# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Vishaal Agrawal; William Duong

**Project Number**
**S1301**

**Project Title**
# Culturing Strains of Volvox to Become Acclimated to a High Level of Salinity

**Abstract**

**Objectives/Goals**
The objective of this experiment was to determine if we could culture a strain of Volvox, normally freshwater algae, to become adjusted to a saltwater environment.

**Methods/Materials**
We obtained our Volvox Aureus from Centennial High School, which also supplied the experimental equipment, and initially exposed them to a wide range of Instant Ocean concentration, from .006g/ml to .014 g/ml, to monitor their sensitivity towards a salt-water environment. After this analysis stage, we exposed the algae to increasingly higher levels of salt concentration. Light transmission and absorbency, as well as visible observations were recorded daily.

**Results**
The data shows that after a period of adaptation, the Volvox was able to survive in an environment it did not expect. We cultured strains to .11 g/ml and .18 g/ml, and they continued to have growth in spite of increasing levels of salinity.

**Conclusions/Discussion**
Sensitivity to the salt water might be limited by the time given towards adaptation before increasing the level of salinity. An experiment conducted over a longer amount of time with a less aggressive schedule might procure different results. It was determined that Volvox could be cultured to survive as well as those in freshwater, when the salt concentration was at .11 g/ml and .18 g/ml.

**Summary Statement**
Strains of freshwater Volvox algae were cultured to become acclimated to oceanic conditions

**Help Received**
Volvox strains obtained through Mrs. Houseman. Mrs. Houseman advised us throughout project. Lab equipment used from Centennial High School.

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Sandra Alcantar

**Project Number**
**S1302**

**Project Title**
## Food Preservation

**Abstract**

**Objectives/Goals**
My objective was to find out how much bacteria can a slice of apple have. I did it by counting the colonies in each petri dish. In this project I had to do was to let the petri dishes ome to room temperature before I took the samples. Then I had to collect bacteria from each slice of an apple. Then inoculate each dish by streaking a pattern gently across the entire surface. After I had to tape them and put them and in a warm location.

**Methods/Materials**
1. Prepared petri dishes containing agar medium and nutrients
2. Bacteria Collected from apples
3. Wax pencil for labeling dishes
4. Masking tape
5. Inoculating loop
6. Antibacterial agent
7. Test tubes,12 x75 mm
8. Paper Towels
9. Small Containers
10. Bleach

**Results**
The Results of my project were that the bacteria grows faster in room temperature than in refrigerator temperature. Their were more colonies in room temperature.

**Conclusions/Discussion**
The conclusion that I made was that bacteria growth may be affected by temperature. This was coorect I prove it by counting the colonies every day. It had to do a lot with bacteria an the temperatures.

**Summary Statement**
I tested how much bacteria a slice of apple had and then inocluate each dish by streaking a pattern of the slice of apple.

**Help Received**
Mrs. Zadik help me to develop the idea

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Sarah-Marie Amiri

**Project Number**
**S1303**

**Project Title**
# The Effects of Upwelling, Eutrophication, and Trace Metals on the Bloom Dynamics of Pseudo-nitzschia

**Abstract**

**Objectives/Goals**
In Santa Barbara County there were countless pinniped and cetacean deaths off the coast, occurring from domoic acid producing diatom Pseudo-nitzschia. My goal was to not only identify what was triggering the bloom dynamics and domoic acid productionof Pseudo-nitzschia, but propose an environmental solution for the county of Santa Barbara as well.

**Methods/Materials**
The experimentation involved isolating Pseudo-nitzschia for three separate tests that helped identify what triggered cell growth and domoic acid toxicity. These included: upwelling, eutrophication, and trace metals dialysis. For the tests I needed a collection of nutrients and trace metals. In the lab I used: beakers, plankton net, Petri dishes, DNA probes, and a microscope. I also utilized the Watershed Center to restore native plants, so that I could help minimize eutrophication at Coal Oil Point, hence reducing harmful algal blooms. In addition, the City helped me get materials such as PVC pipe and containers to test a filter containing magnesium carbonate which I had tested to bind to phosphate).

**Results**
After several tests, I had found that eutrophication resulted in the most cell growth. However, the iron and copper in the trace metal experiment induced enough physiological stress on the diatom to create the most amount of domoic acid. Counter to my hypothesis, I thought upwelling would have the strongest correlation with Harmful Algal Blooms however, it produced substantially less daughter cells than the eutrophication experiment.

**Conclusions/Discussion**
The project was successful in that it identified the problem, and it even inspired me to propose a new solution for the county. Since eutrophication is such an unaddressed issue in the county of Santa Barbara, I was motivated to reduce phosphate emissions in Santa Barbara by at least half. I had found that magnesium carbonate was an excellent phosphate binder, and decreased phosphate by almost 62%. I presented my findings to the city, and they agreed to help me make filters that could incorporate the binder and implement them in to storm drains. This is still an ongoing project, and I hope to have something substantial by the end of August. In light of my findings, I got ocean club (I created at school) to restore native plants (best bio filters) at Coal Oil Point with the Watershed, and the rangers reported that we were able to cut off runoff to the wet lands by almost 20%.

**Summary Statement**
This project enabled me to identify what triggers Pseudo-nitzschia to bloom and produce domoic acid off the coast of Santa Barbara, and begin a eutrophication filtrate system to decrease phosphate emissions in storm drains by at least 60%

**Help Received**
Marine Science Institute gave me lab space, microscopes, DNA probes etc... Mother/ Father drove me to UCSB, wharf, and Coal Oil Point for plant restorations etc..

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Ruchi Banka

**Project Number**
**S1304**

**Project Title**
## The Effect of Electromagnetism on the Competency of Escherichia coli

**Abstract**

**Objectives/Goals**
The objective is to determine whether electromagnetism has an affect on the competency of E. coli. The hypothesis is that the field will cause more E. coli to take up the plasmid and transform

**Methods/Materials**
The experiment requires E. coli culture, pBLU, calcium chloride, Luria Broth, test tubes, pipets, glass beads, LB agar, glass beads, and transfer loops. Petri plates, an ampicllin/ X-gal solution, and equipment such as an incubator, Bunsen burner, and water bath are also needed. On the first day pour all of the plates and then put them in the refrigerator. The next day streak the plates and when done put them upside down in an incubator at 37 for 12-20 hours. After 12-20 hours, bacteria should be at its peak competency. The bacteria are then ready to go through the actual transformation. During the transformation the electromagnetic field is applied to half of the tubes after they had completed the heat shock. After the transformation is complete put the plates in the incubator for a day and then leave them at room temperature for two days.

**Results**
For the plates with magnetism, plate 1 had 221 colonies, plate 2 had 1,076 colonies, plate 3 had 200 colonies, plate 4 had 520 colonies, plate 5 had 864 colonies, plate 6 had 664 colonies, plate 7 had 588 colonies, plate 8 had 824 colonies and plate 9 had 626 colonies. For the plates without magnetism, plate 1 had 128 colonies, plate 2 had 164 colonies, plate 3 had 84 colonies, plate 4 had 188 colonies, plate 5 had 128 colonies, plate 6 had 128 colonies, plate 7 had 132 colonies, plate 8 had 152 colonies and plate 9 had 108 colonies. This suggests that electromagnetism does indeed increase the competency of E. coli.

**Conclusions/Discussion**
The hypothesis that electromagnetism increases the competency of E. coli was supported by the experiment. This suggests that plasmids may become more antibiotic resistant when treated with electromagnetism. Electromagnetism may also be beneficial in terms of genetic engineering and creating transgenic bacteria.

**Summary Statement**
Electromagnetism does increase the competency of Escherichia coli.

**Help Received**
Mrs. Avants and Mr. Garabedian supervised, parents helped cut paper

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**

**Gregory S. Bernstein**

**Project Number**

**S1305**

**Project Title**

## Identification of a New Class of Antibiotics against MRSA

**Abstract**

**Objectives/Goals**

The bacteria Staphylococcus aureus has become a large problem because of its developed resistance to antimicrobial agents. Methicillin-resistant Staphylococcus aureus (MRSA) is currently the most dangerous and prevalent form. It is necessary that new treatments for MRSA be developed.

The compounds I tested were prepared in a synthetic combinational library and are based on the amino acid proline. Their four variable sites can be manipulated to vary their effect. For this experiment, the six most promising compounds from previous screens were tested alongside Vancomycin.

The purpose of this experiment was to determine the effectiveness of a new class of compounds against MRSA relative to the antibiotic Vancomycin by determining their minimum inhibitory concentration (MIC).

I hypothesize that the compounds that are most effective will have similar structure, which may indicate ways to develop them further.

**Methods/Materials**

Plates were prepared with a serial dilution of each compound and inoculated with MRSA. Controls with Vancomycin, DMF (the vehicle used in the compounds), and without MRSA were also prepared. The plates were incubated overnight and then scanned in a plate reader that measures light absorbance. This scan indicated bacteriostatic activity. MRSA was then incubated overnight in the absence of compounds and scanned to determine bactericidal activity. A set of agar plates was also prepared to provide confirmation with qualitative data.

**Results**

Compounds 29 and 31 had the lowest MIC, and therefore are the best candidates for further development. Some compounds were almost as effective as Vancomycin, with only a two-fold difference in concentration between their MICs.

**Conclusions/Discussion**

Compounds 29 and 31 had identical groups on 3 of their 4 variable sites. This indicates that the structure of these groups contributes to their effectiveness, confirming the hypothesis.

The data gathered in this experiment can be used to relate a compound#s effectiveness to its structure.

Further experiments will test the toxicity of the compounds on mammalian cells and determine their range of activity against other bacteria.

**Summary Statement**

I screened a compound library to select candidates for further development into new antibiotics against antibiotic-resistant Staphylococcus aureus.

**Help Received**

Materials provided by Nizet Lab at UCSD, supervision by Dr. Mary Hensler

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Cameron B. Clegg

**Project Number**
**S1306**

**Project Title**
## Wolbachia: A Potential WMD for West Nile Virus

**Abstract**

**Objectives/Goals**
Wolbachia: A Potential WMD for Insects is an experimental study to determine how quickly Wolbachia is spreading amongst an insect population and to test whether or not it can jump minor geographic barriers such as the 20 miles of ocean separating Santa Cruz Island from the mainland. my hypothesis is that if the island flies are tested for Wolbachia infection, then it will be found that there is infection present in the island flies and that the rate of infection found in Santa Barbara will be greater than those found in the Monterey bay area.

**Methods/Materials**
Drosophila Melanogaster fruit flies were captured at various locations through the dispersal of several fly-traps: large buckets with holes drilled in the side, so as to allow entry but deny escape, with rotting fruit and yeast in the bottom of the bucket to act as a lure. Once the flies are captured, they are anesthetized with ether and Polymerase Chain Reaction is utilized to multiply Wolbachia DNA. Agarose gel electrophoresis is used to detect a specific band and determine whether or not the fly was infected with Wolbachia.
Materials: DNA prep:15 mg/ml Proteinase K, 10x PCR buffer, purified H2O
PCR mixture: DNA prep, 16sF primer, 16sR primer, Taq polymerase, dNTPs, 10x buffer, MgCl2, purified H2O
Agarose Gel: Agarose, TBE buffer, EtBr

**Results**
After extensive testing and trapping, Wolbachia was detected in some but not all wild Drosophila Melanogaster collected from various locations. Two of the five Drosophila melanogaster found on Santa Cruz Island were infected with Wolbachia. And three of the nine Drosophila melanogaster caught in Santa Barbara tested positive for Wolbachia infection.

**Conclusions/Discussion**
My hypothesis was correct that there would be D. melanogaster infected with Wolbachia on Santa Cruz Island, however, my hypothesis was incorrect in the assertion that the rates of infection found in Santa Barbara would be greater than those in the Monterey bay area. If strains of Wolbachia could be developed that counteracted West Nile Virus, this information on the pervasiveness of the bacteria could be used to predict how fast the modified strain could be expected to spread.

**Summary Statement**
my project's purpose is to run tests on Drosophila Melanogaster to discover if the bacteria Wolbachia can spread through a population over a geographic barrier; for example: to Santa Cruz island.

**Help Received**
used lab equipment at UCSB and UCSC under supervision of Dr. Steve Poole and Dr. Bill Sullivan, mother helped cutting papers

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Mariah R. Erlick

**Project Number**
**S1307**

**Project Title**
## Inducing Photoreactivation in E. coli

**Abstract**

**Objectives/Goals**
The objective is to test whether E. coli survival through photoreactivation can be increased by a brief exposure to ultraviolet light prior to a longer exposure.

**Methods/Materials**
Groups of K-12 E. coli were exposed to one of three conditions: No UV light, 30 minutes of UV light, and five minutes of UV light followed by 30 minutes of UV light. These groups were each broken up into two groups, one exposed to an hour of visible light after the final 30-minute exposure to UV, one not exposed. Five plates of E. coli were used for each of the six conditions in five trials, for a total of 25 plates for each condition. Plate coverage was evaluated based on histograms of digital photographs.

**Results**
Exposing the strain that received visible light to the extra five minutes of UV light showed a 16.3% increase in survival of 6.8% plate coverage, while exposing the strain that received no visible light showed only a 5.3% increase of 1.9% plate coverage.

**Conclusions/Discussion**
In this project, photoreactivation, a type of DNA repair, was evaluated by controlling whether bacteria were exposed to visible light or not. Constitutive production of photolyase or other enzymes responsible for photoreactivation were triggered with a shorter UV exposure prior to a longer exposure. My results are also applicable to diseases such as Xeroderma Pigmentosum, which can be treated by introducing photoreactivation into human cells. They are applicable in the field of water purification, as they indicate that decontaminating water infected by E. coli is more effective with a long, single exposure than several shorter exposures.

**Summary Statement**
Photoreactivation, a DNA repair system, can be induced by a short exposure to ultraviolet light prior to a longer exposure, which may be important in treatment of diseases such as Xeroderma Pigmentosum, as well as water purification.

**Help Received**
Clint Smith helped with statistical analysis. Dr. Carla Longchamp provided medical information on Xeroderma Pigmentosum.

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Jacqueline M. Havens

**Project Number**
**S1308**

**Project Title**
# Isolation, Identification, and Characterization of Four Antibiotic-Resistant Soil Bacteria

**Abstract**

**Objectives/Goals**
To show that the four bacteria strains are distinct strains; the antibiotic resistance is carried on plasmids that they contain.

**Methods/Materials**
I grew the bacteria on agar plates with Tetracycline, Kanamycin, or Amphicillin. If the bacteria grew on the plate, it is antibiotic resistant. To find multiple resistance, I grew each bacteria (12 samples from each plate) on the other two antibiotics. (Ex. I grew the amphicillin resistant samples on Tet and Kan plates) I purified plasmids with the alkaline-lysis method. I used a spectrophotometer to quantitate the DNA. I ran the results from the alkaline lysis in gels to assure myself that it is plasmid DNA. I then transformed the plasmids into competent bacteria. I grew the transformed bacteria on antibiotic agar plates to make sure that the plasmid was responsible for the antibiotic resistance. (Here, I also grew competent bacteria on the antibiotic agar plates as a control.)

**Results**
I identified four different strains of antibiotic resistant bacteria based on types of antibiotic resistance: amp, tet/amp, kan, and kan/amp. There are twelve samples for each strain except kan, for which there are ten, and kan/amp, where there are two. I also successfully isolated the plasmid DNA of five samples, two resistant to Tet/Amp, one resistant to Kan, and two resistant to just Amp.

**Conclusions/Discussion**
It is unclear how these bacteria acquired antibiotic resistance. Since I have isolated the plasmid as a source of antibiotic resistance, I plan to sequence the plasmid and map the plasmid to get a clear picture of what this plasmid looks like and then perhaps get an idea of the acquiration of the antibiotic resistance through this map.

**Summary Statement**
I identified four species of antibiotic-resistant soil bacteria and have isolated and transformed the plasmids to verify that antibiotic resistance is carried on a plasmid.

**Help Received**
Used lab equipment at UCI under the supervision of Dr. Gardiner

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Kevin T. Hoffman

**Project Number**
**S1309**

**Project Title**
# Alcoholic Fermentation by Saccharomyces cerevisiae in Different Carbohydrates

**Abstract**

**Objectives/Goals**
The objective of this experiment was to determine what type of carbohydrate was utilized best in the alcoholic fermentation process.

**Methods/Materials**
A yeast solution was prepared by mixing Saccharomyces cerevisiae in water. This was divided into different containers; the same amount of water was poured into another as a control. Different carbohydrates were added to each container. The carbohydrates used were sucrose, fructose, Splenda, and glucose. Sucrose was also used for the control. The specific gravity of the liquid in each container was measured with a hydrometer, and then each solution was allowed to ferment undisturbed for five days. After this time, the specific gravity was measured again with the hydrometer. The difference in the specific gravity at the beginning and at the end was determined. A change in specific gravity shows that the yeast had utilized carbohydrate.

**Results**
Glucose had the greatest mean change in specific gravity over the five-day trial period (008 ± .003, n=3). Splenda displayed the least mean change (0.0 ± .002). The control did not change.

**Conclusions/Discussion**
The yeast utilized glucose the best in alcoholic fermentation; this was shown in the fact that glucose had the greatest mean change in specific gravity. I interpreted that the yeast is best suited to fermenting glucose, possibly for a few reasons. For example, glucose may have a smaller molecular size than the other carbohydrates tested, which would mean that it could get into the yeast cell more easily. Because Splenda showed a mean change of 0 (n=3), it shows that it is very inefficient in the alcoholic fermentation process. The absence of change in the control container supports the theory that no force other than the alcoholic fermentation by the yeast was causing the specific gravity to change.

**Summary Statement**
This project is designed to test the utilization of different carbohydrates in alcoholic fermentation by yeast.

**Help Received**
Father proof-read report; mother helped paste things on board

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Laura A. Huppert

**Project Number**
**S1310**

**Project Title**
## Do Livestock Antibiotics Affect Soil Bacteria?

**Abstract**

**Objectives/Goals**
The purpose of this experiment is to determine how antibiotic use in cattle feedlots affects the soil bacteria of that environment. My hypothesis was that soil bacteria collected from farms using antibiotics would have more resistance to these substances.

**Methods/Materials**
Four different locations that provided a spectrum of grazing and antibiotic use were compared, including a site that had never been grazed, an organic cattle farm, a commercial cattle farm that spot-used antibiotics, and a cattle company that was a heavy antibiotics user.

The soils collected at each site were diluted by a factor of 10 E-5, 10 E-6, and 10 E-7 grams / mL saline solution. Two replicates of each dilution were plated on tryptic soy agar medium, one with the antibiotic oxytetracycline, and the other without antibiotic. Antibiotic resistance was assessed by comparing the number of bacterial colonies on plates with and without antibiotic. Also, organic carbon and soil moisture content were determined for site characterization.

**Results**
After monitoring bacteria growth, it was found that bacteria from the heavy antibiotic-using farm appeared the most resistant to oxytetracycline. The difference in the number of bacterial colonies between the antibiotic-positive and antibiotic-negative plates was relatively small for that site, with 52.2% of bacteria resistant, unlike the large difference in bacteria growth between treatments for the other sites.

**Conclusions/Discussion**
This experiment suggests that the degree of antibiotic use is related to bacterial resistance to that antibiotic. If antibiotics are used only mildly at a site, such as for spot treatment of sick cattle, no resistance develops. However, if the antibiotic is used more heavily, the soil bacteria at the farm can become resistant to the antibiotic. This is significant because antibiotic resistance can lead to greater difficulties in treating livestock and human bacterial infections.

**Summary Statement**
This project examines whether soil bacteria are resistant to oxytetracycline at cattle farms that use varying doses of this anitbiotic.

**Help Received**
Margaret Torn and her lab assistant Deb Williard of Lawrence Berkeley National Laboratory allowed me to use their equipment and answered any specific questions that I asked. However, I individually designed, conducted, and analyzed the results for this project.

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Da Eun Im

**Project Number**
**S1311**

**Project Title**
## Roles of Auxotrophic Markers in Candida albicans Virulence

**Abstract**

**Objectives/Goals**
Candida albicans is the most common human opportunistic fungal pathogen that causes disseminated and mucosal infections. This dimorphic fungus, which exists as oval, single yeast cell but forms hyphae under favorable conditions, is the most common cause of yeast infections. The virulence factors, which determine the ability of C. albicans to damage its host cells, will serve as promising targets for therapies against Candida infections. Therefore, we examined the nutrient auxotrophy as a potential modifier of virulence in C. albicans.

**Methods/Materials**
In order to determine the effects of auxotrophy for uracil, arginine, and histidine on essential virulence traits of C. albicans, BWP17 (Ura-Arg-His-) was used as a parental strain to construct Ura+Arg-His- strains, Ura+Arg+His- strains, and Ura+Arg+His+ prototrophic strains. Polymerase Chain Reaction, gel electrophoresis, and growth test on different selection media were performed to check the auxotrophic characteristics of each strain. To examine the ability of each newly created strain to express virulence related traits, hyphal formation test and endothelial cell damage assay were also performed.

**Results**
Ura+Arg-His-, Ura+Arg+His-, and prototrophic strains formed hyphae while BWP17 did not. The abilities of the newly constructed strains, which all were prototrophic for uracil, to cause damage to endothelial cells were significantly higher than that of BWP17.

**Conclusions/Discussion**
Therefore, prototrophy for uracil is essential for the full virulence traits of C. albicans. On the other hand, auxotrophy for arginine and histidine did not affect the virulence traits. In conclusion, inhibiting the production of uracil may be used to develop therapeutic agents that specifically target Candida infections.

**Summary Statement**
Since prototrophy for uracil is essential for the full virulence traits of Candida albicans, the most common human opportunistic fungal pathogen, inhibiting the production of uracil may be used to develop therapeutic agents.

**Help Received**
Used lab equipment in Division of Infectious Diseases at Los Angeles Biomedical Research Institute under the supervision of Dr. Hyunsook Park and Dr. Scott G. Filler; Norma Solis did the portions of damage assay that required using radioactive materials; Southern California Academy of Sciences (SCAS)

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**

**Charles Liu; Adeline Wong; Boyuan Zhu**

**Project Number**

**S1313**

**Project Title**

## Mutations in Saccharomyces cerevisiae After Exposure to Yeast-Killing Compounds

**Abstract**

**Objectives/Goals**

The purpose of this project was to study the effects of curcumin (a turmeric extract) and allyl disulfide (a garlic extract) on Saccharomyces cerevisiae. Both of these compounds are purported to have anti-fungal properties. The project evolved to include looking at whether mutations conferring resistance to azole (a common anti-fungal drug) also conferred resistance to the two compounds and whether mutants could be generated by UV radiation.

**Methods/Materials**

1)To test what compounds and concentrations killed yeast, creating mutants, wildtype S. cerevisiae was grown on plates with YPD (control), 0.1% and 0.3% allyl disulfide (A.D.), 150uM curcumin, and ethanol as a control for curcumin, which had been dissolved in ethanol. 2)To test if azole resistance conferred compound resistance, 10 strains with azole resistance mutations, wildtype yeast, and an RDRd mutant (increased cellular transport levels) were grown on the same compounds and concentrations as before. 3)To test the effects of UV radiation on mutation, about 5x10^7 S. cerevisiae cells were spread onto each of 22 plates, with the same compounds and concentrations as before. The A.D. plates were subjected to 0, 5K, 10K, 20K uJ/cm2 of ultraviolet radiation and the curcumin plates to 0 and 20K.

**Results**

1)Both A.D plates showed diminished growth proportional to their concentrations. The YPD, curcumin, and ethanol plates showed normal growth. 2)The 0.3% A.D. plate was the only one that showed remarkable diminished growth in certain strains. It is possible that A.D. does not inhibit growth through an ergosterol pathway, as an ERG (increased ergosterol metabolism) strain showed poor growth. It seems that the transporter mutant (RDRd) is not resistant either. 3)Despite aberrant lack of growth on some plates, 5K and 10K uJ/cm2 of UV radiation seemed to produce normal or slightly increased growth.

**Conclusions/Discussion**

These experiments should be repeated to test if curcumin is lethal at higher concentrations. The team's hypothesis that A.D. inhibits growth was supported by the diminished growth on the A.D. plates. Some of the azole resistance genes tested may confer resistance to A.D. and curcumin, but azole resistance may be less relevant to compound resistance than the team previously believed. UV radiation seems to be effective in producing successful growth at medium concentrations (5K and 10K uJ/cm2), but it led to sporadic growth at 20K uJ/cm2.

**Summary Statement**

Investigated the effect of chemicals, radiation, and mutations on the growth of S. cerevisiae; investigated the pathways by which certain chemicals kill yeasts; tested whether certain mutations lent multiple substance resistances.

**Help Received**

Obtained yeast samples from Kim Williams of FibroGen; used lab equipment at Stanford University under the supervision of Kim Williams and her colleagues; carried out almost all research at Homestead High School

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Raziel Lizaraga

**Project Number**
**S1314**

**Project Title**
# Synergetic Effect of Gibberellic Acid and Indoleacetic Acid on Ulothrix subtilissima

**Abstract**

**Objectives/Goals**
The purpose of this project is to find out the interaction the plant hormones gibberellic acid and indoleacetic acid on the algae Ulothrix subtilissima.

**Methods/Materials**
The procedure included the preparation of 4 sets of test tubes. The first set consisted of 5 tubes as a control containng the alga and culture medium (soil and salt water). The second set consisted of 15 tubes containing increasing doses of GA , culture medium and the alga. The third set of 20 tubes containing increasing doses of IAA, culture meium and the alga. The fourth set of 25 tubes containing a combination of GA nad IAA at different doses. The experimental set-up included the placement of the culture tubes on a shaker for incubation under light filtered by water (to absorb the heat) during 90 days. For the first 15 days the absorbance was read every other day to check for photosynthetic activity. At the end of the 90 day period, one microliter from each tube was analyzed under the microcope and the cells counted.

**Results**
The number of cells observed in the samples in which GA was used, increased in direct proportion with the amount of hormone being used. The same results were observed for IAA. A synergetic effect was also observed but the number of cells did not increased proportionally with the amounts of hormones being used.

**Conclusions/Discussion**
It can be concluded that the amount of gibberellic acid and indoleacetic acid produce an increment of cells in a direct proportion to the amount of hormone being used.
It was also noted that there is a synergetic effect on the number of cells; however; the relationship was not direct. An optimum amount of both hormones is necessary to produce a synergetic effect. That amount was observed to be an intermediate between the maximum needed for individual peak performance in each hormone. It was also observed that although Ulothrix sublissima is a unicellular algae, it is found organized in filaments. The addition of GA produced longer filaments while the addition of IAA produced shorter filaments in larger quantities

**Summary Statement**
This project is about the synergetic effect of the plant hormones giberrellic acid and indoleacetic acid in the algae Ulothrix subtilissima.

**Help Received**
Central Union High School Science Department provided the laboratory facilities. Parent supplied the needed materials. Central Union High School District sponsored the trip to San Diego to participate in GSDSEF.

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Kathleen N. Magness

**Project Number**
**S1315**

**Project Title**
## Bacterial Transformations Using the Beta-Galactosidase Gene

**Abstract**

**Objectives/Goals**
Objectives/Goals: The object is to discover if bacteria can be successfully transformed without the presence of calcium chloride which is normally used to make the cells competent to take up DNA Hypothesis: The plates with the calcium chloride present will successfully transform, the plates without the calcium chloride will not.

**Methods/Materials**
Methods/Materials: E-coli bacteria was placed in four test tubes labeled as followed: +Plasmid with calcium chloride, -Plasmid with calcium chloride, +Plasmid without calcium chloride, -Plasmid without calcium chloride. The tubes that were labeled #with calcium# had 250 µL of calcium chloride; those labeled #without calcium chloride# had 250 µL of ice water. The tubes labeled #+Plasmid# had 10 µL of plasmid DNA added to them. All of the tubes were heat shocked for 90 minutes, and then 250 µL of Luria Broth was added to them. Then 100 µL from each test tube is added to a set of plates labeled #LB,# #LB/Amp,# and #LB/Amp/X-gal# along with the label from that particular test tube. The plates incubated at 37ºC for 36 hours, results were recorded.

**Results**
Results: My results were inconclusive because the experiment was unsuccessful. In the first run of the experiment, the plates labeled #LB# for all the solutions had substantial bacterial growth, as expected. All of the plates labeled #LB/Amp# had little or no growth, with the exception of the plate that contained no plasmid and no calcium chloride. This plate had a mold growing on it that could have occurred from contamination. This was also expected. However, the plates labeled #LB/Amp/X-gal# all had no growth. This was unexpected because the plate with the Plasmid and calcium chloride should have had colonies that were blue in color as a result of the color-marker gene. The same results came from the second run of the experiment.

**Conclusions/Discussion**
Conclusions/Discussions: The results were inconclusive so I am unable to determine whether or not calcium chloride is required to successfully transform bacteria. The possible reasons for this include the possibility that the ampicillin and x-gal solution denatured when exposed to the agar, improper storage of the materials, or improper preparation. Also, the plate that had the mold growing in it could have occurred because of contamination. The contamination would have occurred during the time when I was preparing the plates

**Summary Statement**
"Bacterial Transformations Using the Beta-Galactosidase Gene" tests success of transformation with the absence of calcium cholride to make the host bacteria competent.

**Help Received**
Help Received: I received help from Mrs. Sara Schlussel with the procedures, and using her lab to conduct the experiment.

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Rachel N. Martinez

**Project Number**
**S1316**

**Project Title**
# Is There a Relationship Between the Disease Severity and the Actual Fungus Titer of the Innoculated Lettuce Plants?

**Abstract**

**Objectives/Goals**
I#m trying to figure out if there is a relationship between the disease severity of the fungus, Verticillium dahliae, on the inoculated lettuce plants compared to the actual fungus titer of the plants.
My hypothesis is that there is a relationship between the disease severity and the actual fungus titer of the inoculated lettuce plants. I think that the higher the level on the disease severity scale the more fungus that plant actually has.

**Methods/Materials**
The materials I will be using are as follows:40 inoculated lettuce plants(12 post inoculated),5 moculated lettuce plants, petridishes, micro pipets , diH2O,scale(fresh weight),PDA (potatodextroseagar),refrigerator, plastic tubes, mortar, pestle, gloves, spatula/spreader, microscope, water & bucket ,and a colony counter,
Using these materials I first washed the lettuce plant#s roots , cut off the foliage, then labeled them. I then weighed the roots. I cut off all of the linear roots , then I ground up each tap root with 1 ml of diH2O. After each root was ground I added 4 more ml of diH2O. Then using a micro pipet I took 1 ml of each tap root mixture and placed it into plastic tubes. I then made dilutions of each mixture. I spread 250 micro liters aliquots of each dilution onto PDA plates. I waited 4 days to count the colonies of Verticillium dahliae. I will then compare the colonies of Verticillium dahliae to the disease severity score I originally made.

**Results**
I found that there was a relationship.The relationship was there but I couldn't tell if there was a great one or barely there

**Conclusions/Discussion**
I fould that there was a relationship between the two. If I tested more inoculated lettuce plants the relationship would be more clear/

**Summary Statement**
It is about finding a relationship between disease severity and the fungus titer.

**Help Received**
Dr.Gary Vallad guided me through my project.I also used the USDA lab in Salinas, California.

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Patrick F. Michaels

**Project Number**
**S1317**

**Project Title**
# Methane Production and Consumption in Suburban Landscapes

**Abstract**

**Objectives/Goals**
Methane, a potent greenhouse gas, is produced by specific archaea called methanogens and consumed by bacteria called methanotrophs. Methanogens reside in anaerobic ecosystems such as over watered lawns or compost heaps.

**Results**
Earlier experiments indicated that saturated yard compost produced methane, suggesting that levels of irrigation in suburban landscapes might influence methane production. This year, measurements of methane production in suburban environments found little methane and little variability with the level of water saturation. Plugs of lawn incubated under high methane concentrations showed that significant levels of methanotrophy were occurring or could be induced. Ammonia inhibits methanotrophs. Ammonia-based fertilizers, when added to portions of a lawn, reduced the level of methanotrophy compared to normally fertilized lawns.

**Conclusions/Discussion**
The study indicates that normal suburban landscapes are not significant methane sources and may even consume methane. Excessive use of ammonia-based fertilizers, particularly in over-watered areas, could turn them into a methane source.

**Summary Statement**
The amount of water and fertilizer applied to suburban landscapes may influence whether they produce or consume methane, an important greenhouse gas.

**Help Received**
Dr. Anthony Michaels gave advice and supervised the use of a GC at the University of Southern California, Mr Robertson also provided advice.

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**

Su F. Ong

**Project Number**

**S1318**

**Project Title**

## Effects of Atmospheric CO(2) on the Nitrogen Production Capabilities of Trichodesmium

**Abstract**

**Objectives/Goals**

As a consequence of the rising levels of anthropogenic (human generated) carbon dioxide in the atmosphere, the world ecosystems are undergoing unforeseen changes. The nitrogen cycle constitutes as one of the most important processes within the biological world, with nitrogen being one of the twenty-five necessary elements for life. Therefore, it is essential to understand of future marine ecosystems in regards to organic nitrogen influx. Here, the effects of increased atmospheric carbon dioxide on the nitrogen production capabilities of Trichodesmium, a marine cyanobacterium responsible for the majority of the nitrogen supply in its ecosystems, are measured.

**Methods/Materials**

By taking advantage of the inverse relationship between pH and CO2 absorption, Trichodesmium cultures were designed to grow in CO2 conditions of the pre-industrial era, the current era, and predicted levels for the years 2060, 2180, and 2250. Nitrogen fixation rates were measured using the acetylene reduction method, in which acetylene is substituted for nitrogen and is broken down into ethylene. 10 mL of culture and 1 mL of acetylene gas were pipetted into gas tight serum vials and allowed to incubated for an interval of 2 hours. Following this, gas samples were withdrawn and ethylene levels were measured using a gas chromatographer.

**Results**

Per trichome, nitrogen fixation rates were found to sharply decrease by 2060 and level out for the future. However, rates per mL were found to be in direct opposition, with rates increasing linearly from 2060 onward. It can, therefore, be concluded that as CO2 levels rise, nitrogen production per trichome will decrease, but this decrease will be more than compensated by a higher growth curves.

**Conclusions/Discussion**

Therefore, an increase in organic marine nitrogen influx can be expected to occur in the future if anthropogenic CO2 continue to rise unabated. The consequences of this augmented nitrogen supply are unknown. The results from this particular research represent only one piece of the huge puzzle that constitutes the question of the effects of anthropogenic carbon dioxide on marine nitrogen cycles.

**Summary Statement**

Exploration of the impact of anthropogenic carbon dioxide on the influx of nitrogen in marine ecosystems.

**Help Received**

Used lab equipment at the University of Southern California under the supervision of Jill Sohm.

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Rachel A. Smith

**Project Number**
**S1319**

**Project Title**
## Effects of Curry and Other Common Foods on the Growth of Oral Bacteria

**Abstract**

**Objectives/Goals**
The objective of the project was to examine if common household food items alter the growth of oral bacteria.

**Methods/Materials**
Human saliva was collected from different individuals and incubated with known amounts of different food items such as milk, cranberry juice, garlic, onion, rosemary and curry powder. After incubating, the treated saliva was plated on Luria broth plates and colony forming units were allowed to grow in an incubator. Colonies were counted and the results were compared to control saliva that had not been treated with any of the foods.

**Results**
The experiments clearly showed that foods had varying effects on the growth of oral bacteria. Some foods increased bacterial growth while others had a growth inhibitory effect. Curry powder had the most dramatic effect on bacterial growth. Saliva treated with curry powder showed a dramatic increase in the number and different types of bacteria. Further investigation showed that curry powders (3 different samples were tested) contained their own population of bacteria that grew rapidly on LB plates. Boiling the curry powders prior to testing with saliva removed the foreign bacteria. Saliva treated with pre-boiled curry powder still showed an increase in bacterial growth.

**Conclusions/Discussion**
The study showed that common food items can have a positive or negative effect on the growth of human oral bacteria. The study also demonstrated that some food itmes that we assume to be free of bacteria may contain high levels of microbes.

**Summary Statement**
The project examined how common food items affect the growth of oral bacteria.

**Help Received**
My father assisted me with my project design and helped me with some of the techniques.

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Nicole A. Sousa

**Project Number**
**S1320**

**Project Title**
## Commensal E. coli Mutants, Biotypes, and You (2)

**Abstract**

**Objectives/Goals**
The purpose of this project was to observe whether or not multiple biotypes of Commensal E. coli thrive within the intestine simultaneously and occupy the human intestine over time, and also to investigate the cause of the mutation in Commensal E. coli samples number 7 and 8 that I isolated last year.

**Methods/Materials**
Commensal E. coli was isolated, biotyped, and tested for antibiotic sensitivity. Samples 7 and 8 from last year were revived, and had plasmids extracted from them. The plasmids were later used in a transformation.

**Results**
Using the data from last year#s Commensal E. coli samples, it was determined that 3 new biotypes of E. coli are now present in my intestine and that multiple biotypes of Commensal E. coli can occupy the intestine simultaneously. Through the transformation, it was determined that the mutation in samples 7 and 8 is most likely present in the samples# genetic information.

**Conclusions/Discussion**
Within hours of birth, warm-blooded animals acquire Commensal E. coli. After this acquisition, the biotypes of the bacteria shift and new biotypes come about, a phenomenon that scientists cannot explain. My data demonstrates that multiple biotypes of E. coli thrive in the intestine simultaneously, and new biotypes appear over time in the intestine. This suggests that through bacterial conjugation, new biotypes of E. coli are introduced to the human body. This is supported by the successful transformation that I conducted with cells susceptible to antibiotics, and with plasmids from samples 7 and 8 that have an intermediate and/or resistant reaction to 4 antibiotics. These cells acquired the same mutations that samples 7 and 8 have, demonstrating the likelihood that the mutations were present within the genetic information of samples 7 and 8. This is significant because doctors need to be extremely careful in dispensing antibiotics to their patients in treating Commensal E. coli- related infections because a mutant biotype could be infecting the patient, making certain antibiotics ineffective. Also, this information could possibly aid researchers in pinpointing where these antibiotic-related mutations within Commensal E. coli are occuring, and what is the most effective way in dealing with them.

**Summary Statement**
This project demonstrates genetic variation in the human intestine with Commensal E. coli and a possibility as to why and how Commensal E. coli mutates

**Help Received**
Belinda Schmahl aided me in ordering materials, Dr. Recht of SJSU allowed me to use her lab, Sarah Thaler was my lab mentor, and Darcy Levee aided me in lab preparation and materials

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Lincoln L. Tran

**Project Number**
**S1322**

**Project Title**
## The Effect of UV Light on Algae Cells

**Abstract**

**Objectives/Goals**
To determine how different time exposures of UV light affect algae survival and growth.

**Methods/Materials**
Immediate effect of UV over time- The initial concentration of Chlorella algae was found using a hemacytometer. Six samples of algae were exposed for 0.5, 1.0, 2.5, 5.0, 7.5, and 10 minutes to UV using stratalinker and a sample with no UV exposure for control. The temperature changes from the exposure every 5 minutes was measured using a thermometer and were duplicated with another three samples. The number of cells that died from the temperature increase were counted using trypan blue to tell dead and live cells.
Growth of exposed algae over time- The initial concentration of the Chlorella algae culture were calculated using a hemacytometer. Six samples of algae were exposed for 0.5, 1.0, 2.5, 5.0, 7.5, and 10 minutes to UV and a sample with no UV a control. Grow for four days. Every two days, a 100 microliter sample of algae was collected and fixed in an equal volume of 100% ethanol. Cells then counted using a hemacytometer.

**Results**
More UV was directly related to # of immediate deaths of algae cells. Over the four-day growth period, the control (0 min) doubled its population for each of the two-day intervals. The 0.5 min sample showed no growth the first two days but did on the fourth day. The 1 min sample showed decline after the two days, with recovery after two more days. For the 5 min, 7.5 min, and 10 min samples, the populations declined for all four days . No algae cells died from the increased temperature.

**Conclusions/Discussion**
My experiments validated my hypothesis. The control (0 min) doubled its population for each of the two-day intervals. The 0.5 min sample showed no growth the first two days. Not certain whether it was because the cells died but grew back or if they didn#t die at all. On the second day, it grew, signifying that there was DNA repair. The 1 min sample showed a decline, indicating that mutation did occur but the population recovered. This may indicate that the algae population underwent cell repair. For the 5 min, 7.5 min, and 10 min samples, the populations experienced a downward decline in population, indicating irreversible DNA damage. The relatively small decrease in population during the first two days in these samples suggests that the mutated cells were able to survive and function in interphase, but died after trying to undergo cell reproduction.

**Summary Statement**
To determine how different time exposures of UV light affect algae survival and growth.

**Help Received**
Dr. Debra and Dr. Gardiner got algae+equipment, Khoi Le was UCI mentor, NCSF Focus Grant gave money

# CALIFORNIA STATE SCIENCE FAIR
## 2005 PROJECT SUMMARY

**Name(s)**
Chang Wang

**Project Number**
**S1323**

**Project Title**
# E. coli Promotion of Photosynthesis in Chloroplast: How Bacteria Benefit Farm Production

**Abstract**

**Objectives/Goals**
Photosynthesis plays a crucial role in plant growth, which has an irreplaceable position in ecosystem. This process in controlled by chloroplast. Studies on regulating factors for chloroplast are very important in agriculture production. In natural environment, E. coli has various interactions with plants, such as through fertilizers. E. coli also share many essential life molecules with chloroplast. However, direct effects of E. coli on photosynthesis is not understood. Here, a study on how E. coli affects the photosynthesis of chloroplasts is conducted.

**Methods/Materials**
First, culture E. coli and make E. coli solutions. Then, extract chloroplasts from spinach leaves and make chloroplast suspension. Third, prepare six cuvetts and add appropriate components as shown in the results. Control solution has all the components except E. coli. Three experimental solutions were prepared, each contains different concentrations of E. coli. Then use spectrophotometer to measure their photosynthetic rate as indicated by the light transmittance percentage every three minutes.

**Results**
Experimental results demonstrate that there is a clearly higher percentage of relative transmittance in chloroplast suspensions in the presence of E. coli; higher the E. coli concentration, the more photosynthesis in chloroplasts. This result is seen in both fresh chloroplasts and chloroplasts with low photosynthetic efficiency.

**Conclusions/Discussion**
E. coli enhanced the photosynthesis in normal and malfunctioned spinach chloroplasts. These effects might be related to the sharing nutrients of E. coli with chloroplasts, and to the anti-phototoxic effects of E. coli componts on the chloroplasts. This study highlights a possibility for further identification of the efficient components in the E. coli and the application of E. coli products to promote plant growth. This could result in increased agriculture production and improved the ecosystem in adverse environment, such as desert and daught areas.

**Summary Statement**
By activiating chloroplasts, E. coli is able to promote photosynthesis in plants, which in turn may benefit agricultural production in future.

**Help Received**
I used lab equipments at Poly High School under the supervision of Mr. Sutton. My parents helped me to arrange the posting.

# CALIFORNIA STATE SCIENCE FAIR
# 2005 PROJECT SUMMARY

**Name(s)**
Fan Yang

**Project Number**
**S1324**

**Project Title**
## Identification of Bacterial Adhesion Antagonists for Contact Lens and Intraocular Lens

**Abstract**

**Objectives/Goals**
The objective of this study is to develop the strategies and to identify anti-adhesion compounds using one-bead one-compound library approach.

**Methods/Materials**
The inhibition of bacterial adhesion by compound-library was assessed by (I) 3-day incubation of fluorescent labeled S. epidermidis, S. aureus and P. aeruginosa with one-bead one-compound library; anti-adhesion compound-beads were picked up and re-incubated with mixed S. epidermidis, S. aureus and P. aeruginosa again for 3 days; (II) decoding of the anti-adhesion compound-beads by Procise 494 Protein Sequencer; (III) evaluation of compounds# anti-adhesion properties on TentaGel lenses; (IV) re-synthesis of anti-adhesion compounds in soluble form to evaluate compounds# toxicities.

**Results**
Three compounds have been identified possessing anti-adhesion properties on TentaGel lenses for at least six days and they have no toxicity to bacteria and human blood cells.

**Conclusions/Discussion**
Our experiments demonstrate the feasibility for compound-grafting-biomaterial to prevent the bacterial adhesion and biofilm formation. Long-lasting anti-adhesion compound grafting lenses may be developed in the future to fight lens related infection. One-bead one-compound library approach and novel screening assays developed in this study can also be applied to detect anti-adhesion compounds for the prevention of medical device related infections.

**Summary Statement**
Three compounds have been identified possessing anti-bacterial adhesion properties on TentaGel lenses for at least six days.

**Help Received**
Xiaobing Wang, PhD: Synthesized the one-bead one-compound library; mass spectrometry analysis; tutor for the synthesis of the compounds on Tenta Gel and Rink resin and compounds purification using RP-HPLC.