandii had equal amts of both viruses in the single and co-infections. On the symptom severity scale, in Spinach and Clevelandii, TBSV was worse than LNSV or the co-infection.

Conclusions/Discussion
I concluded that it was not necessary that 1 virus(LNSV or TBSV)be dominant over the other: they could be equal. The virus with a higher quantity in individual infections was also had a higher quantity in the co-infection. On the symptom severity scale TBSV was worse than LNSV or the co-infection in Spinach and Nicotiana clevelandii. I concluded that the severity of the symptoms in TBSV and LNSV does not always correlate with the amt of the virus.
My symptom severity scale results did not match the RT-PCR. This could be because the tests were not done on the same day. I would like to test how virus amts and symptom severity change over time by conducting RT-PCR & symptom tests daily.
In Nicotiana clevelandii, TBSV had a symptom severity of ~5. LNSV and the co-infections received ratings of ~4. As I only tested 4 plants, additional data may suggest that all 3 conditions are equal.
I also noticed an additive effect in the Lettuce. I would like to conduct an RT-PCR. To further this experiment, I could study what viruses are more severe in a host, and what these viruses have in common.

Summary Statement
This experiment looks at which virus (TBSV or LNSV) is more dominant in different host plants.

Help Received
My mom drove me to the USDA. Dr. William M. Wintermantel and Ms. Laura Hladky (Research Plant pathologists at USDA-ARS) guided me in this experiment.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Gautam V. Soundararajan

Project Number

S1723

Project Title

The Effect of Sapindus mukorossi vs. Commercial Detergents on the Growth of the Diatom, Thalassiosira pseudonana

Abstract

Objectives/Goals

This research is intended to study the effect of a natural cleanser, Ritha Nut (Sapindus Mukorossi) vs. commercial chemical detergent residues in water on the environment. Diatoms, being ideal biological indicators of environmental changes, serve as perfect indicators of harmful detergent residues. A study of the efficacy of Ritha against chemical detergents is also part of this project.

Methods/Materials

Water extraction was performed on Ritha Nut shells to extract the saponins. Detergent concentrations at 1%, 1/10%, 1/100%, and 1/1000% of Ritha Nut, Tide, and Ivory Snow were created. The diatom Thalassiosira Pseudonana was grown in an NEPC solution in an incubator. Different concentrations of the detergent solutions were introduced to the diatoms and a cell count was performed using a hemacytometer and microscope. Absorbance and strength of the Ritha Nut and chemical detergents were also measured using potting soil to simulate dirt and a spectrophotometer.

Results

In this experiment, the growth of Thalassiosira Pseudonana was greater in the Ritha Nut solution compared to the other chemical detergents used. The actual concentration of detergent used in a typical load of laundry is about 1/100%, at which fewer diatoms survived, especially for the chemical detergents. Regarding strength of the Ritha Nut vs. the chemical detergents, Ritha was almost equal to Ivory Snow, but half as strong as Tide.

Conclusions/Discussion

There is a negative impact to the environment when using chemical detergents, in comparison to the environmental benefits that the Ritha Nut offers. Household cleaning products are constantly sent to our water systems and are dismissed as insignificant. However, this research shows that chemicals used in cleaning products are harmful to the environment and the use of natural cleansers, such as Ritha Nut, are beneficial.

Summary Statement

My project tested the efficacy of Ritha Nut as a cleanser and studied its effect (vs. chemical detergents) on the environment using diatoms.

Help Received

Used lab equipment at Scripps Institute of Oceanography under the supervision of Dr. Hildebrand

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

David K. Tang-Quan

Project Number

S1724

Project Title

Evaluating the Role of the ESCRT Complex in Host/Cell Interaction and Stress Response of Candida albicans (Year 3)

Abstract

Objectives/Goals

The fungus Candida albicans can enter the bloodstream in immunocompromised patients, infecting most organs of the body and resulting in disseminated candidiasis, which has a 50% mortality rate, even with treatment. The body utilizes a variety of defense mechanisms to prevent candidiasis and it is hypothesized that the Endosomal Sorting Complex Required for Transport (ESCRT) is integral as a protein sorting and transport apparatus in C. albicans. For C. albicans to colonize patients and cause disease, it must be able to withstand these stressors and invade the host cells.

Methods/Materials

An endocytosis assay with ESCRT insertion mutants was completed to determine the role of the complex in epithelial cell invasion. Then, stress tests were conducted on the ESCRT mutants as well as on the insertion mutants from the HOG1 kinase pathway. Stressors included: protamine (antimicrobial peptides), SDS (cell membrane), H2O2 (oxidative), NaCl (HOG1 pathway), Congo Red and Calcofluor White (cell wall), and CuSO4 (ion).

Results

The endocytosis assay revealed that the ESCRT-1 and ESCRT-3 complexes are important for C. albicans invasion, while ESCRT-0 and ESCRT-3 are important for C. albicans ability to withstand stress. The ESCRT-2 complex did not play a role in either cell invasion or stress response. Results did show a correlation between disruption of the ESCRT complex and a negative impact on C. albicans ability to withstand stress and invade the cell.

Conclusions/Discussion

Overall, early or late gene inhibition in the ESCRT complex can severely impair C. albicans normal function. Most significantly, the HOG1 pathway and the ESCRT complex proved to play a key role in C. albicans general stress response. These discoveries open up the exciting possibility of significantly decreasing the 50% mortality rate of disseminated candidiasis.

Summary Statement

This study focuses on discovering the genes that control various responses of the fungus Candida albicans in order to decrease the mortality rate of the disease it causes.

Help Received

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

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Chau (Jenny) Vuong

Project Number
S1725

Project Title
Menu: Bottled Bacteria

Abstract

Objectives/Goals
To determined the amount of bacteria on water bottles after washing it with room temperature water.

Methods/Materials
Have 6 water bottles i took a sample from the bottle before anything can contaminate it as a control. then pass them out to my 2 helper. we each get 2 bottles, one label wash and the other label not wash. everyday exactly at 3pm i would take a sample of it and swap the nozel of the wash bottles before washing it to get the amount go bacteria in it. then swap it again after washing it with room temperature water only to see how much bacteria a left. the no wash bottles are not wash the entire week, i just take sample of it every day at 3pm so see how much more bacteria it accumulates.
Materials:
-petri dishes
-agar
-latex gloves
-dasani water bottles
-markers
-incubator to grow bacteria
-refridgerator

Results
After 5 long, long day the results said it all. the average number of bacteria remaining on the wash bottles after washing it increase from 0 at the starting day and 7 at the end. on the no wash bottles, the number of bacteria accumulates some increase some stay the same and some decrease.

Conclusions/Discussion
The number of bacteria got left behind increase over time because the number of bacteria grow everyday. and the bottles are not left to air dry afger washing. so the bacteria in the water drop stay in the bottles then continue to divide. As for the not wash bottles, there may be many sources of errors. for one it could decrease if the water in the water bottles may wash it out. not all the side of the cotton swab are properly swap on the petri dishes.

Summary Statement
To determined the amount of bacteria in water bottles wash vs. not wash.

Help Received
No other people assisted in the project.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Haley Washburn

Project Number
S1726

Project Title
Testing for Antibiotic Resistant Bacteria in California Beach Sand

Abstract

Objectives/Goals
The objective of my project was to determine if some of California's beaches were contaminated with antibiotic resistant bacteria. I wanted to discover if there was a potential health hazard to burying yourself, playing, or simply walking barefooted in the sand.

Methods/Materials
To test my project I collected sand at 2 and 12 inch depths from 4 different beaches. Using sterile technique I mixed 5ml of test sand with 5ml distilled water in a test tube then I used a pipette to collect 1ml of the now contaminated water and dropped it onto an ampicillin agar plate (the same process was used for my control, however I used a simple nutrient agar plate). I repeated this process for a total of 8 tests per test sand, then incubated all tests at 37 degrees for 48 hours; at which time I counted the number of bacteria colonies that had grown. Next, I swabbed the bacteria covered ampicillin plates with a cotton swab and then contaminated macrobid, terramycin, and ciprofloxacin agar plates with said cotton swab. I used a new cotton swab for each test. I repeated the process for 8 trials per antibiotic agar plate and once again incubated all tests for 48hrs at 37 degrees. Then I counted and charted the number of bacteria colonies that had grown.

Results
The results from my ampicillin agar plates showed that sand samples from Pismo, Avila, and Santa Cruz all had small amounts af bacteria growth proving limited antibiotic resistance. However, the Morro Beach sample had no visible bacteria growth at either depth. The sand sample from Pismo at 12in depth had no resistance to macrobid or ciprofloxacin. The sample from Morro Bay at 2in depth had no resistance to macrobid. All other sand samples had limited to highly antibiotic resistant bacteria in them having multiple bacteria colonies grown in each test plate.

Conclusions/Discussion
I have learned that while all of the sand I tested had bacteria growth it is the high occurance of antibiotic resistant bacteria growth that is cause for concern. The possibility of a person coming into contact with an antibiotic resistant bacteria while visiting a beach is highly likely and since the CDC estimates 36,000 deaths from antibiotic resistant bacteria in the coming year it would be wise to wear shoes, do not bury yourself in the sand, and use the public rinse stations to limit your possible exposure to said bacteria.

Summary Statement
I am ivestigating the possibility of exposure to antibiotic resistant bacteria during a leisure visit to the beach.

Help Received
Mother photographed my experiment; Nathan Whittington supplied antibiotic agar plates

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Stephen H. Whiting

Project Number

S1727

Project Title

Algae in Waste: Creating Profit from Waste by Growing Algae in Reclaimed Waste Water

Abstract

Objectives/Goals

An experiment was conducted to identify if algae grown in waste water could be an economically viable way to grow algae. For this experiment, six tubes of Nannochloris oculata were grown in two tubes filled with one of three treatments.

The first of these was filtered sea water which was pumped from the Scripps pier in San Diego. This was used as the control for the experiment. The next solution is called f/2. This is a commonly used general enriched medium designed for growing coastal marine algae. It is commonly used in laboratories working with algae to maintain a healthy, steady colony. The third media was an experimental treatment of waste water matched to the nitrate, salinity, and pH of f/2. Optical density was measured as a proxy for growth at 24 hour intervals. These ODs measured the absorbance of light at 750 nm.

Hypothesis: The algae species Nannochloris oculata, when grown in a solution of waste water and sea water, will produce more biomass than if grown in filtered sea water or f/2 alone.

Results

This experiment found that the experimental treatment of waste water grew the algae at a faster rate compared to the sea water and f/2 media and ultimately produced a greater amount of biomass. This experimental treatment would be a good use of multiple forms of waste. The algae could use waste water from a municipal waste treatment center, waste CO2 from a power plant, and sunlight to create biomass. In the near future, this treatment of algae may have a number of practical applications and profitable uses.

Conclusions/Discussion

This experiment supported the hypothesis. This can be explained by the excess nutrients available in the waste water. Growing algae in wastewater could be a potentially useful way to reduce waste and, using sunlight, turn it into a beneficial product. If algae becomes a commercial industry, this experiment could be a preliminary test to see if waste water grows algae well. The biomass has many potential uses, which include bio-fuel, fish feed, and ethanol. This will help contribute to the fight against the effects of global warming. The algae can help scrub harmful chemicals out of the wastewater and produce clean drinking water. This system could potentially use the waste water that is being pumped into the ocean every day. The algae will ultimately reduce waste and create viable products.

Summary Statement

This experiment tested growing algae in a wastewater solution to identify if growing algae in waste would be an acceptable way to reduce waste and create a product with commercial potential.

Help Received

I used the Scripps Institution of Oceanography Photobiology Group's lab under the supervision of Greg Mitchell and my mentor Ben Neal.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)
Alice L. Wong

Project Number
S1728

Project Title
Does Water from the Primary Wash of Oryza sativa Affect the Growth of Escherichia coli?

Abstract

Objectives/Goals
My goal was to test whether the water usually poured out after washing rice has any nutritional value.

Methods/Materials
I tested the nutritional factors by observing how it affected growth on E. coli. I prepared nutritional broth medium in test tubes and added E. coli to it. I left some control and then for the experimental group, I added rice water to it. I incubated it for 24 hours and then measured the amount of E. coli growth through a spectrophotometer.

Results
Instead of increasing the growth of E. coli or having no effect to it, the growth rate was decreased.

Conclusions/Discussion
My hypothesis was not supported although my null hypothesis was rejected. The rice water made a significant difference, but not in the way to promote E. coli growht. Since I tested it on E. coli, it could still have the potential to be nutritional for eukaryotes. This could also be due to the allelopathic factors of rice plants and futher experiments could be used to test whether rice water has the potential to be a natural herbicide or antibiotic.

Summary Statement
My project tested whether rice water has any nutritional value to it.

Help Received
I used work area and equipment at my high school under my advisor's supervision and obtained E. coli from Fresno city college.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Olivia E. Wong

Project Number

S1729

Project Title

To Test or Not to Test: 2009 Swine Flu with Rapid Influenza Antigen Test, RIAT

Abstract

Objectives/Goals

The objective is to study the performance of Rapid Influenza Antigen Testing (RIAT) on the diagnosis of 2009 H1N1 Swine Flu and to compare with Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) in an observational study performed at Desert Regional Medical Center (DRMC) from August 2009 to November 2009.

Methods/Materials

Eluted Nasal/Nasopharyngeal specimen were applied to the RIAT detection card, an immunochromatographic membrane assay using monoclonal antibodies detecting the nucleoprotein antigens of Influenza A and B. The results of RIAT tests were compared with the results of the RT-PCR tests sent out to the state laboratory from August 2009 to November 2009.

Results

A significance Z test for two pooled sample proportion was computed to determine whether the difference in the number of positive tests confirmed by each independent viral diagnostic tests was statistically significant at default 5 percent significance level. For the cumulative data from August 2009 to November 2009, RIAT detected 36 patients out of 252 total cases while RT-PCR detected 99 positive cases out of 364 ordered. The z score was calculated, z = -5.232849393 reaping a p-value of (3.0309093X10 ^-7). Since the p-value is lower than the 5 percent significance level, the null hypothesis that the number of positive cases confirmed by both viral diagnostic testing as equivalent should be rejected in favor of the alternative hypothesis.

Conclusions/Discussion

RIAT has been the mainstay of influenza testing due to its commercial availability and its instantaneous 15 minutes diagnosis serving as a point of care test. Poor performance of the RIAT tests stem from its wide range of sensitivity (10%-70%), to detect the 2009 H1N1 Influenza A virus, which requires further viral diagnostic testing with either the RT-PCR or viral culture to confirm the negative RIAT testing. Inability to differentiate between Influenza A subtypes and its lower sensitivity to detect the swine flu is confirmed by the significance z-tests for two-pooled sample proportion. Thus, the CDC cautions diagnostic decisions should be determined by the patient's symptoms, risks of complication, and epidemiology links.

Summary Statement

Due to the wide range of sensitivity of the RIAT tests, negative RIAT does not rule out swine flu, but needs to be verified with the RT-PCR testing.

Help Received

I used the microbiology lab at DRMC under the supervision of John Franzier.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

Peter L. Zhan

Project Number

S1730

Project Title

Quantitative Analysis of the Effect of Temperature on Bacterial Growth Rates

Abstract

Objectives/Goals

The purpose of this experiment was to mathematically analyze the influence of temperature on bacterial growth using fundamental chemical and statistical principles.

Methods/Materials

In my experiment, I incubated E. coli at various temperatures. All E. coli used came from a common stock. At various times, I measured the optical density (OD) of the cultures. By performing nonlinear regressions, I obtained the growth rate constants at different temperatures. I only included data from the exponential growth phase. I then analyzed the correlation between expected growth rate constants based on the Arrhenius equation and observed growth rate constants.

Results

The observed k values, per hour, at 11°C, 18°C, 28°C, 37°C, 41°C, and 43°C were, respectively, .016122, .07386, .3675, .43338, .40764, and .25836. In comparison to the graphs of the simulated growth rate constants calculated using Q(10) values of 1.2 and 3, the graph of the observed growth rate constants had much steeper slopes. Although there was a relatively poor correlation between the observed k values and simulated k values because of uncorrelated k above the critical temperature for E. coli, Spearman rank correlation analysis of the observed and simulated k at temperatures below the critical temperature reveals a perfect monotonic relationship between the observed and simulated k.

Conclusions/Discussion

Three major conclusions may be drawn from my data. First, at low temperatures, bacteria significantly upregulate their metabolic rate; their growth rate constant k is much larger than the predicted rate based on simple chemical principles. Second, below optimal temperatures, both the growth rate constant and the chemical reaction rate constant increase as temperature increases, albeit at different rates. Third, bacteria are significantly more susceptible to temperature changes than are chemical reactions. These findings are particularly alarming as we face global warming, as even relatively small increases in temperature in any temperature range pose risks to the delicate nature of life's regulatory abilities.

Summary Statement

Using fundamental chemical and statistical principles, I analyzed the influence of temperature on bacterial growth.

Help Received

My AP Statistics teacher Andrea Gould and AP Chemistry teacher Kevin Doyle sponsored and reviewed my project. My father, Dr. Hangjun Zhan, helped me procure some of the necessary materials and supervised my instrument usage.

CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY

Name(s)

David M. Zimmerman

Project Number

S1731

Project Title

Stress Enhances Growth Rate and Electricity Production by Shewanella sp. in a Microbial Fuel Cell

Abstract

Objectives/Goals

The microbial fuel cell (MFC) is a device that uses microorganisms to produce electrical current through the oxidation of organic matter. Commercialization of MFC technology requires the selection of microorganisms to optimize current production. Shewanella oneidensis MR-1 (MR-1) is a facultatively anaerobic proteobacterium studied for its ability to produce current in MFCs. Studies of related enterobacteria indicate that stress-induced mutations enhancing amino-acid catabolism can confer competitive growth advantages. The purpose of my study was to determine if MR-1 expresses an elevated growth rate when aged and stressed in a MFC and if this is accompanied by enhanced current production.

Methods/Materials

MFCs were constructed from acrylic plastic. Carbon-cloth air-cathodes were impregnated with a Pt catalyst. MR-1 was grown aerobically on agar plates and later in Na-PIPES buffered Luria broth batch culture at 30° C. Following incubation for 36 hours, cell suspensions normalized by cell count were inoculated into MFCs. Lactate was added as the sole substrate. The voltage drop produced by 1-day-old (wildtype) cells was measured across a 20 ohm load; 24 hours later, serial dilutions and colony assays were performed on MFC cell samples to assess growth rate. MFC inocula were then aged without additional substrate for 10 days to induce a stress response and moved to fresh MFCs for voltage and subsequent growth measurements, as above.

Results

Aged strains exhibited significantly elevated current production ($p<0.01$) and subsequent growth ($p<0.01$) with respect to wildtype. There was also a strong correlation between current density and growth rate ($R^2=0.97$).

Conclusions/Discussion

These data represent strong evidence for the growth advantage in stationary phase (GASP) phenotype. These results are consistent with MR-1's noted metabolic versatility and phylogenetic resemblance to the enterobacteria. It is likely that this link between growth and current production is due to some common mutation(s). Though these enhancements might be the result of physiological adaptation, this is unlikely, given the immediately observable enhanced current production in aged strains of MR-1 after resuspension and reinoculation. These findings suggest that selective mutational stresses may confer competitive growth advantages to Shewanella spp. which themselves result in elevated current production in MFCs.

Summary Statement

Selectively stressed cultures of Shewanella oneidensis MR-1 displayed a competitive growth advantage over wildtype, accompanied by significantly enhanced current production in microbial fuel cells.

Help Received

H. Wayne Harris (USC) provided cultures and advice regarding experimental design. High school instructors Michael Grasso and Tamara Miller (BWS) supervised my laboratory work.