CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Raj M. Amin

Project Number
S1301

Project Title

Determining the Presence of Chlamydophila pneumoniae in the San Joaquin Valley via Development of a Real Time PCR

Abstract

Objectives/Goals

This research project sought to develop a more accurate and reliable real time PCR test for the detection of Chlamydophila pneumoniae via an internal control. This project sought to determine the epidemiological presence of the organism in the San Joaquin Valley.

Methods/Materials

As of April 3rd, 191 patient samples from Children#s Hospital of Central California were used to determine the accuracy, sensitivity, and reproducibility of this novel PCR test. The samples were pre-extracted with the Qiagen DNA mini kit.
Development of the PCR diagnostic method involved unique creation of a master mix containing the primers, probes and internal control. Dilution of primers and probe concentrations for optimal detection were first tested. Secondly, the most specific internal control was developed using Human epithelial cells-2 to culture C. pneumoniae. These cultures were extracted, tested and inserted as a competitive internal control in the master mix.

Results

This study was successful in the development of a specific and reliable Real Time PCR test. Sensitivity was 1.0 x 10E-5 parts of genomic C. pneumoniae DNA and reproducibility, shown by positive and negative controls, was 100%. This study was successful in establishing the first highly specific and accurate competitive internal control (diluted to 2.5 x 10E-8) for the detection of this specific organism. 191 valley specific samples were tested of which 1.8% were positive and 83.7% were negative for C. pneumoniae. The internal control detected an inhibitor in 14.65% of all patient samples.

Conclusions/Discussion

The competitive internal control accuracy narrowed patient sample turnover rates (possible inhibitor present, causing different detection methods to be used) to 14.65% vs. 60% by the CDC, giving this test a 43.7% more accurate first trial sample determinant.
Epidemiologically, results compared similarly with other U.S. areas. The population tested, mainly 5-15 years of age, had a low prevalence. However, 62.5% infants tested worldwide for C. pneumoniae are positive. This population lacks developed immune systems, leaving them susceptible to illness and cause false negatives on the standard detection method, antibody level testing. C. pneumoniae#s ability to manifest into greater human ailments if undiagnosed is cause for retaining this study#s real time PCR test for its significantly faster, more reliable, and cost effective qualities.

Summary Statement

Chlamydophila pneumoniae is an atypical pneumoniae which leads to significant other health problems given manifestation time; this study#s results suggest the developed PCR may overcome detection hindrances posed by previous methods.

Help Received

Thanks to Alwyn Briones and Keith Zucker for lab space and purchase of materials.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Rena Banka

Project Number

S1302

Project Title

Does Vitis Extract (White Grape Seed Tannin) Have an Effect on Escherichia coli Plasimd Competency?

Abstract

Objectives/Goals

The goal of my experiment was to grow E. coli on nutrient agar treated with quantitative amounts of vitis extract. After allowing growth I harvested the colonies following the treatment. Then completed a p-blue plasmid protocol to count the competent colonies following incubation. My hypothesis was that the antioxidants in the vitis extract could be beneficial to our health and the plasmids would take up few cells in both the ampicillin plate and the p-blue plasmid protocol.

Methods/Materials

Materials: White Grape Seed Tannin (vitis extract),Presensitized LyphoCells, Super coiled pGAL (Blue Colony) DNA, Control Buffer, Ampicillin, X-Gal in solvent. Methods:1.Make plates. 2. Streak for isolation 3. Treat plates with e. coli. 4. complete tranformation 5.count transformations

Results

From all my observations and data I have come to the conclusion that vitis extract decreases the competency of E. coli. This shows that plasmids may have a harder time getting transformed when they are treated with vitis extract. When I tested the E. coli on the plates with ampicillin the bacteria on the controls, which contained the vitis extract but no plasmids, did not grow. This is because the ampicillin wiped them out. However the plates with the vitis extract, ampicillin and the plasmids transformed a couple of cells, fewer than the expected however. The pGal plates were similar to the ampicillin plates. All in all my results showed that the transformation rate was slowed down tremendously meaning that the vitis extract had a positive effect on the competency of the E. coli. On average my plates with ampicillin was 900 cells transformed per microgram of DNA. My plates with X-gal were 1020 cells transformed per microgram of DNA. My control was from 10,000 cells to 10,000,000 cells per microgram of DNA. So the numbers dropped tremendously.

Conclusions/Discussion

From analyzing the data, all the plates that were exposed to the vitis extract had a lot less colonies transformed than the expected amount for normally treated E. coli. This suggests that the vitis extract is having an affect on how the plasmids enter the cell wall of the bacteria. For humans this could be beneficial because most E. coli is found in the urinary tracts of our system and drinking wine with this extract in it shows that it allows less cells to be transformed in these tracts since the wine would usually pass through them.

Summary Statement

In my experiment I tested the effect of vitis extract on the competency of E. coli. The bacteria was transformed in the antibiotic, ampicillin, and I observed the effect vitis extract has on the transformation.

Help Received

Rebecca Avants guided me in safety procedures.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Steven D. Brewster

Project Number

S1303

Project Title

Alternate Light Rays on Micro-Organisms

Abstract

Objectives/Goals

The purpose of this project was to determine if an alternate light source would yield a direct effect in the micro-organisms, Euglena and Pelomyxa Carolinensis. This was determined by exposing samples of the two to four different types of lights, Red, Blue, Green, and U.V. The samples were exposed in one hour intervals followed by a one hour observation period, the samples were observed using a stereoscope and a microscope. Their size, shape, and the total amount were recorded and used as data. The results of these exposures were surprisingly different from my original expectations. The two samples of Euglena exposed to the Red and Blue light sources increased by the tens of thousands; however the samples exposed to the U.V. light source diminished.

Summary Statement

To determine whether or not alternate light rays will alter micro-organisms in any manner.

Help Received

Advice given by Mrs. Stoebner, used lab equipment at Ridgeview High School

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Mariah R. Erlick

Project Number

S1304

Project Title

Wastewater Treatment's Effect on Ultraviolet Light Resistance

Abstract

Objectives/Goals

The objective is to determine if treating wastewater with ultraviolet light will increase bacterial resistance to ultraviolet light in the effluent by triggering constitutive production of DNA repair enzymes.

Methods/Materials

Samples were collected from the influent and effluent of two wastewater plants: one used ultraviolet treatment, the other traditional chemical treatment. Each of these four sources was broken into two groups: one exposed to an additional hour of ultraviolet light, the other not exposed. Three plates of each of the eight conditions were used in each of five trials, for a total of fifteen plates per condition. Plate coverage was calculated based on histograms of digital photographs.

Results

After ultraviolet treatment, an additional hour of ultraviolet treatment decreased plate coverage 4.23%. After chemical treatment, that same amount of ultraviolet treatment reduced plate coverage only 2.72%. I used t-tests to verify results.

Conclusions/Discussion

Contrary to my hypothesis, I found that chemical treatment induced more resistance to ultraviolet light than ultraviolet treatment. One theory that explains this is that the time lapse between wastewater treatment and experimentation. Another explanation is that the bacteria in the wastewater did not have inducible repair systems. My data encourages the use of ultraviolet systems to treat wastewater and suggests that the concerns about inducing bacterial resistance in the effluent are unjustified.

Summary Statement

Ultraviolet wastewater treatment does not induce constitutive repair enzymes and does not cause ultraviolet light resistance in the effluent.

Help Received

Lab techs at the Ukiah Wastewater Treatment Plant and Laguna Subregional Treatment Plant helped with sample collection. Clint Smith helped with statistical analysis.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Romualdo C. Firme, Jr.

Project Number

S1305

Project Title

Bacteria: Iodine and Chlorine

Abstract

Objectives/Goals

Complete Abstract:
Familiar household products such as: Clorox, Iodine, Anti-bacterial soap, etc., can help aid us in getting rid of bacteria that lies around us everyday. Why is this important? How can this help us? Well, the bacteria that is present all around us and the things we touch can cause us to become ill and preventing or killing them can help in our well-being. Being a person that tries to avoid bacteria, I have always wondered what products can kill bacteria and how well they do their job. This brought me to iodine and chlorine. For my science project, I decided to use these halogens as my anti-bacterial agents. I placed the chlorine and iodine in different dilutions into sterile cups that contained a hundred ml. of water and five ml. of bacteria, from a nutrient broth. I then plated a drop of the solution I had made into a prepared Petri-dish, containing agar. Throughout my whole experiment, I made sure to use sterile techniques and made sure everything I used was sterilized and/or autoclaved. After a day or two of letting the bacteria colonies grow, I calculated my data and made my observations. For my Iodine group, I had one compromised dish, which was probably due to bad technique. However, my Chlorine group came out successfully with fewer colonies in the higher concentrations. Moreover, my data showed significance between the control and test groups. Basically, my data and the results of my whole experiment came out to be what I had expected during the beginning of this project.

Summary Statement

My project demonstrates the efficiency of Iodine's and Chlorine's bacterial-killing-abilities.

Help Received

Biology teacher, Mr. Callaway, supervised/assisted during the experimenting in his lab.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Helen N. Jones

Project Number
S1306

Project Title
Antibiotic Sensitivity

Abstract

Objectives/Goals
I want to find out which type of antibiotic will best treat the calves on the Mendiboure Ranch with scours. I am not at all sure about which antibiotic will successfully treat bacterial scours in the calves on the Mendiboure Ranch. I think that there will be differences in susceptibility to different antibiotics.

Methods/Materials
I used the following equipment: 3 small plastic bags, 3 small inoculation loops, 2 large inoculation loops, 3 fecal samples from scouring calves, 3 sterile swabs, 3 MacConkey/sheep blood agar plates, incubator, test tube with tryptic soy broth, BBL Enterotube II, Mueller-Hinton agar plate, and 8 different antibiotic discs.

a) collect fecal samples from scouring calves
b) inoculate MacConkey/Sheep Blood Agar Plates
c) incubate at 37 degrees Celsius for about 36 hours
d) identify the bacteria
e) inoculate Tryptic Soy Broth
f) incubate at 37 degrees Celsius for about 24 hours
g) inoculate Mueller-Hinton Agar and apply antibiotic discs
h) incubate approximately 24 hours at 37 degrees Celsius
i) check bacterial growth in areas surrounding antibiotic discs

Results
The bacteria was identified as E.coli. The bacteria was responsive to the antibiotics- Cefotaxime, Ampicillin, Levoquin, Augmentin, and Ceftazadime. And the bacteria was non-responsive to the antibiotics- Penicillin, Erythromycin, and Clindamycin.

Conclusions/Discussion
There were definite differences in the sensitivity of the bacteria to different antibiotics. Levoquin appears to be the best antibiotic to treat bacterial scours in calves on the Mendiboure Ranch. Many of our calves die each year due to the disease because the antibiotic we treat them with is not effective. Also the Mendiboure Ranch sells many of its cattle and they eventually go to slaughter. If cattle have been treated with many different types of antibiotic and people eat their meat those people have a high risk of not responding to the same types of antibiotics the cattle have been treated with if those people get sick. Now that I have found out which antibiotic will be most effective in calves sick with scours on the Mendiboure

Summary Statement
I did my project because if cattle have been treated with many different types of antibiotic and people eat their meat those people have a high risk of not responding to the same types of antibiotics the cattle have been treated with.

Help Received
Modoc Medical Center helped me by donating supplies and time to help me with this project; Cheryll Affonso helped me set up the board; My Mother helped me type some of my report.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Eric C. Langman

Project Number

S1307

Project Title

Concentrating Trypansoma lewisi in Transparent Growth Medium: A Model for Improving Field Diagnosis of T. brucei

Abstract

Objectives/Goals

The overall objective of this project is to demonstrate that it is possible to exploit cathodic galvanotaxis (the migration of ciliates and flagellates to the cathode of a DC field) in such a way that it will concentrate living trypanosomes in an electrolyte solution. If this could be demonstrated, it might be possible to construct a small device, using a battery as a voltage source, with which a field scientist could concentrate trypanosomes in a blood sample. A simple concentration technique could make the field detection of sleeping sickness more sensitive, especially when the parasites are still in their early stages and not plentiful enough in blood to be easily detected.

To do this, however, two secondary objectives were presented. First, we would have to find a way cultivate the test-subject, Trypanosoma lewisi, in an optically clear solution, so that it would be possible to examine the influence on the living organism of DC fields of different strengths. Normally, T. lewisi is cultured in a blood agar that lacks the required transparency. Second, we would have to build a device that would accommodate the tests of cathodic galvanotaxis. This device would have to be a small chamber, with a cathode in one end and an anode in the other. It would also need to be completely transparent for examination of the galvanotaxis should it occur.

Methods/Materials

A transparent chamber capable of maintaining a uniform current through it was constructed using a large microscope slide, fragments of standard microscope slides, two platinum wires, and silicone adhesive. T. lewisi was successfully cultured in a solution containing 40 mL of Schneider's Drosophila medium, 10 mL of Fetal Bovine Serum, and 1 mL streptomycin/penicillin. To perform the actual experiment, place a sample of T. lewisi in the constructed chamber. Then induce desired current in the sample by completing a circuit through the appropriate resistor. After 40 minutes, check the results by performing a double blind experiment with a trained microscopist.

Results

The secondary objectives were accomplished, and initial results indicate that the overall objective can also be successful.

Conclusions/Discussion

Some indication of success has been found with direct observation of the cathode and anode within the test cell. However, our trials with the experiment so far are insufficient to make a definite claim; more trials will need to be carried out.

Summary Statement

My goal is to show that trypanosomes will migrate to and concentrate at the cathode of a DC field; a diagnostic device could be created implementing the results that would improve the field detection accuracy of early-stage trypanosomiasis.

Help Received

Elaine Preston was a great help throughout the entire process. Not only did she introduce the experiment idea to me, but she also taught me how to use the necessary laboratory equipment, helped me obtain the required materials, and supervised me as I carried out the actual experiments.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Stephanie Lee; Nolan Woo

Project Number

S1308

Project Title

To Be or Not to Be: The Story of Bacteria vs. Anti-bacterial Agents

Abstract

Objectives/Goals

The purpose of this project was to figure out which anti-bacterial agents were effective against both Staphylococcus aureus and Pseudomonas aeruginosa. We believe that all anti-bacterial agents will effectively eliminate Staphylococcus aureus, but not Pseudomonas aeruginosa because Pseudomonas aeruginosa is considered more toxic.

Methods/Materials

We utilized safety materials such a gloves and lab coats to keep from contaminating our materials during our experimentation. The bacteria cultures that we used were lab samples of Staphylococcus aureus and Pseudomonas aeruginosa, of which we cultured our own samples into blood agar plates with cotton swabs and sterile saline. The anti-bacterial agents that we tested on the bacteria were Sani-Cloth Plus, Sani-Cloth, bleach solution, Lysol, and Sanimaster III. We also used additional materials such as a 200 μ-liter pipette with sterile tips, VITEK Calorimeter, incubator, and refrigerator to conduct our experiment.

Results

At the end of our experiment, some bacteria still remained after we added certain anti-bacterial agents such as the Sani-Cloth Plus, but the majority of the anti-bacterial substances was successful in eliminating bacterial growth for both types of bacteria.

Conclusions/Discussion

We concluded that most of our anti-bacterial agents are able to fight off these two types of bacteria because in our experiment, all but one of our anti-bacterial agents were at least 99.9% effective against both bacteria.

Summary Statement

Our project is about discovering which anti-bacterial agents are more effective in eliminating two types of bacteria found in hospitals.

Help Received

We used the laboratory equipment in the microbiology lab at USC University Hospital under the supervision of Arthur Gali, the supervisor of the lab.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Daphne Liang

Project Number

S1309

Project Title

The Effects of Different Colored Lights on Algal Oxygen Production

Abstract

Objectives/Goals

My objective was to determine whether the color of light has any effects on an algae's growth and oxygen production. I believed that if the color of light matched the classification color of the algae, then it would degrade its rate of photosynthesis, thus producing less oxygen.

Methods/Materials

Two types of algae were used to perform this experiment. Batrachospermum, a red algae, and Volvox Aureus, a green algae, were both cultured under red and green light under the same temperature conditions. After three hours, I used a Dissolved Oxygen Kit to determine the amount of oxygen that was released by the algae during photosynthesis.

Results

The algae was more prolific when the classification color differed from the color of light it was cultured under. When the colors matched, not as much oxygen was produced.

Conclusions/Discussion

My conclusion is that when the color of light does not match the classification color of the algae, more oxygen would be produced during photosynthesis. The reason for this lies in the pigments that certain types of algae contain. Red algae contains phycoerythrin, which reflects red wavelengths and absorbs blue wavelengths. Therefore, the algae would simply reflect the energy released by the red light and absorb the energy produced by the green light.

Summary Statement

My project demonstrates whether the color of light would affect the amount of oxygen released by the algae during photosynthesis.

Help Received

Dissolved Oxygen Kit was borrowed from Dr. Allen Jang.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Samantha Lowther; Danielle Sanfilippo

Project Number

S1310

Project Title

Testing...Testing...Where's the MYC? A Study of the Development and Effects of Mycorrhizae on Tagetes erecta

Abstract

Objectives/Goals

Farmers & florists have tried to apply chemical methods to produce desired results in plant growth & health. These man-made enhancers have largely failed to produce promised results. Today people are exploring nature in search of more promising outcomes. Mycorrhizae, a symbiotic bond between fungi & plant roots, seems to be a promising answer. Though this project uses only one plant, Tagetes erecta (marigolds), the results can be applied to an array of plant life. The goal of this project was to determine which soil mixture produces the best environment for mycorrhizae production on Tagetes erecta roots. It is predicted that soil enriched with organic fertilizer will produce the best results.

Methods/Materials

One control & 3 experimental groups of Tagetes erecta were used. Each group consisted of 15 pots/3 seeds each for a total of 180 plants. The control group consisted of the base soil, while the 3 experimental groups consisted of a blend of the base soil + a small amount of 1 of the 3 fertilizers. All 3 fertilizers had different compositions & purposes. The Tagetes erecta were planted late Dec. & controlled throughout their growth period (sunlight, distilled water, & room temp.). Daily observations & measurements were recorded. Soil tests determining composition & pH were conducted before & after mycorrhizae formation. Plants were dug up & roots were examined for mycorrhizae

Results

Tagetes erecta planted in soil 4 (base soil+peat moss) produced the best results; still, the plants in soil 3 (base soil+inorganic fertilizer) produced fairly equal results. The avg. plant height in soil 4 was 4.75½ & average leaf length was 3 cm. Soil 3 plant height avg. 4.25½ & leaf length was 3 cm. Soil groups 1 & 2 were the weakest in the project; however, soil 1 (base soil only) did produce better results than soil 2 (base soil+organic fertilizer), which produced fairly weak results. All roots were microscopically examined. Plants grown in soils 3 & 4 produced mycorrhizae, contributing to their overall success.

Conclusions/Discussion

Acquired data analysis showed the hypothesis to be false. Tagetes erecta in soil 2 did not produce the best results; this group was the weakest. The two groups least expected to produce a positive outcome, groups 3 & 4, were the most successful groups. Not only did they produce the tallest plants & most substantial roots, they gained mycorrhizae which led to stronger, healthier plants.

Summary Statement

An experiment designed to uncover the ideal conditions for the development of mycorrhizae and observe the overall effect of the mycorrhizae on Tagetes erecta plants.

Help Received

No help was recieved in doing the above listed project.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Mario A. Magana

Project Number

S1311

Project Title

Cleaning Water Via Silver

Abstract

Objectives/Goals

Complete Abstract:
I, like many people, consider anti-bacterial agents (i.e. hand sanitizers, anti-bacterial soaps Lysol, Clorox, etc.) as a very crucial part of our lives. Because one of the goals in my life is to search for the best way to maintain myself as much as I can away from germs, I always had bacteria in mind when science-project-topic-picking came. The way I arrived to my question: Does silver affect bacteria? was via research online and with Mr. Callaway#s knowledge of an old theory. He had heard that during the cowboy times, the travelers would put a silver coin into a barrel of water to clean or rid it of bacteria, with this in mind and some further research; I found more and much more modern uses of silver as an anti-bacterial agent.

There was no way of performing such an experiment without a bacteria source, so overcoming a great deal of my misophobia played a big part. To my advantage, three other of my peers were involved in a microbiology topic, and specifically bacteria. With this in mind, I was able to use a nutrient broth which was made with mouth-bacteria collected from a peer and put into a container with broth and sugar. After a weekend, this was our bacteria source. For silver, Mr. Callaway was nice enough to lend me several silver dollars (coins were sterilized with alcohol and placed over a flame). With three small cups, I put two coins in each and 1ml of bacteria in the 1st one, 5ml in the 2nd, and 10ml in the 3rd. For my control, I placed two coins in one cup with no bacteria. Our unfortunate luck took action when we discovered that the Petri dishes we had prepared with the agar (which was autoclaved beforehand) were apparently faulty and not sterilized like the package they came in claimed. This forced us to reduce our sample sizes to half of what we had started with. After finding new, glass Petri dishes, autoclaving, and adding the agar, I was ready to use a sterilized pipette to drop one drop (1/20 of a bacteria ml) of each solution in the cups into each dish. After a weekend, I was very pleased to find that silver had an immense impact on the bacteria-colony count. The comparison of my control group results (just bacteria in a Petri dish) and the dishes with the silver coins is amazingly significant, due to the Standard Deviation calculations I performed.

Summary Statement

My project tests Silver's properties and their affect on bacteria.

Help Received

My science teacher, Mr. Callaway, assisted/supervised my experimenting in his lab.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Angelique Moore; Ziyeda Sidikov; Anna Vasilchenko

Project Number

S1312

Project Title

Retarding the Growth of Escherichia coli with Varying Light Wavelengths

Abstract

Objectives/Goals

Not all E. coli are bad, and UV light is harmful to humans. If there was a way to minimize the growth rate of the bacteria so as to harness what is needed then scientist could grow only what is needed for various reasons without the constant problem of over growth. Also, if extermination was needed, then UV light would not be necessary. People could turn on a non-harmful light to kill the bacteria without worrying about being exposed to harmful rays.

Methods/Materials

After gaining all materials needed, create E. coli dilutions of 1:1000 and 1:10000. Cover the nutirient agar plates with four drops of the poluted .09% saline solution. Place these coated plates upside down in their repective boxes for approximately 48 hours. After the time frame, remove the plates and count the number of colonies per quarter of each plate.
1. 3 lamps; 2.1 violet filter; 3. 1 red filter; 4. 1 yellow filter; 5. 15 agar plates with agar (3 per light, 3 control, and 3 tests); 6. 1 small vial of E. Coli; 7. 1 300 mL flask of 0.9% Saline Solution; 8. 1 incubator set to 37 degrees C; 9. 3 boxes with 1 window each; 10. Several pipettes; 11. Several Q-tips; 12. 5 vials with lids; 13.4 thermometers.

Results

Control 1 105 entire plate Naked eye
Control 2 462 entire plate Naked eye
Control 3 388 entire plate Naked eye
Red 1 3 in center 40 magnification
Red 2 19 in center 40 mag
Red 3 19 center 40 mag
Violet 1 1 center 40 mag
Violet 2 31 center 40 mag
Violet 3 35 center 40 mag
Yellow 1 2 center 40 mag
Yellow 2 31 center 40 mag
Yellow 3 35 center 40 mag

Research continuing

Conclusions/Discussion

Summary Statement

Our study investigated the impact of different wavelengths of light on bacterial growth (E.coli) with some surprising results.

Help Received

Our Advisor, Martha Kimber, provided useful microbiology protocol information from UCD library.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Christopher L. Ng

Project Number

S1313

Project Title

Bacteria's Worst Enemy: Testing the Antibacterial Properties of Colloidal Silver

Abstract

Objectives/Goals

Colloidal silver is known to have germ killing and antibacterial properties. The purpose of this experiment was to not only test the anti-bacterial properties of silver in general but to also create a colloidal-silver based soap.

Methods/Materials

The colloidal-silver and soap were applied to the Petri dishes through circles of filter paper. I collected the data using two different methods, a standard colony count to determine which method removed the most colonies, and I measured the surface area of the bacteria to determine the surface area in cm2 that has been removed by the silver.

Results

In the Petri dishes containing the colloidal silver, there was an average of 3.00 colonies removed with a standard deviation of 1.22. One possibility why there may not have been many colonies removed is because the concentration of the colloidal silver is too low. The test with the colloidal-silver soap had even lower results than the silver as expected, with an average of 2.00 colonies removed with a standard deviation of 0.70.

Conclusions/Discussion

These results seem to be consistent with my hypothesis being that the colloidal-silver would be more effective, although I expected them both to have larger effects on the bacteria. I predict that applying a stronger concentrate of silver than 20ppm would show better results, such as that in the 300+ ppm range.

Summary Statement

To test the antibacterial properties of colloidal silver and if it would be effective in a soap form.

Help Received

I Used the lab in De La Salle High School under the supervision of Mrs. Victoria Acquistapace, M. Ed.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Evelyn J. Park

Project Number

S1314

Project Title

The Effect of EtOH and Antimicrobial Peptide RP-1 on Apoptosis in Various Pathogenic Microbes

Abstract

Objectives/Goals

The purpose of this project was to elucidate mechanisms and stages of microbial apoptosis/programmed cell death, as well as to evaluate the effects of the antimicrobial agents ethanol and RP-1 on apoptosis on three prototypic microoorganisms: Staphylococcus aureus (gram + bacteria), Escherichia coli (Gram - bacteria), and Candida albicans (fungus).

Methods/Materials

A homology search for microbial homologues of human apoptotic proteins was performed using NCBI's BLAST engine. S. aureus, E. coli, and C. albicans were grown overnight to stationary phase, then subcultured to mid-logarithmic phase. Cells were then harvested, washed, and resuspended in buffer. The inoculum was quantified by spectrophotometry (420 nm and 600 nm) and diluted to 5 x 106 colony-forming units. Cells were then incubated with DiOC5, treated with either buffer, 70% ethanol, or 50 ug/ml RP-1 and were incubated at 37º with agitation for varying time periods of 0, 30, and 60 minutes. The fluorophores AnnexinV and propidium iodide were then added to the samples and samples were incubated for 30 minutes. Samples were then put through flow cytometry; fluorescence data was gathered on channels FL-1 through FL-4 using a Becton-Dickinson FACSCalibur cytometer and CellQuest software.

Results

The homology search on BLAST failed to find any significant microbial homologues (E values were all above 1). C. albicans showed a strong signal for cell membrane energy, even while a strong apoptotic signal was also being expressed. Overall, changes in permeability were rare; most change occured in terms of cell energy as cells lost their membrane energy. However, RP-1 actually hyperpolarized some cells.

Conclusions/Discussion

The homologue search's failure to find significant results does not mean that microbial homologues of human apoptotic proteins do not exist; a different method or search algorithm may discover such homologues. Also, contrary to expectations, ethanol induced a higher level of apoptosis than did RP-1 in all three organisms, and RP-1 induced a higher level of permeability than did ethanol in all three organisms. This may be due to the fact that EtOH permeabilized cells to the point of total lysis, causing the fluorphore signal to become less concentrated and appear weaker. Also, RP-1, which is slower-acting than EtOH, may not have expressed its full effect in just 30 minutes of incubation with the microorganisms.

Summary Statement

My project focuses on studying different aspects of apoptosis in microorganisms, using both bioinformatics and experimentation.

Help Received

Dad helped with board; worked in lab at Harbor-UCLA under the supervision of Dr. Yeaman

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Benjamin G. Rosenblum

Project Number

S1315

Project Title

Outbreak, Epidemic, Pandemic: An Investigation into the Patterns of the Spread of Infectious Disease

Abstract

Objectives/Goals

The main objective of this experiment is to determine patterns in the spread of infectious disease. This experiment can then be used as a representation of an actual human disease. Comparisons with historical pandemics and a possible future pandemic, such as Bird Flu, can then be created.

Methods/Materials

GloGerm Bacteria Simulation and the Eubacterium, Micrococcus roseus, were used to simulate infectious disease outbreak scenarios. Various human-human and human-object interactions were investigated.

Results

The method of infection spread was deduced based on the patterns of several different instances of infection spread. Vector-borne illness and human-to-human contact illness reveal different patterns of infection.

Conclusions/Discussion

Epidemiological analysis can differentiate the means by which infection is spread. Historical analysis, experimentation, and prediction of future events can be correlated.

Summary Statement

My project illustrates the spread of infection using a high school classroom as a model and shows that patterns of infection are correlated with the means of infection.

Help Received

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)

Jimin Sung

Project Number

S1316

Project Title

Climate Change and Coral Reefs: Trouble Ahead?

Abstract

Objectives/Goals

Oceans are becoming warmer and more acidic as the result of human activities like burning fossil fuels. This project investigates the effect of decreased pH and increased temperature on the ability of algal coral symbionts to use photosynthesis. The research may help to better understand coral reef bleaching events.

Methods/Materials

Three experiments were performed. In the first two experiments, the pH of the algal growth media was decreased by adding a chemical buffer or by adding gaseous CO(2). In the third experiment, an electric heater was used to increase the temperature of the algal cultures. After changing the pH or temperature, the photosynthetic quantum efficiency of the algae was measured using a fluorometer. Other studies have demonstrated a strong relationship between lower quantum efficiency and enviromental stress.

Results

Decreasing the pH of the algal cultures by the addition of a buffer solution or by adding gaseous CO(2) was very weakly correlated with quantum efficiency. Increasing the temperature of the algal cultures was very strongly negatively correlated with lower quantum efficiency. The relationship of increased temperature to lower quantum efficiency was so strong that it passes the Student's T Test at a 98% confidence level.

Conclusions/Discussion

Loss of coral reefs could gravely impact organisms that depend on them as a habitat or a source of food. Fisheries associated with coral reefs provide 25% of the fish catch in developing countries. Tropical oceans are already approaching the critical temperature of 34 degrees Celsius that compromises the photosynthetic mechanisms of algal coral symbionts. Developing an instrument capable of measuring quantum efficiency, temperature and pH in situ on a coral reef will be necessary to better assess the impact of climate change on coral reefs.

Summary Statement

This project investigates the effect of simulated climate change on the ability of coral symbionts to use photosynthesis.

Help Received

Fluorometer, incubator, laminar flow hood and incubator were provided by the Monterey Bay Aquarium Research Institute(MBARI). Algae cultures were furnished by the Bigelow Marine Laboratory, University of Maine.

CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
Timothy N. Tran

Project Number
S1317

Project Title
It Stops Malaria but What About Bacteria?

Abstract

Objectives/Goals
The goal of this project is to determine if millipede secretions have antimicrobial properties.

Methods/Materials
Millipede secretions of Orthoporus texicolons and Archispirostreptus gigas were collected onto small, sterile filter disks. After the disks were weighed, they were placed on lawns streaked of different organisms: Streptococcus uberis, Micrococcus luteus, and Escherichia coli. The Mueller-Hinton plates were then incubated aerobically for 24 hours at 37°C. The diameter of microbial growth inhibition was measured and compared amongst the different millipede species and different bacterial organisms.

Results
Millipede secretions were effective in limiting the growth of E. coli, M. luteus, and S. uberis. The largest zones of diameter were seen against S. uberis while the smallest zones occurred against E. coli. It appears that the secretions of Archispirostreptus gigas were more effective in limiting the growth of S. uberis than the secretions of Orthoporus texicolons.

Conclusions/Discussion
I conclude that millipede secretions are effective in inhibiting the growth of E. coli, M. luteus, and S. uberis.

Summary Statement
To test millipede secretions for antimicrobial properties.

Help Received
Mentored by Jerry Kakkanad and Kathy Tran of Schmahl Science Workshop. Used facilities and equipment at Santa Clara University and The Insect Discovery Lab.