# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Chris Ballard; Micky Einstein

**Project Number**
**J1301**

**Project Title**
## Bacteria Reaction to Antibacterial Soap

**Abstract**

**Objectives/Goals**
The hypothesis is that the bacteria will become resistant to the soap by the second generation. This hypothesis was formed because most germs have been gaining resistance to their attackers.

**Methods/Materials**
1. Swab hand with a cotton applicator.
2. Streak five different petri dishes with the applicator.
3. Incubate bacteria at 37 degrees Celsius.
4. Use one pipette per petri dish and remove a small amount of bacteria from each. Place it in the tryptic soy broth.
5. Incubate the broth at 37 degrees Celsius until cloudy (usually completed in twenty-four hours).
6. Dip cotton applicator in bacteria and streak on five plates.
7. Make and place the different soap disks on all of the different plates.
8. Incubate until grown.
9. Measure the diameter of the circle around soap disk.
10. Repeat steps four through nine until fourth generation of bacteria has been recorded.

**Results**
The bacteria did gain resistance over time, therefore, our hypothesis was correct. The soap that displayed the most resistance gain was Dial. The second generation of Dial also had resistant bacteria growing within the circle where no bacteria grows.

**Conclusions/Discussion**
This experiment shows that bacteria gains resistance to anti-bacterial soap. Therefore, it is best to wash the hands with regular soap for at lest 60 seconds. This experiment is valid and repeatable. Next time this experiment is done it should be done while monitored. The amount of soap on the disks has to be measured to make this experiment more valid. This experiment must also be done inside at the same place each time. The anti-bacerial soaps are not as effective in killing the bacteria as expected.

**Summary Statement**
The main motive is to see if bacteria becomes more resistant over time to anti-bacterial soap and which soap is most effective.

**Help Received**
Lab Technician in Mom's office. Showed us technique of culturing bacteria.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Gwyneth Lynn Baynham

**Project Number**
**J1302**

**Project Title**
## Always Be Clean: Decreased Germs = Increased Attendance

**Abstract**

**Objectives/Goals**
The objective is to determine if the use of a hand sanitizer three times per day by students results in the decreased the spread of communicable illnesses in classrooms, resulting in decreased student absenteeism due to illnesses.

**Methods/Materials**
One classroom participated as an #experimental group# and two classrooms were used as blind control groups. All classrooms were from the same school and represent similar socio-economic groups. The experimental group used a non-alcohol hand sanitizer three times per day, prior to times when they traditionally ate. At the end of 38 calendar days the absences from the experimental group and control groups were tallied. An absence was counted only if it was for an acute illness. The rate of absenteeism was compared between the experimental and control groups

**Results**
The experimental group had a much lower absentee rate when compared to the control groups. The absentee rate for the Experimental Group was 1%. Control Group 1 had an absentee rate of 2.4% and Control Group 2 had a rate of 4%. In comparison, the Experimental Group had 59% less absentees than Control Group 1 and 75% less absentees than Control Group 2. The use of the hand sanitizer was well accepted by both the students and the teacher.

**Conclusions/Discussion**
The use of hand sanitizer decreased absentees an average of 67%. The results are similar to classroom studies conducted by Woodward Laboratories, their studies showed a decrease of 33% of absentees.

**Summary Statement**
My project is about preventing the spread of communicable diseases in classrooms by the use of a hand sanitizer resulting in decreased illness and the reduction of absences due to this intervention.

**Help Received**
My mother helped define topic, type and edit. Woodward Laboratories provided technical assistance and donated the hand sanitizer. Mrs. Kutz, the teacher of the experimental group, assisted by participating and making sure her students used the hand sanitizer at the appropriate times each day.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Alexandra J. Berger

**Project Number**
**J1303**

**Project Title**
## Biophotolysis in Various Bacterial and Algal Cultures

**Abstract**

**Objectives/Goals**
I determined which microorganisms most efficiently produce hydrogen through biophotolysis (the microbial production of hydrogen): photosynthetic bacteria from the soil or natural water, Anabaena sp. of cyanobacteria, or Chlamydomonas reinhardtii sp. of Eukaryotic Algae. I believe the photosynthetic bacteria from the soil are the most effective hydrogen producers.

**Methods/Materials**
I made a medium for growing the photosynthetic bacteria from the soil and natural water by combining water, fruit, monosodium glutamate, and bicarbonate. To measure hydrogen, I used the gas-collection method with a pneumatic trough with water and a metal tray inside with an inverted graduated cylinder filled with water. I put microorganisms in vials and inserted rubber stoppers so that there was no air. A piece of glass tubing attached to a piece of rubber tubing was placed in a hole in the stopper. This tubing went into one of the graduated cylinders. I observed the amount of water displaced for a 120-hour period. I tested for hydrogen by lighting a wooden split and I holding the splint near the end of the glass tubing. If the fire flared up, hydrogen was present.

**Results**
The Anabaena sp. and Chlamydomonas reinhardtii sp. produced an average of 0 ml. of hydrogen after 120 hours. After 120 hours, the photosynthetic bacteria from the soil had produced an average of 19.75 ml. of hydrogen with a standard deviation of 1.8 ml. After 120 hours, the photosynthetic bacteria from the natural water produced an average of 9.25 ml. of hydrogen with a standard deviation of 0.886 ml.

**Conclusions/Discussion**
My hypothesis was correct, photosynthetic bacteria in the soil are the most effective hydrogen producers. Hydrogen fuel cells are beneficial to our environment because the only byproduct of them is water. The problem with fuel cells is that hydrogen is not found pure naturally. Because of this, it has to be created. The popular way to create hydrogen is to split water molecules into 2 hydrogen atoms and an oxygen atom, but it takes a lot of energy and the energy is usually created from fossil fuels. This defeats the purpose of using hydrogen fuel cells. The only other method of creating pure hydrogen for fuel cells is through biophotolysis. This method is safe and inexpensive. My project was created to help with the process of determining which type of microorganisms should be used in order for this method to become reality.

**Summary Statement**
My project is about the efficiency of biophotolysis in microorganisms.

**Help Received**
none

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Kelsey L. Capron

**Project Number**
**J1304**

**Project Title**
## Natural Antibiotics vs. Pharmaceutical Antibiotics

**Abstract**

**Objectives/Goals**
My objective was to learn if natural antibiotics or pharmaceutical antibiotics are more effective on slowing bacteria growth.

**Methods/Materials**
I cultured bacteria from my mouth, then measured and compared the zones of inhibion of natural and pharmaceutical antibiotics.
I used 5 different natural antibiotics: Usnea, garlic, onion, white sage, and osha.
I used 5 different pharmaceutical antibiotics: Ampicillin, erythromyacin, neomycin, streptomycin, tetracycline, and kanamycin.

**Results**
Pharmaceutical antibiotics worked more consistantly than natural antibiotics, however, garlic averaged the widest zones of inhibion. Although garlic averaged the widest zone of inhibion (1.58 cm.), ampicillin and tetracycline were very close (1.47 cm.)

**Conclusions/Discussion**
My conclusion is that pharmaceutical antibiotics are more reliable, therefor more useful.

**Summary Statement**
I tested natural antibiotics against pharmaceutical antibiotics to find out which is more effective on reducing the growth of bacteria.

**Help Received**
Father helped make incubator; father gave advice on graphs.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Alexa C. Dell

**Project Number**
**J1305**

**Project Title**
## Do Sponges Clean or Spread Bacteria?

**Abstract**

**Objectives/Goals**
To determine the amount of bacteria in a kitchen sponge, and if using them spreads bacteria. If so, can they, and how often should they, be sanitized.

**Methods/Materials**
Three different sponges were cultured after being used for one, two, and three weeks for regular kitchen use. (Used for scrapping dirty dishes, for cleaning dishes in soapy water, and for wiping coutertops.) The cultured agar plates were placed in an incubator and checked at 24 and 48 hours. After determining which created a more bacteria-free countertop (bleach, Soft Scrub, or Lysol Anti-bacterial Kitchen Cleaner) each sponge was used on the countertop, and the countertop was then cultured, incubated and checked at 24 and 48 hours. The three week sponge was then cut into four pieces and each piece was used to determine the best method to reduce the amount of bacteria in the sponge: microwave, dishwasher, clothes washer, or bleach/water soak. These were also cultured, incubated and checked at 24 and 48 hours.

**Results**
The kitchen sponge quickly builds up a large amount of bacteria such as Salmonella, E. Coli, Bacillus, Listeria, Staphylococci, and Streptococci. The one, two, and three week sponges all contained large amounts of bacteria. The cultures proved that the sponge does spread bacteria. Soaking the sponge for five minutes in bleach proved to be the best way to reduce the amount of bacteria, and bleach was also the best countertop cleaner. The microwave proved to be a quick easy way to reduce the bacteria in a sponge.

**Conclusions/Discussion**
My results did support my hypothesis, kitchen sponges do harbor bacteria, and can spread bacteria. Information from this project is valuable for everyone to know. Care must be taken in order to prevent food poisening. There is also the possibility of a bacterial infection through an open wound. Precautions should be taken to help limit the amount of bacteria in the home and workplace.

**Summary Statement**
The bacteria sponges contain and spread, and how to limit them.

**Help Received**
Used the incubator at Santa Barbara Cottage Hospital.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Kaysie A. Ellingson

**Project Number**
**J1306**

**Project Title**
# Finish Your Medicine: Will Diluted Amounts of Ampicillin Be Effective in Killing Eschericia coli Bacteria?

**Abstract**

**Objectives/Goals**
The objective is to determine is diluted ampicillin will be effective in killing Eschericia coli and to see if E. coli would become resistant to the ampicillin when exposed several times to the diluted amounts.

**Methods/Materials**
A 1:10 serial dilution of Ampicillin was done and mixed with agar. Each plate was streaked with E. coli. The resistant colonies were observed after 24 hours. More tests were done using serial dilutions of ampicillin. 0.1ml of E. coli was added to each dilution and grown in tryptic soy broth for 24 hours. Each dilution was plated and incubated 24 hours. The resistant colonies were counted and analyzed.

**Results**
The first test proved that E. coli was very resistant to Ampicillin that was diluted 10(-8), 10(-6), and 10(-4). Masses of colonies of bacteria were observed growing on the dishes. To improve this project, a different method of testing was done. The results of the second tests proved that each dilution (1:2, 1:4) was effective in killing the E. coli. Every dilution after that was ineffective in killing the bacteria. The same experiment was repeated. This time 2 colonies of bacteria were found growing in the agar that was plated with a dilution of 1:4. An isolated colony of bacteria from the 1:4 dilution was used in the third test. After 24 hours bacteria had grown in the 1:2 dilution the E. coli bacteria had become resistant to the known working concentration.

**Conclusions/Discussion**
The theory that antibiotics may become ineffective against bacteria if they are not taken as prescribed by a doctor prompted this experiment. diluted Ampicillin has little effect in killing E. coli bacteria. It is known that the working concentration of Ampicillin is 1/500ml dilution. The hypothesis was proven to be wrong; a lesser amount using 10(-8), 10(-6), and 10(-4) dilution was ineffective in killing the E. coli bacteria. In each of the tests the bacteria were very hardy. Further testin gproved that the known working concentration was effective in killing E. coli, and the next concentration 1:4 was also effecive. However, when exposing resistant bacteria to the ampicillin again, the bacteria grew even more resistant - growing on the petri dish that contained the known working concentration of ampicillin. Further testing needs to be done to verify these results.

**Summary Statement**
This project tested the effectiveness of diluted amounts of ampicillin against E. coli bacteria to determine if the bacteria become more resistant when exposed to low levels of antibiotic.

**Help Received**
I received direction for tests from microbiologist, Raydolfo Aprecio at Loma Linda University, borrowed pipette from Loma Linda University. My dad took pictures of petri dishes on his digital camera. My mom helped type some of my project, drove me to Loma Linda University to pick up materials.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

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

**Project Number**
**J1307**

**Project Title**
## Overexposed: Ultraviolet Light and Its Effect on Algae

**Abstract**

**Objectives/Goals**
The purpose of this project was to discover the relationship between ultraviolet light and the percentage of growth of Chlorella algae. I hypothesized that the more ultraviolet light the algae was exposed to, the lower the growth rate would be and the change would be linear.

**Methods/Materials**
Ten petri dishes were filled with a Chlorella algae solution. Slides were prepared before exposure and the number of algae cells were counted under a microscope. Two petri dishes each were exposed to zero, one, five, ten, and fifteen minutes of ultraviolet light from a short wave lamp. Cells were counted and the dishes were exposed for each of the five days following. The entire experiment was repeated. The growth rate in percentages was calculated for each sample.

**Results**
The control samples showed almost uninhibited growth to about 450% of the original cell count on the final day. The one minute samples were inhibited but continued to grow to about 300%. Both the five and ten minute samples showed little growth or decrease, averaging about 140% on the final day. The fifteen minute sample decreased considerably in algae cells to about 30%.

**Conclusions/Discussion**
The algae that received ultraviolet light exposure had a decreased growth rate. However, the decrease was not linear nor inversely proportional to the amount of UV exposure. There are damage repair mechanisms in algae that can fix damage in DNA caused by exposure to ultraviolet light. I believe that somewhere between the ten and fifteen minute exposure levels, there was a critical amount of exposure where the damage repair mechanisms were so overwhelmed that the growth rate considerably declined.

**Summary Statement**
I compared growth rates of algae that was exposed to controlled levels of ultraviolet light to algae that was not exposed to any ultraviolet light.

**Help Received**
Safety gear, light source, and microscope borrowed from Colin Matheson, my science teacher. Mother took some pictures.Sunny LeMoine, my English teacher, helped grammatically edit background research and conclusions.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Daniel P. Ferons

**Project Number**
**J1308**

**Project Title**
## How Clean Are the Tops of Soda Cans?

**Abstract**

**Objectives/Goals**
If I buy a soda at school, what is the most effective way to clean the top of the can before drinking the soda?

**Methods/Materials**
I bought four cans of soda from the cafeteria and four cans from the soda machine at school. From each group, one can was not cleaned, one was wiped with my t-shirt, one was rinsed with water and dried with a paper towel and one was washed with soap and water. A sterile q-tip was used to take a sample from each can and put on a petri dish. The samples were incubated to see if bacteria was present. I checked them for four days and counted the bacteria colonies growing each day.

**Results**
The reults were the cans that were not cleaned grew the most bacteria colonies. The cans that were cleaned grew fewer colonies. The caferteria can cleaned with a t-shirt had the fewest bacteria colonies for that group. The vending machine can that was washed with soap and water was the cleanest for that group.

**Conclusions/Discussion**
Tops of un-cleaned cans grew the most bacteria colonies. All types of cleaning a studnet can do at school were successful in reducing bacteria growth. Soda cans should be at least wiped off before you drink out of them.

**Summary Statement**
Soda cans should be cleaned before you drink out of the can.

**Help Received**
Santa Margarita Water District Lab provided petri dishes, a portable incubator and other items along with explaining how to use them.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Heghineh Galstian

**Project Number**
**J1309**

**Project Title**
## Do Bactericides Affect the Growth of E. coli and Streptococcus lactis Bacteria?

**Abstract**

**Objectives/Goals**
The project will test if bacteria prone to variables such as Lactose Agar, Nutrient Agar and plates containing Ampicillin. The bacteria would either die or continue to grow, showing that the bacteria are resistant to that certain bactericide.

**Methods/Materials**
E.Coli and Streptococcus Lactis Bacteria are inoculated in Lactose Agar, Nutrient Agar and plates containing Ampicillin. Bactericides such as Isopropyl Alcohol, Hydrogen Peroxide, Bleach, Mouthwash, Iodine, Disinfectant disk and Antibiotic Disk were given to each bacteria species. After 48 hours, plates were checked for inhibition and measured.

**Results**
In result antibiotics affect the growth of bacteria in different ways. The most affective bactericides were disinfectant disk and bleach. Bleach kills all bacteria found on Earth that is known. Cross contamination may be a reasonable explanation of not so accurate results. The sterile section, the control, may have inhibition because of other bactericides in the other sections that were strong enough to reach to section 1.

**Conclusions/Discussion**
In conclusion bactericides do not affect the same way to the same bacteria. Bacteria were resistant to some of the bactericides. Many considerations were taken to keep the plates clean from other bacteria found in the air. Bactericides are used for different purposes and are very helpful in many things in life. In the future, new bactericides will be made to prevent bacteria growth, which are resistant to bactericides.

**Summary Statement**
E. Coli and Streptococcus Lactis bacteria are tested with different antibiotics to see if the bactericides affect the growth of the different bacteria species.

**Help Received**

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Krystine M. Gonzalez

**Project Number**
**J1310**

**Project Title**
## Mouth Funk?

**Abstract**

**Objectives/Goals**
My problem was which mouth wash will kill streptococcus salivarious. My hypothesis was that scope mouthwash would kill the most streptococcus salivarious. Scope has an active ingredient called cetylpyridinium chloride anti-plaque agent with bactericidal activity. This is why I think scope will kill the most streptococcus salivarious.

**Methods/Materials**
I inoculated streptococcus salivarious on to sterile petri dish with nutrient agar. Dipped sterile blank disk into one of the six mouthwashes I am testing. Put blank sterile disk containing mouthwash on petri dish (two sterile disks per dish). Then I incubated dishes for 24 hours at 34 degrees celsius.

**Results**
The best working mouthwash was mountain breeze reducing a total average of .25 centimeters of streptococcus salivarious. Then came scope reducing .24 centimeters, rite aid reducing .15 centimeters, equate reducing .09 centimeters, and last cogate phosflur and listerine reducing .05 centimeters average.

**Conclusions/Discussion**
Out of the six mouthwashes that were tested the largest zone of inhibition was mountain breeze, second was scope, third was rite aid, fourth was equate, listerine and colgate phosflur were tied for fifth. My hypothesis was wrong, mountain breeze has a larger zone of inhibition because of more effective ingerdients. Mountain breeze has two active ingredients one is peroxide and the other is cetylpyridinium chloride which are both antiplaque agents with bacteriacidal. This is why mountain breeze was the most effevtive mouthwash by killin streptococcus salvarious.

**Summary Statement**
This project is about which mouthwash is most effective against streptococcus salivarious (a floral mouth bacteria).

**Help Received**
I received help from Mr. Ed McCarthy whom watched over me while conducting my experiment. Also my mom and grandmom for helping me build my board.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
E. Jayne Gustafson

**Project Number**
**J1311**

**Project Title**
## Do Dogs, Cats, or Humans Have the Most Bacteria in Their Mouths?

**Abstract**

**Objectives/Goals**
The objective of this study was to determine if dogs, cats, or humans have the most bacteria in their mouth. Dogs put their mouths in places where cats and humans would not. Therefore, dogs should have the most bacteria in their mouth.

**Methods/Materials**
To answer this question, saliva samples were collected from the mouths of 10 cats, 10 dogs, and 10 human subjects using clean cotton swabs or Q-tips. Each sample was then placed on a section of one of ten nutrient-dishes, each pre-marked with a section for a sample from a cat, a dog, a human, and a control with no sample. The nutrient dishes were stored in a dry, dark place for 9 days. The number of bacteria colonies in each of the four sections of each of the 10 nutrient dishes were counted and recorded every 3 days for a total of nine days.

**Results**
For each animal the number of colonies varied greatly. Dogs had an average of 53 bacteria colonies grow in the nutrient dish, cats had an average of 16 colonies, and humans had an average of 5 colonies. There were two dishes where the human had more bacteria than the cat and in some cases no bacteria grew.

**Conclusions/Discussion**
The data supported the hypothesis that dogs would have the most bacteria in their mouths. This is likely the case because humans brush their teeth daily but dogs and cats rarely get their teeth cleaned. Also, the number of colonies could have varied if the animal had just eaten. A cat#s mouth would have more bacteria if they had just had something to eat, but cleaner if they just had something to drink. However, most important is the fact that dogs will eat just about anything. Can you believe that some people like to have their dogs lick their mouth and they don#t even wash it off afterwards?

**Summary Statement**
Bacteria growth in saliva samples from the mouth of 10 cats, 10 dogs, and 10 human subjects placed in nutrient-dishes was measured to see if dogs, cats, or humans have the most bacteria in their mouth.

**Help Received**
Mrs. Zemke provided nutrient dishes. Father helped format data plot and transfer digital photographs to the written report.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Denali Halsey; Alice Rosenthal

**Project Number**
**J1312**

**Project Title**
# The Effect of Different Substances on How Many Bacteria Colonies They Create in Your Saliva

**Abstract**

**Objectives/Goals**
The purpose of our experiment was to find out which substance created the most bacteria in your saliva. We used sugars, salts,and fats.

**Methods/Materials**
There were only two test subjects in this experiment, as we didn't have enough money or equitment to expand out test pool. Both my self and Alice were the test subjects. The following is a condensed version of how we completed our tests. After our agar media was made, we put the dishes in the autoclave to ensusre that no contamination was on the media to make sure the agar was pure. Next we cleaned our our mouths with toothpaste and innoculated six petri dishes with just saliva, no substance(three tests per subject per substance). This was repeated with the different substances. Once all 24 plates were innoculated, we incubated them at 30 degrees cenigrate for 48 hours. We then compaired (by counting bacteria colonies in randon squares if the colonies were too numerous to count for the entire dish) bacteria colonies, in the petri dish, and averaged the bacteria counts for each substance per person. We also compared all six of the substances tested against each other to come to our final result.

**Results**
In our results, the substance salt produced the most bacteria for Alice, for Denali, sugar created the most bacteria. Combined together, butter produced the most bacteria.

**Conclusions/Discussion**
We concuded that just like all animals, bacteria adapt to their surroundings. So the bacteria in one persons mouth is different from bacteria in another person's mouth, just like fingerprints. Bacteria might different in other's mouth because of different dietary habits, the temperature in your mouth might be slightly higher than in another person's mouth, and brushing habits might be different.
Another thing we determined from this project was that there is one "bad" bacteria in your mouth called Streptous mutants or S. mutants which thrives on refined sugar. Most of the other bacteria in your mouth receive calories and sugar from the food that goes into your mouth. That is why we got butter (our fat)with the highest counts because it not only contains alot of calories,it also contains milk which is not a base or acid and being neutral we believe thats why butter had the highest average of colonies and no other counts were very close to the butter tests. We determined that butter most likely does not negatively or positivly affect the growth of bacteria cells.

**Summary Statement**
The purpose of our experiment was to find out which substance out of sugar, salt, and butter creats the most bacteria in your saliva.

**Help Received**
Mother helped get board, David Perez at Monterey health dept. helped make agar, Granite Canyon lab. used to incubate petri dishes.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Hannah Hays

**Project Number**
**J1313**

**Project Title**
## Which Is Cleaner, Dog Spit or Human Spit?

**Abstract**

**Objectives/Goals**
This science fair project is to determine if dog spit is cleaner than human spit. I have always been interested to find the answer because I kiss my dog and my parents hate this.

**Methods/Materials**
My experiment consisted of culturing my dog's and my saliva. I performed my experiment a total of six times utilizing rubber gloves, sterile swabs and innoculating loops, culture plates and an incubator. The cultures were grown aerobically and the results were read at 48 hours and the results were compared.

**Results**
The first three cultures showed that we each grew Streptococcus and Staphylococcus although I had a heavier growth of each organism. The second set of cultures showed that we each grew >100 of normal flora although my dog had more normal growth.

**Conclusions/Discussion**
My conclusion, through my background research and experimental results, tends to support my hypothesis that dog mouths are cleaner than human mouths. The tests were not strongly conclusive, however, and further testing would be good. I now see why laboratories and companies perform MANY experiments.

**Summary Statement**
This project is to determine which is cleaner: dog spit or human spit.

**Help Received**
Mother helped type report; Used incubator at Modoc Medical Center Lab under supervision of Larry Manzer , MS, CLS, and he interpreted the culture results; Father drove me to District Science Fair and Mrs. Sally Clark, my science teacher, for her expertise and guidance and lastly to my dog, Ruger.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Jonathan T.S. Hoh

**Project Number**
**J1314**

**Project Title**
## Can an Algae Sprial be Used to Promote a Mass Growth of Chlorella Algae?

**Abstract**

**Objectives/Goals**
The purpose of this experiment was to find out what effect a chosen fertilizer concentration in a coil of tubing would have on the growth of algae. Phosphates, often found in detergents and fertilizer would help promote growth to algae. Too much of it could cause the algae to die, but just the right amount diluted could be extra food for the algae and promote growth.

**Methods/Materials**
Information gathered from a previous series of experiments was used to determine the best concentration for the system. This year is the second phase in experiments where tubing was wrapped in a circular pattern and tied onto a mat for support. Algae and the concentration of fertilizer were added in the coil with a light source in the center. Using calculations, it was increased in proportion in a larger system than a petri dish.

**Results**
Using these techniques, algae approximately doubled in growth daily compared to a petri dish method with the same dilution that took a week to double. What caused algae to die was direct exposure to sunlight (overheating) and the shredding of algae because of a too powerful pump motor. Repeating the experiments using the motor for about ten seconds two times a day, the algae were not shredded.

**Conclusions/Discussion**
A mass growth of Chlorella algae can be grown with a fertilizer concentration of 1:128, which was determined from testing as the best concentration to stimulate growth. The results show algae grew best with the 1:128 serial dilution and gentle circulation of nutrients. With such a design, algae doubled in amount daily while it took a whole week for the same concentration in a petri dish to grow. These experimental findings also demonstrate that algae cannot withstand extreme heat and can die from being shredded by spinning blades of a pump. The right dilution of fertilizer and limited circulation through the algae spiral promoted algae growth far better than a stationary system.

If the concentration of fertilizer is known, using calculations, the size of the growing system can be increased far larger than a petri dish. This has practical applications for growing algae in large quantity for food products.

**Summary Statement**
Optimal concentration of fertilizer determined and used in closed spiral to cause double growth/day.

**Help Received**
Supplies and equipment purchased by Dad. Helped with construction. Science teacher advised.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
D. Clifton Huang

**Project Number**
**J1315**

**Project Title**
## Spice Aromatherapy

**Abstract**

**Objectives/Goals**
My objective is to determine if pungent smelling spices contain subtances that can be carried in their vapors that can inhibit bacterial growth.

**Methods/Materials**
1.8 agar plates are swabbed with S. marcescens.
2.8 agar plates are swabbed with B. subtilis.
3.Crush each of the 7 variables: cinnamon, clove, garlic, horseradish, ginger,jalapeno chili pepper,and black pepper.
4.Invert all the plates so that the agar would now be on top and the lid would be on the bottom.
5.Place 20 grams each of the variable on the lid of one S. marcescens plate and one B. subtilis plate.
6.Record bacterial growth at 24 hours, 48 hours, and 72 hours.

**Results**
Trial 1: There was prominent bacterial growth on the control and chili pepper plates after 48 hours and no bacterial growth on the horseradish, ginger, clove and cinnamon plates. Black pepper slows bacterial growth but does not stop it. Garlic stops the growth of S. marcescens but not B. Subtilis.
Trial 2: The experiment failed because the week old sample bacteria had died. The lids on the test tubes were in too tight and did not allow air to enter. As these are aerobic bacteria, they needed oxygen to survive.

**Conclusions/Discussion**
Since ancient times, spices has been used medicinally by many different cultures to ward off diseases. It has been applied topically, ingested, hung around the house or worn as a necklace. My experiment proves that certain pungent smelling spices contain antibacterial substances that are also carried in their vapors. Ginger, clove, cinnamon and garlic have potent antibacterial vapors. Garlic vapors are potent on some bacteria only. Black pepper vapors has antibacterial properties but not strong enough to stop it.

**Summary Statement**
My project is to find out if the vapors of pungent smelling spices like clove, cinammon, garlic, horseradish, ginger, jalapen chili pepper, and black pepper can stop bacterial growth.

**Help Received**
Mr Hobbs, my science teacher and Mr Hughes, my English teacher helped me organize my thoughts and project. My parents funded my experiment.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Kavonna M. Jackson

**Project Number**
**J1316**

**Project Title**
## Would You Like Sugar with That?

**Abstract**

**Objectives/Goals**
My objective was to learn if a high concentration of dextrose solution is detrimental to the growth of the bacteria Serratia Marcescens.

**Methods/Materials**
Twenty sterile agar filled petri dishes were swabbed with the Serratia Marcescens bacteria. Then sterile disks were saturated in zero to twenty grams of the dextrose solution. The disks were then placed on the bacteria. Next, the bacteria was incubated at thirty-seven degrees Celsius for two days. The results were studied and noted. A dillution of 1/10mm followed this, which was plated in sterile agar filled petri dishes. Lastly, the dishes were incubated for two days at thirty-seven degrees Celsius. The results were studied and noted.

**Results**
The control and the bacteria with five to fifteen grams dextrose solution were uncountable. The bacteria with twenty grams dextrose solution grew about 300 colonies, which was a lot less than the others.

**Conclusions/Discussion**
The results supported my hypothesis in saying that the highest concentration of dextrose is detrimental to the growth of the Serratia Marcescens.

**Summary Statement**
My project researches and test to see how different concentrations of dextrose solution effect the growth of the bacteria Serratia Marcescens.

**Help Received**
Mr. McCarthy helped me to structure my project and supervised my experiment. He also let me use his incubator to incubate the bacteria.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Olivia R. Jackson

**Project Number**
**J1317**

**Project Title**
## Algal Affairs

**Abstract**

**Objectives/Goals**
The objective of my experiment was to determine whether heat has an effect on the growth of algae. I hypothesized that warmer temperatures would cause more algae to grow in both freshwater and saltwater samples.

**Methods/Materials**
I did this by filling eight buckets with a liter of saltwater and eight with a liter of freshwater. Four freshwater and four saltwater buckets were placed inside on heating pads, and the rest were kept outside. Every day for seven days, I measured the temperature and the amount of algae in each bucket, and took photographs. To measure the amount of algae, I used a multimeter, a photo resistor, and a laser.

**Results**
I found that the highest growth rates occurred in warmer temperatures for freshwater algae and in colder temperatures for saltwater algae.

**Conclusions/Discussion**
My hypothesis was proven partially correct, algae in freshwater samples did grow more in a warmer environment. Saltwater algae, however, grew better in colder temperatures. One thing that could have caused this difference is the fact that lakes are constantly changing temperatures, so freshwater algae would be more adapted to varying temperature. Oceans, though, because of there size, have almost the same temperature all of the time. Algae from this source wouldn't be as used to different temperatures.

**Summary Statement**
My project is about the effects of temperature on algal growth rates in freshwater and saltwater samples.

**Help Received**
My dad, mom, or little brother held the flashlight for me each night, my dad drove me to get the water for the experiment, and I consulted George I. Matsumoto and Johnathon Friedman via telephone and e-mail.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Nathan H. Kandus

**Project Number**
**J1318**

**Project Title**
## Koch's Postulate: Orange Ya' Glad We Have Penicillin?

**Abstract**

**Objectives/Goals**
The purpose of my science project was to see if different fruit grew the mould of penicillin different, using the method designed by Robert Koch. The reason I did this was because I was interested to see if a disease was carried by different hosts, if it would mutate or adapt to better fit the environment.

**Methods/Materials**
Materials:6 oranges, 3 lemons,3 limes, 1 vile of penicillin, pitri dishes, agar, toothpicks, cotton swabs, bags, twist ties
Procedures: 1.Make a wound on two of the oranges; 2.Using a cotton swab, infect those two oranges with the penicillin mould from the vile. This will be called series 1; 3.Wait four days and record observations of infected fruit; 4.With a cotton swab, apply some of the mould from the oranges on a pitri dish; 5.Wait two days and observe the pitri dish; 6.Repeat step two using the mould from the pitri dish with two oranges, two lemons and two limes. This will be called series 2; 7.Wait two days and observe infected fruit; 8.Using the fruit you infected two days ago, repeat step four ; 9.Two days later, observe pitri dish, and compare two first pitri dish.

**Results**
I found that when penicillin grew on different fruits, the colonies looked about the same, but the amount of mould was the main thing that varied. I found that when you grew mould on oranges, it grew more mould than limes, and the limes grew more than the lemons. I also experimented of sprayed fruit. The lemons colonies shot up higher than any other fruit. Limes grew the second most, and the oranges grew the least.

**Conclusions/Discussion**
The fruits all grew the mould differently. This told me that the chemical composition must be different in all of these fruits, and that is why the penicillin grew differently. Almost all of the sprayed fruit did not grow mould well. However, the lemon grew the mould better when it was sprayed. The explanation I could think of for this was that the pesticides reacted with the lemons chemical properties to turn it into an ideal habitat for mould to grow. This proved that pesticides could stunt growth. If the orange and the human body reacted the same way, pesticides might be able to fight off diseases or they might also kill the bacteria that our body needs to survive. The lime showed a decrease in colonies, but the mould covered .5% larger area. I maybe the mould that did manage to survive had less competition, so it was able to make the individual colonies bigger.

**Summary Statement**
The effects of different environmentson a pathogen.

**Help Received**
Mr, Pembleton, for helping me get the penicillin.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Kaitlin A. Kaufmann

**Project Number**
**J1319**

**Project Title**
# Is the Temperature of Inactivation Different for Each Type of Phage?

**Abstract**

**Objectives/Goals**
The objective is to determine if temperature of inactivation is different for each type of bacteriophage. I believe this could be used as an easy field test to identify phage from field samples.

**Methods/Materials**
Dr. Cynthia Eayre, Research Plant Pathologist for USDA-ARS, and University of California, Davis provided phage samples. Crown Gall Bacteria (Agrobacterium spp.) was cultured by Dr. Eayre for my host. Research for a biological control for this economically harmful bacteria is being conducted due to the phase out of the soil fumigant Methyl Bromide. 40 phage samples have been screened for activity on Agrobacterium, but have not been specifically identified or classified. I used 4 of these with proven activity on the host. I prepared plates with pseudomonas agar, then a plaque of the host in a sloppy agar. I used a heat block to heat the 4 phage in water. Using a pipette I applied drops of phage onto the prepared plates starting at 30ºC and repeating at 5º increments. Each replication was a series of 5 temps (spread of 25º) and a control. 24-48 hours later I evaluated the results of the control of the bacteria. I repeated the process, increasing the temp range until all 4 phage inactivated. I repeated the inactivation levels a second time to confirm

**Results**
Each phage was repeatedly tested by Dr. Eayre for activity on Agrobacterium. By testing the activity on this host until a temperature was achieved with no activity I was able to determine the temperature of inactivation. The results show a different temperature for each phage used. Phage 1 unstable at 70ºC and inactivated at 75ºC; Phage 2 unstable at 50ºC and inactivated at 70ºC; Phage 3 unstable at 80ºC with inactivation at 90ºC; Phage 4 unstable at 85ºC with activity still present above 95ºC.

**Conclusions/Discussion**
Each phage sample did have a different temperature threshold. These tests supported my hypothesis of a different temperature of inactivation for each type of phage. Further identifying the phage through traditional methods will provide confirmation of my results. This test can be a very valuable tool in the bacteriophage work being done in many disciplines of research. A fast, inexpensive test to identify phage in field samples could provide valuable information early in work to being done to find cures for diseases around the world.

**Summary Statement**
To see if temperature of inactivation can be used to identify bacteriophage.

**Help Received**
Used lab facilities at USDA-ARS Research Station under the supervision of Dr. Cynthia Eayre.

# CALIFORNIA STATE SCIENCE FAIR
# 2002 PROJECT SUMMARY

**Name(s)**
David Kepner; Michael Kezian

**Project Number**
**J1320**

**Project Title**
## Effect of Preservatives on Meat

**Abstract**

**Objectives/Goals**
The purpose of our experiment is to add certain preservatives to meat, and analyze at differing times whether they will inhibit bacterial growth on the meat.

**Methods/Materials**
Preservative of curry paste, garlic, tobacco paste, salt, sugar, mayonnaise, and the control, sterile distilled water, was evenly spread on the surface meat and incubated at room temperature for intervals of 12, 24, and 48 hours.
Bacterial colony forming units, CFU, was measured using two different techniques; A. direct swab of sample, and B. 1- hour enriching broth and plating.
Zone of inhibition tests were completed.

**Results**
The results revealed preservative samples of garlic, tobacco, salt and sugar had the highest degree of inhibition of bacterial growth.
Curry powder had the most amount of bacterial growth. The 3 trials showed very consistent and reproducible results. The longer meat was left out at room temperature, the larger the number of bacterial colonies formed.
The meat sample treated with salt showed the least amount of bacterial growth.

**Conclusions/Discussion**
Direct swab technique and enhanced inoculation technique yielded similar and consistent bacterial inhibition results for the garlic, tobacco and salt samples.
Salt acted as the best preservative with the least amount of bacterial growth, while the curry powder proved to be the worst.
The turbidity of the inoculated sample tubes were also consistent with the agar plating method.
The zone of inhibition study also depicted the salt sample as having the largest zone of inhibition of 2.0 cm versus the control of 0.0 cm .
The results of the study also supported the second part of our hypothesis that keeping meat at room temperature longer drastically increased the bacterial growth on the meat.
The salt samples inhibited the bacterial growth by altering the water balance of the bacterial cell and its environment. The salt preservative dehydrated the bacterial colonies it contacted.
Curry sample exhibited the highest degree of bacterial colonization at all time intervals. The curry sample may have a microbial enhancing effect when added to meats and left our at room temperature.

**Summary Statement**
Our experiment involved the scientific method of microbiological analysis of bacterial inhibition of preservatives on meat.

**Help Received**
Thanks to Mrs O#Hanlon with graphic and creative layout, Mrs Kezian with report organization, Dr. Kezian for science advise, Hardee Medical Supply for technical support, Mr. Rodriguez for teaching me Microsoft Powerpoint.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Emily A. Koch

**Project Number**
**J1321**

**Project Title**
## Garlic and Bacterial Inhibition

**Abstract**

**Objectives/Goals**
The objective of my project is to determine if garlic (Allium sativum) inhibits bacteria such as Bacillus subtilis, and, if so, how does its effectiveness compare to pharmaceutical antibiotics and disinfectants.

**Methods/Materials**
I prepared 30 nutrient agar petri dishes and divided them into six groups of five dishes. I seeded each petri dish with a broth of Bacillus subtilis. I then placed sterile paper discs in each petri dish. In the first group, I placed three discs which contained penicillin. Streptomycin discs went into group two, tetracycline discs in group three, glutaraldehyde discs in group four, phenol (5%) alcohol discs in group five, and raw garlic saturated discs in group six. I incubated all the petri dishes for 48 hours and calculated the percentages of the zones of bacterial inhibition.

**Results**
I determined that streptomycin was the most effective agent to inhibit the growth of Bacillus subtilis, followed by tetracycline. Garlic was actually more effective than penicillin. Glutaraldehyde was less effective followed by phenole alcohol.

**Conclusions/Discussion**
People who believe in natural medicine say that garlic is very important to human health because it protects the immune system from bacteria. Because my Mom eats lots of garlic and never gets sick, I wanted to do an experiment to see if garlic was a factor in her health. I went to the Biomedical Library at the University of California at San Diego and discovered that in 1858, Louis Pasteur experimented with garlic and concluded that it had antibacterial properties. My experiment showed that garlic was effective against Bacillus subtilis, compared to pharmaceutical antibiotics and disinfectants.

**Summary Statement**
My experiment determined that garlic inhibits the growth of Bacillus subtilis compared to pharmaceutical antibiotics and disinfectants.

**Help Received**
My mother's health and love of garlic inspired my project. My father helped me with my experiment and took digitial photographs of the results. James Dunford, M.D., gave me advice on how to measure zones of bacterial inhibition.and

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Megan D. Langenfeld

**Project Number**
**J1322**

**Project Title**
## E. coli vs. Ampicillin: "In This Corner..."

**Abstract**

**Objectives/Goals**
The objective is to determine the frequency of ampicillin resistant E.coli from the digestive tract.

**Methods/Materials**
Stool specimens were obtained from 54 Bakersfield residents. 1-2 isolates of E.coli were identified from the volunteer stool specimens. An automated susceptibility test was performed on each E.coli isolate to determine if the E.coli was sensitive or resistant to the ampicillin. 60 isolates of E.coli were tested. The percentage of ampicillin resistant E.coli strains were calculated.

**Results**
In my experiment 24 of the 60 E.coli isolates were found to be resistant to ampicillin and 36 were found to be sensitive. This calculated to be 40% of the E.coli strains were resistant to ampicillin and 60% were sensitive.

**Conclusions/Discussion**
Penicillin and its derivatives such as ampicillin were the first commercially available antibiotics. Today, these antibiotics are very commonly prescribed for a number of infections and diseases. This antibiotic has widespread use in the community, which may explain the increased resistance E.coli has developed to ampicillin.

**Summary Statement**
The objective is to determine the frequency of ampicillin resistant E.coli from the digestive tract.

**Help Received**
I worked on my experiment in the lab at Memorial hospital under the supervision of my parents (microbiologists).

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Joseph R. Long

**Project Number**
**J1323**

**Project Title**
## Extremozymes

**Abstract**

**Objectives/Goals**
The objective of my project was to grow one-celled organisms in pond water with different nutrients added and to freeze them to see if some cells continue to grow and others don#t.

**Methods/Materials**
Eight glass jars were filled with 1 1/2 cups pond water, each two jars had a different additive added, either Peptone, Sodium Bicarbonate, and Yeast Extract, and two jars with nothing added. All the jars were allowed to sit in the sun for two weeks. After being in the sun, one jar for each additive and the control were placed in the freezer for 72 hours. After being in the freezer, the jars were allowed to thaw in the sun. After they thawed all samples were observed under a microscope (must have a 1000x lens) and sketched.

**Results**
When the pond water was observed, one-celled organisms were seen in all the experimental groups. I observed single bacteria in the Peptone experimental group and clusters of bacteria in the Peptone control. In the Yeast experimental group I observed something I wasn#t expecting: one-celled organisms that I did not see in the control group. I saw larger cell masses in the control sample of the Sodium Bicarbonate than in the experimental group. There was algae in both Sodium Bicarbonate groups.

**Conclusions/Discussion**
Is it possible to freeze cells without killing them? Yes, some one-celled organisms survived freezing. From my research I found that some cells are chemically protected and produce their own #anti-freeze# (for example, glycerol). Cells surviving in freezing temperatures are important because on Europa, one of Jupiter#s moons, scientists think there is a frozen lake and it is possible that there are bacteria under the ice. If some cells can survive freezing, then it is possible that there is life in outer space.

**Summary Statement**
I grew one celled organisms in pond water with different nutrients added and froze them to see how various types of cells are affected.

**Help Received**
Mother helped design backboard; Used microscope at Humboldt State University under the supervision of Dr. Patricia Siering.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Caitlin R.S. Merrill

**Project Number**
**J1324**

**Project Title**
## Mascara Malady: What Are You Really Doing to Your Eyes?

**Abstract**

**Objectives/Goals**
The object of my project was to determine how three different types of mascara affected the growth of the bacterium Staphylococcus epidermidis, and in what way. I took quantitative and qualitative tests to achieve this goal.

**Methods/Materials**
My project was very fun to perform. To begin, I went and bought my mascaras, alcohol, hypoallergenic, and waterproof. After that, I began my qualitative tests. I made agar from a powder. I then sterilized it and poured it into plates. After that, I made nutrient broth for bacteria. Once it dissolved it, I sterilized it too. I then mixed in my bacteria Staphylococcus epidermidis and let it incubate for one day. The next day, I prepared sterile circles of paper. I coated some of them with the three types of mascara. I then placed the dots with mascara four to a plate with three plates for each type, made three plates with dots with no mascara for a control, and made three plates with no dots. After that, I took a bacteria loop and made rings with the bacteria mixture around the dots, and around the empty space on my plain control plates with no dots. The next day, I checked for growth by drawing the bacteria rings. In total, I drew on day 1, day 2, day 3, day 8, and day 10.

Then, I performed quantitative tests. I put 4 ml of nutrient broth in each of four test tubes. I then took 4 ml of bacteria and released 1 ml into each test tube. Following that, I took a measured amount of each mascara, and placed it in three of the four test tubes. The fourth one was my control. These were then incubated over night, and the following day I took the tests. I placed the control in the Spec. 20 and set it at 100%. A Spec. 20 is a machine which measures how much light passes through the contents of a test tube. It then measured the amount of light passing through each test tube, affected by the bacteria growth. I took this test four times and my experiment was done.

**Results**
Analyzing these results, it appears that alcohol and hypoallergenic had the most mold spores developing. What I found interesting is that by the end of the ten day period, 9 out of 12 of the dots on my control with paper had rings of bacteria in contact with them.

**Conclusions/Discussion**
Out of the three mascaras, it appeared that hypoallergenic had the most bacteria growth, alcohol the second most, and the waterproof mascara the least amount of bacteria growth.

**Summary Statement**
In my project, I determined how different mascaras affected the growth of Staphylococcus epidermidis.

**Help Received**
My teacher, Mr. Susman, provided lab and equipment.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Alexander J. Mule

**Project Number**
**J1325**

**Project Title**
## The Five Second Rule: To Eat or Not to Eat?

**Abstract**

**Objectives/Goals**
The objective is to determine if a piece of food that is dropped on the floor will collect significantly less bacteria if it is retrieved in 5 seconds or less versus more than 5 seconds and whether or not there is a difference if the food is wet or dry.

**Methods/Materials**
Cultures were taken with sterile, dry swabs and wet swabs (created by dipping dry ones in Trypticase Soy Broth) and touched for 2, 5, or 30 seconds to the same brick of a kitchen floor on four separate days. The controls were 0 second (not touched to the floor) swabs that were plated for all four trials. Cultures were plated on blood agar, incubated at 36-38 degrees Celsius for 48 hours, read, and charted.

**Results**
Colony counts for all controls were low. Average colony counts from dry swabs were 56 and 58 after 2 and 5 seconds of contact with the floor respectively, but 416 after 30 seconds. Wet swabs averaged 281 colonies after 2 seconds, and were too numerous to count after both 5 and 30 seconds.

**Conclusions/Discussion**
There are significantly lower counts on a clean, dry object after it contacts a dry, contaminated surface for 5 seconds or less. A clean, wet object has significantly higher bacteria counts than a dry one after any contact time. Therefore, it is probably safe to pick up and eat a dry piece of food that has been on a dry surface for 5 seconds or less. It is probably never safe to pick up and eat a piece of wet or sticky food or food that has been dropped on a wet surface.

**Summary Statement**
The project is about testing the validity of the so called, Five Second Rule; that is, whether or not a piece of wet or dry food that is dropped on the floor and picked up quickly will collect significant amounts of bacteria.

**Help Received**
My dad helped me with the experiments, my mom with the display, the Director of Microbiology at Anaheim Memorial Hospital with materials and information, and my science teacher with guidance.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Sarah C. Nahigian

**Project Number**
**J1326**

**Project Title**
## The Antibacterial Effectiveness of Various Essential Oils

**Abstract**

**Objectives/Goals**
Objective: The objective of this experiment was to determine if various essential oils could be effective antibacterial agents on the bacteria, bacillus subtilis.

**Methods/Materials**
Materials and Methods: Eighty petri dishes were inoculated with bacillus subtilis. The essential oils tested were cinnamon, clove bud, eucalyptus, oregano, rosewood, sage, tea tree, and red thyme. The controls used were vegetable oil and distilled water. Filter disks dipped into each oil were placed on the inoculated dishes. Ten dishes of five disks each were done for each oil. The dishes were placed in an incubator for 36 hours. They were then removed and the zone of inhibition was measured in millimeters per disk. All measurements were recorded and averaged. One overall average was calculated for each oil. Oregano, rosewood, and red thyme were retested using a single disk per dish because these oils allowed no bacterial growth. Five readings were done for each of these retested oils.

**Results**
Results: Red thyme showed the most bacterial effectiveness with an average inhibition zone of 28 millimeters. Oregano showed the second best effectiveness with an average zone of 26.4 mm. Rosewood showed good results of 15.6 mm. Cinnamon showed fairly good results of 9.44 mm, while tea tree and clove bud showed moderate results of 6.58 mm and 6.08 mm respectively. Eucalyptus and sage showed low inhibition readings of 3.82 and 3.7mm. Distilled water and vegetable oil showed no bacterial inhibition.

**Conclusions/Discussion**
Conclusion: My hypothesis for the red thyme, tea tree, rosewood, sage, distilled water and vegetable oil was correct. My hypothesis for oregano, cinnamon, clove bud, and eucalyptus was incorrect. In conclusion, I found through my investigation and testing that essential oils can inhibit bacterial growth and that they can act as effective antibacterial agents. The results of this project help to expand our ever increasing knowledge of microbiology and show that natural products such as essential oils can serve as powerful antibacterial agents.

**Summary Statement**
My project is about the antibacterial effectiveness of various essential oils.

**Help Received**
Mr. Whittington provided the bacillus, nutrient agar, dishes, and the incubator. My mother helped with the board.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Kristina M. Renda

**Project Number**
**J1327**

**Project Title**
## Where Does Bacteria "Hang Out" on the School Play Yard?

**Abstract**

**Objectives/Goals**
People have different degrees of concern regarding germs and bacteria in public places. Their fears range from none at all to severe phobias. The objective of my experiment was to identify a place (the shool play yard)where large numbers of people frequent daily and determine which of those areas have the highest level of bacteria.

**Methods/Materials**
The materials I used were 9 sterile petri dishes with Standard Plate Count Agar, 9 sterile cotton swabs, 100 milliliters of sterile water, 9 adhesive labels for the petri plate, one heat lamp for incubation, one empty shoe box, and one sheet of dark construction paper to use as a counting grid.
I took the sterile cotton swab wetted with sterile water and rubbed the surface being tested with the swab covering one square inch in each location. The locations I chose were the receiver of a pay phone, stair railing, monkey bars, slide, soda machine button, water fountain, picnic table, bench, and a basketball. I then rubbed the cotton swab over the sterile agar in an individual petri plate for each location. I incubated the bacteria for 48 hours by placing the petri plates under a heat lamp at 90 degrees F. After incubation I counted the bacteria colonies for each location using a dark colored paper with one centimeter grids drawn on it.

**Results**
The following bacteria colony counts were recorded for each location on the school play yard; water fountain = 56, soda machine = 78, bench = 187, monkey bars = 610, stair railing = 1,038, pay phone receiver = 1,365. The remaining three locations; picnic table, basketball and slide, had the growth of bacteria that was too numerous to count. The presence of bacteria colonies were so great, they merged together into clumps which could not be recorded in a count.

**Conclusions/Discussion**
I have concluded that the picnic table was the most unsanitary surface of the nine locations sampled. After inspecting the surfaces, it was easy to understand why this was so. The surface of the picnic tables are not smooth. They have a porous surface that provides a great location for bacteria to hide. Additionally, it does not appear to me that the tables are cleaned on a regular basis with disinfecting solutions.And lastly, the tables had residue from the kids' lunches on the surface giving the bacteria a readily available food supply.

**Summary Statement**
This project identifies where bacteria is most likely to be found in common areas on the school play yard.

**Help Received**
To prepare for my experiment I received assistance from the scientists at the Safeway Laboaratory and Mr. Chuck Stoffers, Director of Food Safety for Safeway Inc. They supplied me with materials and described the proper way to take samples.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Loriana M. Robles Andrade

**Project Number**
**J1328**

**Project Title**
## Good Cells Gone Bad

**Abstract**

**Objectives/Goals**
Objective: The first objective was to record the growth rates of normal yeast cells when covered with different types of material and kept at body temperature. The second objective was to record the growth rates of yeast cells with added sugar to show how bad dietary habits and diabetes can also increase the risk of yeast infections.

**Methods/Materials**
Materials and Methods: One set of cells was made using a mixture of water and yeast. While another set of cells was made using a mixture of water,sugar,and yeast. The cells were placed on slides,then placed in sleeves of material. The material used was cotton,nylon,spandex,polyester,and silk. Each slide was placed into a 5 gallon fish tank. The fish tank was insulated to keep its inside temperature at between 98 and 99 degrees. Each day the slides were removed and the yeast cells were counted under a microscope. This was done twice a day for 5 days. I also performed 100 surveys of women ranging in age from 15 to over 40 to help support the results of my experiment.

**Results**
Results: The yeast cells that were made from the water and yeast mixture and covered with cotton had the lowest growth rate. While the yeast cells covered in spandex had the highest growth rate. The yeast cells that were made using the water,yeast,and sugar all had higher growth rates than the yeast cells that were only made with water and yeast. However cotton still had the lowest growth rate among these cells while spandex had the highest growth rate.

**Conclusions/Discussion**
Conclusion: My conclusion was that cotton was the best type of undergarment to wear to help prevent the growth of harmful cells that can cause yeast infections in the body. The surveys that I did also supported this conclusion. I also found that by adding sugar to the yeast mixture it increased the number of cells no matter what type of material it was wrapped in. The added sugar in the yeast mixture showed how imbalances could be created in our bodies by our diets or by diabetes.
Discussion: The cells in our bodies each have a specific function. If the environment that the cells live in changes even a small amount,it could cause the increase or decrease of certain cells. If there are to many cells or if there are not enough cells in a certain part of our body we become sick. Everyone must do what they can to keep their bodies healthy, so we may live long healthy lives.

**Summary Statement**
How different fabrics and sugar content affected yeast cell growth rate.

**Help Received**
Mother helped with surveys and helped put display together. Father helped with typing of report. Various people helped by filling out surveys used in experiment.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Lauren E. Ruh

**Project Number**
**J1329**

**Project Title**
## Comparing Vegetable Effects on Growth of Bacteria

**Abstract**

**Objectives/Goals**
The objective is determine how a vegetable solution will effect the growth rate of bacteria. Will the vegetables inhibit or promote growth of Bacillus. (controlled bateria) and saliva (unknown bacteria)

**Methods/Materials**
Make a liquid vegetable solution for each vegetable : brussell sprouts, celery, parsley, lettuce, cabbage, mint. Swab petri dish with solution. Make Bacillus broth. Place filter paper into broth and place on perti dish. 12 trials for each vegetable. Record growth rings of bacteria. Repeat steps for saliva broth.

**Results**
The parsley inhibited growth of bacteria. Cabbage had the largest ring of growth. Other vegetables averaged between 1- 2.5 cm ring of growth.
Results were the same for both the controlled bacteria(Bacillus) and the saliva.

**Conclusions/Discussion**
My conclusion shows that certain vegetables can help prevent growth of bacteria. Eating these vegetables can help prevent bacterial growth in your mouth. Thus helping to prevent tooth decay.

**Summary Statement**
Determining how vegetables help promote or inhibit bacterial growth.

**Help Received**
Mother helped make solutions, gather materials, put board together. Teacher helped with written assignments, how to do project.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Alison H. Ryu

**Project Number**
**J1330**

**Project Title**
## E. coli Susceptibility

**Abstract**

**Objectives/Goals**
As bacteria becomes a growing threat to many people's health, this science fair project investigates the susceptibility of E-coli to six different antibiotics, with different mechanisms of action, to find which is the most effective.

**Methods/Materials**
Six different E-coli strains were grown previously on agar plates. The E-coli strains were then swabbed into vials, measured on the MacFarland Scale, and plated evenly on six agar plates. Each E-coli colony was tested with six E-tests (one of each antibiotic), and then placed in an incubator for approximately 20 hours to produce results.

**Results**
Out of the six antibiotics measured on the Minimum Inhibitory Concentration Scale, Tetracycline was found to be the most effective antibiotic in treating an E-coli infection.

**Conclusions/Discussion**
My original hypothesis that Cephalothin would be the most effective antibiotic was incorrect. I learned that the antibiotics had different mechanisms of action to treat the infection. Cephalothin, a commonly overused antibiotic which inhibits the cell wall, is likely to be less affective because of acquired bacterial resistance. Tetracycline, which affects the bacteria's ribosomes and can only be administered orally, is not commonly used for E-coli infections. The advantage to underutilization is the likelihood of less bacterial resistance. Antibiotics work in different ways to inhibit or destroy the bacteria. Bacteria respond to the challenge of antibiotic usage by developing resistance, and thereby rendering some commonly used antibiotics minimally effective.

**Summary Statement**
This project evaluates the susceptibility of E-coli to a broad range of antibiotics which demonstrate different modes of action, making bacterial resistance an important factor in prescribing the most effective antibiotic.

**Help Received**
Used lab equipment at St. Francis Hospital under the supervision of Ms. Jane Brooks; interviewed Ms. Diane Ozasa, Pharm. D., interviewd Ms. Lisa Berryman, Pharm. D., interviewed Dr. Richard Ryu, M.D.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Conor M. Saunders

**Project Number**
**J1331**

**Project Title**
**Buyer Beware**

**Abstract**

**Objectives/Goals**
The object of my science project was to find out which store#s shopping carts (Albertson#s, Pavillions, Rite Aid and Costco) had the greatest amount of bacteria. I believe that Rite Aid will have the greatest amount of bacteria because it has the highest person to cart ratio and doesn#t clean their carts. I think that Costco will have the least amount of bacteria because it has the lowest person to cart ratio and cleans their carts the most.

**Methods/Materials**
I swiped the handles and insides of two shopping carts from each store and inoculated them on a blood agar petri dish and left them in an incubator for three day to grow. After, I recorded my data.

**Results**
Pavillions had the least amount of colonies, while Rite Aid had the greatest amount of colonies and the most diverse. A colony on inside of a Rite Aid cart was beta-hemolytic streptococci, which causes Strep throat.

**Conclusions/Discussion**
My conclusion is that the amount of people who use the carts and how well they are cleaned do affect the amount of bacteria on a shopping cart.

**Summary Statement**
I tested shopping carts from four different stores for bacteria and compared the results to see which store had the most bacteria.

**Help Received**
Father set me up with Dr. Patel; Used lab equipment at Eisenhower Medical Center under the supervision of Dr. Patel.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Meicheng Shi

**Project Number**
**J1332**

**Project Title**
## What Keeps Vampires Away?

**Abstract**

**Objectives/Goals**
The purpose of my experiment was to determine the effect of fresh garlic juice on various bacteria to see if the antiseptic property lessons if garlic juice has been subjected to boiling or freezing temperature for a given amount of time. If garlic has antiseptic power, then the effect will vary with the concentration of the garlic juice and the types of bacteria. If extreme temperatures affect the antiseptic power, then garlic juice that has been boiled or frozen will have less antiseptic power than garlic juice that has not been boiled or frozen.

**Methods/Materials**
. I tested the antiseptic power of fresh, boiled and frozen garlic on three different types of bacteria (E.coli, B.cereus, S.epidermis) and bread mold. I also tested the healing power of garlic with 100%, 50%, 20%, and 0% fresh garlic juice. The testing process required petri dishes, nutrient agar, the subcultured bacteria, a pipet, garlic juice, and an incubator. The nutrient agar was placed into the petri dishes, along with the subcultured bacteria. Then, plates soaked in garlic juice were put into the petri dishes. They were incubated for 48 hours, and then observed. The process was repeated the all the bacteria.

**Results**
The results showed that the garlic juice was most effective on B.cereus, and least effective on bread mold. Also, fresh garlic juice was much more effective than boiled or frozen juice, and boiled garlic cloves had no effect at all!

**Conclusions/Discussion**
My hypothesis proved correct. This experiment and its results are important to us because it shows us how a common household food can be used to heal. For example, if immediate treatment is needed for a scrape or cut, someone could simply apply garlic to the wound and that would kill the bacteria without need of more complicated medical treatment.

**Summary Statement**
The effect of fresh, boiled and frozen garlic juice on various bacteria and mold.

**Help Received**
Mr.Lee helped with experimentation and he got the bacteria. He also helped with analyzing the data.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Mark T. Tebbets

**Project Number**
**J1333**

**Project Title**
## Decontamination of Insect Eggs with Sodium Hypochlorite to Control Bacteria

**Abstract**

**Objectives/Goals**
My project was to determine if sodium hypochlorite kills the spore-forming bacterium, Bacillus thuringiensis but does not kill the eggs of the navel orangeworm, Amyelois transitella.

**Methods/Materials**
Brain Heart Infusion nutrient agar plates were streaked with the insect pathogen Bt, Bacillus thuringiensis, to grow the bacteria. Bacteria spores or navel orangeworm (NOW)insect eggs were exposed to selected concentrations of sodium hypochlorite for 15 minutes. They were then rinsed for 15 minutes with distilled water. The bacteria were streaked onto new agar plates, incubated for 2 days, then checked for growth. The insect eggs were incubated after rinsing for 5 days then checked for egg hatch.

**Results**
Sodium hypochlorite (SH) was very effective in killing the spore-forming bacteria. A 2.0% concentration of SH killed all spores of Bt and 1.0% also killed nearly all of the bacterial spores. However, 0.5% SH did not adequately kill the Bt.

Sodium hypochlorite did not kill all of the NOW eggs but the proportion of eggs hatching was reduced when exposed to SH. The percentage of egg hatch was only 56 to 74% compared to 85% in the control group.

**Conclusions/Discussion**
In conclusion, sodium hypochlorite effectively kills spore-forming bacteria. Although SH does reduce hatch it does not significantly kill NOW insect eggs. The bacteria are controlled and there is still a good recovery of viable eggs after treatment. In practical application, sodium hypochlorite can successfully be used in insect rearing to effectively control spore-forming bacteria and still provide a good recovery of healthy insect eggs for use in research or other studies.

**Summary Statement**
Sodium hypochlorite is tested for decontamination of insect eggs from spore-forming bacteria.

**Help Received**
Insect eggs, bacteria, agar plates and use of incubators supplied by USDA-ARS, Parlier, CA. Father advised in bacteria handling and rinsing procedure. Science teacher made suggestions for improving content on board.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Veralyn R. Vanderkraan

**Project Number**
**J1334**

**Project Title**
## Tobacco Is a Mouthful

**Abstract**

**Objectives/Goals**
My objective was to find out if the different amounts of nicotine and tar in cigarettes affected the amount of bacteria in your mouth.

**Methods/Materials**
I had the adult smoke three different types of cigarettes (ultra light, light and dark) on various occasions. Thereafter, I took seven samples from the adult#s mouth, and placed them in petri dishes. I also took seven samples from the adult#s mouth before they smoked any type of cigarette. These samples then grew in an incubator. The amount of bacteria was later counted for my results.

**Results**
The major findings of this experiment show that on average there were: 351 colonies of bacteria in each petri dish for the before samples, 357 colonies for the ultra light, 451 colonies for the light and 549 colonies for the dark cigarettes. These results show that on average there were 198 more colonies of bacteria in your mouth after smoking a dark cigarette, then if you had never smoked at all.

**Conclusions/Discussion**
I have found that, the more nicotine and tar in the cigarette, the more bacteria in your mouth. This makes my hypothesis the exact opposite of my conclusion. This happened because, the nicotine destroyed a certain element of your saliva that is responsible for protecting the mouth from extra bacteria. Without this element, bacteria is able to grow freely and multiply faster. In short, smoking a cigarette high in nicotine will increase the amount of bacteria in your mouth, which can possibly lead to disease. So in conclusion, DON#T SMOKE!

**Summary Statement**
My experiment was to find out if the amount of nicotine/tar in cigarettes affected the amount of bacteria in your mouth.

**Help Received**
Science teacher helped make agar for petri dishes.

# CALIFORNIA STATE SCIENCE FAIR
## 2002 PROJECT SUMMARY

**Name(s)**
Alyssa N. Warren

**Project Number**
**J1335**

**Project Title**
## Gesundheit

**Abstract**

**Objectives/Goals**
To see if germs from one sneeze could contaminate an entire room.

**Methods/Materials**
Prep Procedures a)Create temperature-controlled environment; b)Create map showing placement of each petri dish on graph paper; c)Spread drop cloth on floor; d)Mark locations from graph paper onto drop cloth; e)Hang another drop cloth over doorway.
Control, Tests 1 & 2 Procedures a)Label set of petri dishes; b)Place petri dishes in designated locations on drop cloth; c)Take lids off dishes & note time uncovered; d)Sneeze (Test 1 & 2 only); d)Expose dishes for 1hour; e)Cover dishes & place in incubator; g)Repeat steps a-e for each Control, Test 1 and Test 2 dishes
24-hour, 48-hour, & 72-hour Observation Procedures a)Take out one set of dishes; b)Take picture of all dishes together; c)Observe each dish; d)Take a picture of each dish by itself; e)Repeat steps a-d for Test 1 and Test 2 dishes; f)Repeat steps a-e for 24 hour, 48 hour, and 72 hour
Disposal Procedures a)Tape all dishes closed; b)Place dishes in a plastic bag; c)Place bags in bio-hazardous waste bags; d)Deliver bags to disposal service

**Results**
There were more types of germs in the room after the sneeze. On average a control dish had 2.2 different colonies, a Test 1 dish had 3 different colonies, and a Test 2 dish had 2.8 different colonies. This shows control dishes had less types of germs than Tests 1 & 2.

**Conclusions/Discussion**
Germs from a sneeze can contaminate a whole room. My hypothesis was correct because the dish farthest from the sneeze had germs in it that weren#t on the dish in the control. This shows that other germs from the sneeze traveled to the back of the room. One thing that was strange is how Test 1 and 2 had more fungus. A person cannot sneeze fungus. Since there was one small fungus in the control, I think that fungus was in the room to begin with. A problem I had is that fungus took over some dishes, which stopped other bacteria from growing. If there hadn#t been any fungus I would have been able to see more bacteria. My results may have been different if I had more petri dishes to test and to see if bacteria landed between the dishes I had. I could have had more accurate observations if I had a microscope. When I was observing and taking pictures each day I opened the lid therefore a few bacteria may have entered each dish. This explains why the control had a few more small colonies. Sneezes contaminate a whole room.

**Summary Statement**
My project is about the distance germs spread from one sneeze.

**Help Received**
Mother helped set-up and Grandpa helped review results