

69th Annual Fair



**Connecticut  
Science &  
Engineering  
Fair**

**March 14 - 18, 2017**

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**Student Abstracts**

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## Fair Categories

	Life Sciences	Physical Sciences
<b>7<sup>th</sup> &amp; 8<sup>th</sup> Grade Team</b>	<b>LT (1001 – 1999)</b>	<b>PT (4001 – 4999)</b>
<b>7<sup>th</sup> Grade</b>	<b>L7 (2001 – 2499)</b>	<b>P7 (5001 – 5499)</b>
<b>8<sup>th</sup> Grade</b>	<b>L8 (2501 – 2999)</b>	<b>P8 (5501 – 5999)</b>
<b>High School</b>	<b>LS (3001 – 3499)</b>	<b>PS (6001 – 6499)</b>
<b>High School Team</b>	<b>LST (3501 – 3999)</b>	<b>PST (6501 – 6999)</b>

## Special Categories

<b>AT = Applied Technology</b>	<b>EE = Engineering: Electrical &amp; Mechanical</b>
<b>AS = Animal Science</b>	<b>ET = Energy &amp; Transportation</b>
<b>BE = Behavioral &amp; Social Sciences</b>	<b>EV = Environmental Analysis</b>
<b>BI = Biochemistry</b>	<b>EM = Environmental Management</b>
<b>CB = Cellular &amp; Molecular Biology</b>	<b>MA = Mathematical Sciences</b>
<b>CH = Chemistry</b>	<b>ME = Medicine &amp; Health Sciences</b>
<b>CS = Computer Science</b>	<b>MI = Microbiology</b>
<b>EA = Earth Science</b>	<b>PH = Physics &amp; Astronomy</b>
<b>EN = Engineering: Materials &amp; Bioengineering</b>	<b>PS = Plant Science</b>

## Special Category Composites

<b>Biotechnology</b>	<b>AS, BI, CB, EN, ME, MI, PS</b>
<b>Environmental</b>	<b>EV, EM</b>
<b>Engineering</b>	<b>EN, EE</b>
<b>Sustainability</b>	<b>EA, EN, EE, ET, EV, EM</b>

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LT

Project  
Number

1001

Title: How Sweet Is It?

Student Name(s): K. Feliciano, J. Koonitsky

## Abstract:

For our science fair project we chose to measure the glucose concentration in natural and processed foods and drinks. We chose to measure glucose because glucose is a very important type of sugar. Glucose is the only fuel used by brain cells. It is an important source of energy for muscles and other tissues in the body. Our hypothesis was that we think the processed foods will have more glucose than the natural foods. We also thought that the test strips will give us accurate results because of the test with glucose concentration controls. The first thing we did was make the glucose concentration controls. To do that we added certain amounts of glucose powder into water. We then tested those controls to make sure that the test strips were giving us accurate results. Next we tested the foods and drinks. We dipped the test strips into the liquid and waited 30 seconds. During the 30 seconds the test strips changed to a different color, giving us the percentage of glucose concentration. Like we predicted, the processed foods had more sugar than the natural foods. This is because companies of processed foods want to improve the flavors and taste of their foods by adding sugar. The glucose test strips worked correctly because we kept them in the container, keeping them away from heat and moisture which can interfere with the results. We got accurate results because we waited an equal amount of time for each of the results to appear.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BI CH ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LT

Project  
Number

1002

Title: Is "Non-toxic" dish Detergent safe for the environment?

Student Name(s): B. King, O. Divon

## Abstract:

Some dish detergents are marketed as "non-toxic" and, therefore, are expected to be safe for the environment. To determine the safety of these detergents we placed a fixed amount hornwort (an aquatic plant which was photographed, measured and weighed) into three 5.5-gallon fish tanks which were filled with water. The experiment was run in two parts, over 24 days. In the first 12 days, our control tank (1) contained only water. In addition, tank 2 contained 30 ml of Seventh Generation Natural Dish Liquid while tank 3 contained 60 ml of the same detergent. In the second part of the experiment, the control tank (4) contained only water, while tank 5 had 1.25 ml of detergent plus water and tank 6 had 0.6 ml of detergent plus water. In both experiments, the plants were observed over 12 days, and measured/weighed on experiment days 6 and 12. Throughout the experiments, the plants in the control tanks (1 & 4) did not change much. The plants in the high concentration detergent tanks (2 & 3) lost a lot of weight as the study went on. By the 12th day, most of the fronds had died. The plants exposed to lower concentrations of detergent also lost weight over the course of the experiment, however, the amount of loss was approximately half that seen in the tanks with higher concentrations of detergent. We concluded that "non-toxic" dish detergent is likely to be toxic to the growth of aquatic plants, even in low concentrations.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

LT

Project  
Number

1003

Title: Test Methods

Student Name(s): J. Zito, E. Acharya

## Abstract:

The U.S. lags when it comes to education. Many countries score above the United States in math. In fact, American students taking The Programme for International Student Assessment (PISA) scored below average. Methods, therefore, are needed to help improve scores on math assessments.

The purpose of the project was to evaluate methods that have claimed to help students score higher on assessments. If successful, the results of the tests will show how each method affects the students being tested. It is hypothesized that if a student has gum while taking a test, then students will score higher on a math test. To test the hypothesis, a math test was designed with easy problems that all participants can answer, but the test had a time limit to evoke pressure. The different methods were gum, mint, a stress ball, and a control. The test was given to twenty seventh and eighth graders.

The highest average score for seventh graders was the control followed by the stress ball, mint, and lastly gum. The data was interesting because the mint, stress ball, and gum's scores were similar, with numbers of 47.66%, 49.5%, and 46.75% respectively. The control was an outlier, with a score of 57.75%. The eighth graders scored the highest with the stress ball at 85.75%, followed by the control with 80%, mint at 58%, and lastly gum at 49.5%. The data indicates that there is no correlation between the methods used and student test scores.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

198

Fair Category

LT

Project Number

1004

Title: Strawberry Vs. Aloe

Student Name(s): G. Casturani, G. Riccio-Weisse, C. Merritt

## Abstract:

The experiment we performed was to see if aloe vera juice or lemon juice would keep strawberries from developing mold. We chose this experiment because we want people to be able to preserve their strawberries. People should care about the work we did because it will help people save money, time, and preserve their strawberries. We investigated the issue that caused strawberries to mold. Our hypothesis was if you clean strawberries in aloe vera juice then they will not develop mold as easily. We investigated the problem by doing an experiment over the course of five days. The most important variables in our experiment were the controls. The controls keep the experiment fair. Our results were that over a five day period lemon juice kept strawberries the freshest. In our experiment lemon juice came in first, keeping the strawberries the freshest. Next came water and aloe vera juice both having all strawberries extremely filled with mold. This science fair will help people keep their strawberries fresh for as long as possible. In this project our hypothesis was disproven but one feels that the objectives were met. This project will help people all over the world preserve their strawberries.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EA EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

LT

Project Number

1005

Title: Malleability of the Human's Internal Rhythm

Student Name(s): A. Cosme, K. Miller

## Abstract:

A human's internal rhythm largely relies on external input, such as natural lighting and sleep cycles to align itself with real-time as accurately as possible. Our project mainly focuses on the topic of the visually impaired because they have less external input to help their rhythm stay accurate. We wondered if the lack of the external input that most people have would affect their rhythm in any way. The purpose of this project is to investigate whether the lack of a common external input affects the internal rhythm of someone who can't see, and/or if they have an additional or heightened external input that affects their internal rhythm in a more positive way. Our method for investigating this topic was creating the illusion of visible impairment by blindfolding each of the twenty-four subjects, and having them count to a minute while a metronome plays at its own rhythm in the background. We divided equally the subjects into two groups based at random and told them to either rely on the metronome to establish a rhythm, or ignore it based on the group they were placed in. Group A, the group that was told to rely on the metronome for a rhythm, was closer to a full minute (on average). Its scores were in the upper to mid forties, its overall average was 48.62 seconds and Group B's overall average was 40.02 seconds.

Technical Disciplines Selected by the Student  
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BE ME

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

206

Fair Category

LT

Project  
Number

1006

Title: The Effect of Different Materials Used as a Filter on the Purity of Water

Student Name(s): A. Bushati, J. Cela

## Abstract:

The purpose of this experiment was to learn which homemade filter is most preeminent in cleaning contaminated water. All across the world there are families suffering from poverty, with no way to get food or water. We decided that we were going to do something about it. We chose three green materials that we thought were qualified enough to purify unfiltered water. The three materials we chose were cilantro, coffee grinds, and rice. We were able to obtain three two liter bottles, which we cut and used as a funnel. We then placed a layer of cilantro in between a layer of rock and sand for extra filtration. We then did the same with the coffee grinds and rice. Next, we poured the pond water through the funnel and tested the "filtered" water for coliform bacteria and phosphate with a water monitoring kit. We were shocked to learn that the green material that was most effective in cleaning the adulterated water was the coffee grinds. The cilantro and rice were less effective. In conclusion we feel that coffee grinds could be a better water filtration product in developing countries. We are excited to about the fact that there are green solutions to water problems in developing countries.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

125

Fair Category

LT

Project Number

1007

Title: Dancing Plants

Student Name(s): D. Ponce, E. West

## Abstract:

This experiment is to determine if music helps plants grow. The hypothesis is that plants that are introduced to music will grow faster. This will create more options to grow flowers naturally rather than poisoning environments with unnatural substances that are often used as fertilizers. To perform the experiment, play 30 minutes of classical music to one plant, jazz music to another but keep another plant away from music. Measure the height of the plants to determine if there is any difference in growth. Repeat the process above for 11 days. After the 11 days the plant that "listened" to classical music grew taller, whereas the jazz plant grew minimal. In conclusion, different types of music will affect the growth of plants in various ways.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

103

Fair Category

LT

Project Number

1008

Title: Teething You The Truth

Student Name(s): H. Lazaro, C. Higgins

**Abstract:**

Our project was about how sugary drinks effect the enamel. We learned that Red Bull effects your teeth the most. The Red Bull took off part of the white that protects the crown of the tooth.(the top part of your tooth) All the drinks we tested did something to the tooth. The Gatorade dyed to tooth yellow/green. The Root beer dyed the tooth brown. The apple juice made the tooth get a little orange tint to it. The water did nothing to the tooth.We also learned not to drink a lot of these drinks so our teeth would not be affected.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

154

Fair Category

LT

Project Number

1009

Title: Seaweed and Tsunamis

Student Name(s): A. Cox, S. Urban

## Abstract:

Our experiment is to determine if the amount of seaweed in the ocean affects the size and strength of a wave. We conducted our experiment by using a fish tank to represent the ocean. We used pieces of artificial seaweed, adding an additional piece for each trial. We made the wave by pulling a piece of plastic sheet board from the bottom of the tank up to the top. This displaced the water in the correct way to make a realistic wave. In the end our results showed that the more seaweed we added to the fish tank the smaller our wave was. This is because the seaweed interferes with the uniformity of the wave and creates drag in the moving water. This project could be helpful in the real world. The results from our experiment could provide a possible way to lessen the destruction and devastation of the tsunamis that occur each year.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EA EM EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

LT

Project Number

1010

Title: Which Food Groups Gives Us The Most Chemical Energy?

Student Name(s): J. Campolo, A. Campolo

## Abstract:

Food energy is chemical energy that we get from our food. The amount of energy we absorb through our food we eat is called the energy intake, and it is the fuel our body needs for it to function correctly. A calorie equals a unit of energy that is needed for our bodies to survive. Our bodies take in calories by storing energy for our bodies to use throughout the day. But our bodies need more than just energy to survive we also need nutrition like protein and fat from different foods. We tested different food groups including carbohydrates, fruits, vegetables, proteins, and snacks by constructing a calorimeter. A calorimeter was constructed with two cans, a lighter, thermometer and other supplies. We burned food from the food groups under a can of water. We took the temperature of the water before and after the burning. The difference in water temperature was then multiplied by the amount of water in the can and that gave us the amount of chemical energy the food gave off. We then convert the energy into calories. Our hypothesis was conflicted as Joseph's felt that vegetables would provide our bodies with the most chemical energy & Anthony felt proteins would provide the most. We discovered that protein was the best source of chemical energy, fruit snacks were the least source of energy and vegetables could not be tested, as they never caught on fire as they are water based food.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LT

Project Number

1011

Title: Household Cleaners Versus Bacteria

Student Name(s): M. Riggs, S. Soto

## Abstract:

There are many different cleaning products available to consumers today. The purpose of this experiment is to prove that traditional cleaners that are purchased in the grocery store such as Windex and Clorox are better at preventing bacteria growth than organic/natural cleaners and household cleaners/ disinfectants. We chose this topic because one team member's family cleans with organic /natural cleaners and the other team member's family cleans with traditional cleaners. We were interested to determine which cleaner is most effective. Our hypothesis is that traditional cleaners such as Windex or bleach solutions will do a better job at preventing bacteria growth than organic/ natural cleaning products or household cleaners/ disinfectants such as hydrogen peroxide and rubbing alcohol.

The investigation was conducted by preparing three testing areas: countertop, shoe, and sink. The level of bacteria growth was measured after 24 hours in a laboratory oven.

The results of our experiment were mixed. The results supported our hypothesis because the traditional cleaners performed better than organic/ natural cleaners approximately 67% of the time. However, our hypothesis was incorrect because hydrogen peroxide, which is a household cleaner/ disinfectant, out performed in our shoe, sink and countertop testing.

The conclusion that we can draw is that traditional cleaners are effective in preventing bacteria growth. However, there are health risks associated with these products and many consumers do not want to buy them. Therefore, people would be better off using a 3% hydrogen peroxide solution to prevent bacteria when they clean and disinfect at home.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BI EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

218

Fair Category

LT

Project  
Number

1012

Title: Clean... Chemical Free... Protect your Family!

Student Name(s): A. Coleman, J. Wilson

## Abstract:

Which natural cleaning agent is best at cleaning a carpet stain? The purpose of this experiment is to make recommendations on natural cleaning agents so families can protect members who spend time close to the ground, such as babies and pets. Our hypothesis is the higher the acidity of a natural cleaning agent, the better it will clean a carpet stain. In our experiment, we tested the ability of four natural cleaning agents, lemon juice, vinegar, orange juice, and vegetable oil to clean a grape juice stain on a carpet. Each agent had a different level of acidity. We poured grape juice onto a carpet sample, let it dry to create the stain, and then poured one of the cleaning agents onto the carpet sample. After allowing it to dry, we surveyed ten people to compare an unstained carpet sample with test samples. The survey group voted vinegar the best at cleaning the stain. Our hypothesis was disproven because vinegar was not the most acidic. Lemon juice had the highest acidity, but was not the best carpet cleaner. However, we have proven vinegar is a good natural cleaning agent for a grape juice stain on a carpet. Our conclusion is there are likely more variables in the stain cleaning process than just the acidity level of the cleaner.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LT

Project Number

1013

Title: Algae vs. Vinegar

Student Name(s): L. Hosten, J. Logwa

## Abstract:

Our project is about what are the affects of growing algae in vinegar. If testing we predict the vinegar will have a affect to the appearance of the algae. We are doing this project to find out if algae could survive conditions of the vinegar. First we filled all three beakers with the same amounts of algae then we placed different amounts of vinegar in the beaker and diluted them to pH levels of 5.0, 6.0, 7.0 Then we took pictures for four days. On the first day none of the algae in either three groups showed any reaction to the vinegar (Group 1 had 150% vinegar, group 2 had 30% vinegar and 120% water, group 3 5% vinegar) However on the second day, group one sank to the bottom beaker, group two floated to the top, group three reacted differently, some algae floated while the rest sank. On the third day all of the groups of algae sank to the bottom of the beaker. on the last day all groups remained at the bottom except for group two which floated. In conclusion our hypothesis was correct the algae did have a noticeable reaction to the vinegar at different levels of acidity. My results show that algae most aquatic animals will not survive the conditions of the water being that the algae cannot. We would run our project longer for more data and maybe test how certain bacteria will react to the new pH of the algae.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AS PS PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

79

Fair Category

LT

Project  
Number

1014

Title: Extracting DNA from fruit

Student Name(s): B. Oliveras, M. Mitchell

## Abstract:

We are doing an experiment to see what fruit can get the most DNA extracted from it. We chose 3 fruits Bananas, Strawberries, and Raspberries. In our hypothesis we predicted that the strawberries would have the most DNA and the raspberries the least. Our educated guess was incorrect. In our results all 3 of our test we did, the bananas always had the most DNA. In all 3 test that we did the strawberries always had the least DNA.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

213

Fair Category

LT

Project  
Number

1015

Title: Can You Cope With Your Dish Soap?

Student Name(s): A. Oddo, A. Mullins

## Abstract:

Are you tired of coping with your dish soap? Then our experiment will answer all the questions you have about the best cleaning agent. To find out what dish soap worked the best and why, we looked at five different dish soaps which were Dawn, Ajax, Palmolive, Just The Basics, and Total Home. Our hypothesis was that since Dawn cleans both dishes and animals, we thought the chemicals would be different from your standard dish soap which would make Dawn better. For our procedure, we first put some food on our kitchenware to be cleaned, and left the food out on our utensils for one day. Next, we cleaned our kitchenware until they were as clean as we could get them. Lastly, we used our senses of sight and touch to determine which dish soaps had cleaned these objects the best. Out of the five products we tested, our hypothesis turned out to be correct and Dawn dish soap had cleaned dishes the best. In this experiment, we concluded that Dawn was the best dish soap for some key components mixed in their soap such as Sodium Lauryl Sulfate that made cleaning a lot easier. In the end, this experiment was both fun and very interesting to understand why Dawn works so well.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH BI EN

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

187

Fair Category

LT

Project  
Number

1016

Title: How do brine shrimp hatch in different pH's?

Student Name(s): B. Cohen, J. Marcus

## Abstract:

The purpose of this project is to find out the optimal pH for hatching brine shrimp using the scientific method. The hypothesis of this experiment is that the brine shrimp hatched in the pH that is about neutral. This was thought because the pH would not be too extreme for the brine shrimp to hatch and thrive. The experiment was a three day process involving three petri dishes with 25 brine shrimp eggs each of a different pH, one high, one low, and a neutral control group. Our results from the hatches were that the brine shrimp in the high pH group hatched more successfully than the low pH group and the control group. In addition to that, the brine shrimp in the low pH group did not hatch at all because they could not handle the low pH, and the control group just hatched in less numbers than the high pH group. In conclusion, hatching brine in high pH water is a good idea for people looking to get populous hatch results, and hatching brine shrimp in too low a pH can seriously affect your hatch.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CB EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

230

Fair Category

LT

Project Number

1017

Title: Oil Spill Effect On Aquatic Plants

Student Name(s): C. McDougall, M. Johnston

## Abstract:

We have chosen to do our project on how oil spills affect aquatic plants, to spread awareness against oil spills because they have big effects on plants and animals in the ocean. For example, oil causes erosion killing 15 feet of plants in a year on the Coast of the Northern Gulf of Mexico. The problem being studied is how oil spills affect the photosynthesis process in the Moneywort aquatic plant.

We discovered this project after learning about the BP oil spill that happened in 2010 in the Gulf Of Mexico. We wanted to prove to people how much damage a single oil spill does. We try to help prevent oil spills from happening by spreading awareness on how to stop them. In John F Kennedy Middle School, we hang up posters that state, "Stop sailors from dumping their oil into our oceans!"

Some problems that we discovered while doing this experiment were that some plants don't produce enough oxygen to measure. The first time we did this experiment we did it with a plant called the Giant Corkscrew. This plant was very hard to work with and died quickly so we switched over to the Moneywort plant. This plant made it easy to test and had more visible results. By doing this experiment, our results showed the difference between oil and non oil is 6 centimeters of air produced.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EA PS EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

204

Fair Category

L7

Project Number

2001

Title: The Effect of Petroleum Pollution on the Growth of Ramshorn Snails (*Planorbis Rebrum*)

Student Name(s): G. Gargano

## Abstract:

This study was conducted to identify how petroleum pollution affects the growth of living organisms in freshwater systems. Ramshorn Snails and two non-hazardous petroleum products, Vaseline petroleum jelly and Nivea body lotion, were used for the experiment. Mass and shell length of the snails were measured before and after the products were introduced to the trials using different doses to test the effect of the product and varying concentrations on snail growth. It was predicted that the body lotion would negatively impact the growth of the snail and kill the snail at higher concentrations where the petroleum jelly would not cause any negative effect.

The results showed that the body lotion as predicted caused a decrease in mass and abnormal shell development in each trial with varying amounts of the substance and would kill the snail at increased concentrations. Surprisingly, the petroleum jelly also showed a decrease in mass and shell growth in the trial with the highest dose. This experiment successfully concluded that the addition of even the least toxic petroleum products have a negative effect on the growth of Ramshorn snails as concentration levels increase, thus confirming that more toxic substances could provide devastating results to living organisms in freshwater systems.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AS EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

57

Fair Category

L7

Project Number

2002

Title: How Many Bacterial Are On Door Knobs?

Student Name(s): Y. Rosa

## Abstract:

My study measured the number of bacteria on bathroom door knobs. The adults were most likely to wash their hands and there were less bacteria on the adult's bathroom door knobs. For student's bathroom door knobs, there was a lot of bacteria therefore that most likely means there was not a lot of students washing their hands.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

126

Fair Category

L7

Project Number

2003

Title: Baking Soda Experiment

Student Name(s): T. Amaral

## Abstract:

The purpose of this experiment was to see how baking soda reacts with different liquids. The hypothesis was that the vinegar would have the largest reaction with the backing soda. The steps used were measuring the baking soda and the liquid for the certain test. Then using a timer I measured the time taken to react fully. Lastly the heights of the reaction were compared to see which one reacted longer or higher. Throughout this experiment it turns out lemon juice had the longest and largest reaction with the baking soda. Lemon juice went 9 centimeters in 25 seconds the vinegar went up 4.84 centimeters in 6 seconds the coke went up 1.67 centimeters in 3.67 seconds. In conclusion the lemon juice showed my hypothesis was incorrect.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

203

Fair Category

L7

Project  
Number

2004

Title: Food? Mold? Time

Student Name(s): K. Payne

## Abstract:

I want to see which food will grow mold the fastest. I predict that the regular lettuce in the sealed jar will mold the fastest because within the first 6 hours it began to turn brown. I collected by graph as well as pictures. I used 5 different foods. You will need a knife, samples to test, zip-top bags, and a marker. I started my project December 26, 2016- January 4, 2017. Everything in the cabinet all had little to no mold showing except for the lettuce which began to turn very light brown around the edges. In the window seal everything in there had same little to no mold showing except for the cooked same which began to lose the pink color. In the room temperature as well had little to no mold except for the ham, it started to change color. In the sealed jar no sign of forming mold except for the lettuce started to turn brown. Everything in the freezer no color change as well no mold. In conclusion, my hypothesis was correct I predicted that the lettuce in the sealed jar will grow mold the fastest. It was the first food to show signs of getting old.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

L7

Project  
Number

2005

Title: "Watts" the Efficiency of Solar Cells?

Student Name(s): K. Szczepanski

## Abstract:

My experiment was to try and determine at what angle a solar cell generates the most power. I noticed that many roofs in my neighborhood had solar panels on them. The angles of those roofs and the number of solar panels varied. I wondered what angle was the most efficient for generating power. For my experiment I put solar cells on 4 stands set at different angles (0° or 180°, 30°, 60°, 90°). I took readings at 9:00AM and 12:00 noon for 4-5 days. I left the cells in the sun for 8-12 minutes, then recorded the Volts and Amps for each cell. Using the formula Volts times Current (Amps) equals Power (Watts), I calculated the power generated by each cell. My hypothesis was at 9:00 AM the cell at a 30° would generate the most power due to the low position of the sun and at 12:00 noon the 0° or 180° angle would generate the most power when the sun would be more directly overhead. As a result of my experiment, my hypothesis in both cases were incorrect. At 9:00AM the average power generated (highest to lowest) was 60°, 90°, 30° then 0°/180° and at 12:00 noon, it was 60°, 30°, 90° then 0°/180°. I learned that angle of the solar cells did effect their efficiency but differently than I anticipated. I conducted additional research and discovered that the angle of incidence and latitude, along with other factors I had considered (temperature, environment, etc.) effected the cells efficiency.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET EE PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

216

Fair Category

L7

Project Number

2007

Title: The Effects of Radiation on Yeast

Student Name(s): C. O'Keefe

## Abstract:

Living things are constantly being exposed to radiation. This exposure comes from natural sources as well as man-made sources. Radiation exposure can have both beneficial and harmful effects on living things. This experiment attempts to discover if X-ray radiation has an effect on the growth of yeast. Yeast was chosen as it is a eukaryotic organism and using yeast as a test organism is a safe way to study the effect of X-rays on living organisms. The experiment was completed by X-raying four packets of yeast with different amounts of X-ray radiation. One packet of yeast was not exposed to X-ray radiation this was my control group.

In the experiment the other controlled variables were the temperature of the water, amount of yeast used, amount of sugar added and the storage of the yeast for the duration of the experiment. The independent variable was the amount of X-ray radiation delivered to the yeast. The dependent variable was the amount of gas released.

The results indicate that the yeast that received higher doses of X-ray radiation expanded faster. It was also observed that the yeast with no radiation had a faster initial reaction time.

The conclusion is that the more radiation the yeast received, the faster the yeast grew.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB MI PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

L7

Project  
Number

2008

Title: What Level of Acidity is Best For Growing Simple Plants?

Student Name(s): M. Sadlouskos

## Abstract:

I studied which amount of fertilizer is best for growing simple plants. I researched what level of acidity would be best for a lima bean plant. The purpose of this experiment was to see what amount of fertilizer would be best for a simple plant. My research identified that an acidity level with a range of 6-6.8 would allow the plant thrive most successfully. While conducting my experiment, I used varying amounts of fertilizer in 75g of Organic Potting Soil. This would help me see if my theory of a pH level of 6-6.8 was accurate.

The plants grew in the corner of my kitchen with equal amount of light for each plant. I watered the plants three tablespoons of water every three days. At first nothing was growing in the cups. Then soon after we got some sprouts in the cups that were labeled 0g of fertilizer and 12.5g of fertilizer. Throughout the growing process none of the other plants in any of the other soil/fertilizer mixtures grew. Even the plants in the in the 12.5g of fertilizer weren't as tall as the plants in the 0g of fertilizer. To improve this project in the future I would use smaller and more precise amounts of fertilizer. This could help maintain precise measurement to help plant growth be more successful. This could also help me it could give me more data by having more soil/fertilizer mixtures.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EA EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

L7

Project  
Number

2009

Title: Don't get hooked!

Student Name(s): N. Carrasquillo

## Abstract:

The purpose of this project is to show how smoking affect your lungs. I used a single balloon to represent healthy lungs, double balloons to represent semi-smokers lungs and triple balloons to for unhealthy long-term smokers lungs. I inflated these balloons and measured their circumference. My hypothesis is that, by making the balloons less elastic, it will be more difficult to inflate your lungs. First I blew up one balloon as big as possible in one large breath for four seconds, I held the balloon closed tightly while someone used a tape measurer to find and write down its circumference. I repeated these steps to create a less-elastic balloon (double) and a less elastic balloon (triple).

I built the lung models for each type of lung and used straws to represent the bronchial tubes. I narrowed the straw connected to the less elastic (double and triple) balloons to simulate narrowed bronchial tubes in the lungs by pinching the straw protruding from the less elastic balloon. I pushed and pulled the bottom balloon knot in and out to represent the movement of the diaphragm in the human body. The motion caused air to flow in and out of the balloons in the same way the lungs inflate and deflate when we breathe. My hypothesis was supported; your lungs do become less elastic the more you smoke.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

234

Fair Category

L7

Project Number

2010

Title: How Does Radiation Affect Organisms?

Student Name(s): J. Bonilla

## Abstract:

My objective of study was to see if microwave radiation can affect humans as people suspect. To test this I used yeast, a living organism, to see if microwave radiation would affect it. I predicted at first that exposing cells to microwave radiation would not affect them. For my project I did 3 trials with non-microwaved yeast, 15 second microwaved yeast, and 30 second microwaved yeast. I then put each in a separate beaker and noted how long it took for it to bubble up. After collecting my data I put it into a table to display my results. The main findings of my study was that my 15 second trial yeast that was radiated had higher foam, but the 30 second trial yeast that was radiated had no foam and was killed. My control had an average of 0.5 which meant it was alive. My study answered my research question because from my results I found that the more time that you microwave yeast it will kill it. With my 15 second trial there were more bubbles showing that living organisms can have a limit to how much radiation they can handle. My findings highlight that this might need further research because it concerns our health and well-being. If the microwave killed the yeast after 30 seconds, how would it affect us when heating up our food and killing our nutrients.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV AS PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

L7

Project Number

2011

Title: How different colored lights impact plant growth

Student Name(s): A. Liebskind

## Abstract:

How different colored lights impact plant growth. The lights used were: red, yellow, green, and blue with a white light, control group. Light travels at different size wavelengths and is measured in nanometers. The shorter the wavelength the more energy is produced. The wavelengths were: red at 700, yellow at 570, green at 510, and blue at 450. The hypothesis is the plant exposed to the blue light will grow the most because, it has the shortest wavelength.

Eight seeds each were put into five pots. The control group was put on a window sill. The other four were put into a container, partitioned into four sections to receive the different colored, lights above them. Every two days, all five plants were watered with a 2/8 cup of water.

After 14 days, all eight seeds grew in the red and blue groups versus seven in the yellow, and six in the green. Only four grew for the control group. At the end, the plants were measured in millimeters and compared. The growth were: red 32mm, blue 29, yellow 26, and green 23. The red group grew the most, although it had the longest wavelength. While the green group grew less than the yellow group, even though it had a shorter wavelength.

According to science the blue should have grown the tallest. However, this experiment disproves that statement. The results show that red light and the control, grew the most therefore, colored light wavelength did not prove what science indicates.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

L7

Project  
Number

2012

Title: BITE BRIGHT a Natural Tooth Paste

Student Name(s): M. Marino

## Abstract:

The purpose of this project is to make a healthy, fluoride free natural toothpaste that cleans and protects your teeth.

### Procedure

Step one of test one, is soak tooth one in the Neutral Sodium Fluoride Gel. Next soak tooth two in the Acidic Fluoride.

Step two of test one is to clean tooth three with recipe one. Then clean tooth four with recipe two; next clean tooth five with recipe three. After that clean tooth six with recipe four.

Step three of test one is to stain tooth one with coke, tooth two with coffee, tooth three with gatorade, tooth four in water, tooth five with coke, and tooth six with gatorade. Then wait three days.

Step one of test two is to stain the teeth, tooth one with coke, tooth two with coffee, tooth three with gatorade, and tooth four with water.

Step two of test two is to clean the teeth to see if the fluoride and toothpaste work for cleaning the teeth. Apply toothpaste and leave it for 48 hours, then rinse them with water.

Step one of test three is to first stain four teeth in coffee. Step two of test three is to apply the toothpastes. I will leave them for 72 hours then I rinse them.

Overall my project has been very successful. The toothpastes I created, cleans the teeth, the products are all natural, non-fluoride added, and all are healthy and have superior benefits for the oral hygiene and health.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

59

Fair Category

L7

Project Number

2013

Title: How Much Can You Remember

Student Name(s): S. Levest

**Abstract:**

My hypotheies was correct, adults mind is more developed then a child or teenagers. What I notices about the teenager and children testing is that the teenager had one more word than the children and what caught my attention because then there would have been a tie between the teenager and children. But could the children have beat the teenagers.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

158

Fair Category

L7

Project Number

2014

Title: Which Bioplastic is more Elastic

Student Name(s): K. Kathir

## Abstract:

Bioplastics are natural starch or plant based plastics, rather than generally used petroleum-based plastics. The first plastic ever made is still not degraded as of today. Plastic is harmful to the environment and to natural habitats. Improving tensile strength of bioplastic is a key research question in the bioplastic world. The aim of this project is to test various starch blends and its effects on the durability of bioplastic. The hypothesis tested was bioplastic made from agar alone will have the greatest tensile strength compared to the tapioca starch bioplastic and the tapioca starch and agar blend. These bioplastics were made by optimizing the ratios of the ingredients. The homemade bioplastics' tensile strength was then measured using a spring scale. The agar bioplastic had the most tensile strength, as predicted. The tapioca starch alone had the least one. Hopefully the results from this project will help finding the best type of bioplastic that will preserve our environment.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

146

Fair Category

L7

Project Number

2015

Title: Secret Life of Trees on Sweet Birch Dr.

Student Name(s): D. Gay

## Abstract:

The purpose of the project was to determine the age of trees in my neighborhood and to find out which existed first, the trees or the homes. Did the developer of my neighborhood clear cut the trees? If the majority of trees in my neighborhood are older than the existing homes then the developer did not clear cut the trees. The procedure involved measuring the circumference of 12 various species of trees and using an online tree age calculator to determine their age. The data revealed the trees ages ranged from 67 to 189 years old. After documenting the ages of the trees and researching the ages of homes in the neighborhood, all of the trees were older than the homes on Sweet Birch Dr. The oldest home was built in 1959 (59 yrs old). The developer of my neighborhood did not clear cut the trees.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

194

Fair Category

L7

Project  
Number

2016

**Title:** Larva-B-Gone: A Safer Way To Eliminate The Threat Of Zika And Other Mosquito Borne Diseases.

**Student Name(s):** A. Boudreau

## Abstract:

Mosquitoes are considered as the world's most dangerous animal. This is because they are capable of spreading disease causing pathogens. West Nile, malaria, Yellow Fever, Eastern Equine Encephalitis (EEE), and just last year – Zika Virus. Chemical larvicides placed into aquatic environments can possibly harm other organisms and disrupt the aquatic ecosystem. So I thought why not use plant extracts to act as possible larvicides? *Aedes Aegyptii* eggs were acquired and hatched in growing chambers. The larvae were exposed to 10ml, and up to 50 ml of various plant extracts (geranium, lavender, marigold, and lemongrass). In the containers were also snails, daphnia, and elodea plants to mimic a freshwater pond ecosystem. The results demonstrated that lemongrass began killing larvae at the 10 ml level, whereas the other plant extracts began at higher levels. The lemongrass had an 80% death rate of the larvae. The other plants averaged at 0% to 70% at the 50ml level. the experiment proved my hypothesis that certain plant extracts are able to act as a mosquito larvicide. I think lemongrass was the most effective because citronella that is used in candles and for natural mosquito repellent is made from lemongrass.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM PS ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

L7

Project  
Number

2017

**Title:** Hitting All the Right Notes: Unlocking the Formula to Oscar-Winning Original Songs

**Student Name(s):** M. Porcello

**Abstract:**

Abstract

The way our brains process music is complex. The auditory cortex interprets music differently from talking or noise. Other areas of the brain trigger chemical reactions and emotions that cause individual responses to music. This study looks at whether, despite all of the different genres, hundreds of thousands of new songs released each year and unique ways music is processed by each person, there is a formula to determining a successful song.

Using the Oscar for best original song as the definition of a successful song, seven independent variables were analyzed, including musical tempo, key, genre, song length, song topic, vocalist(s) and the popularity of the movie where the song appeared. Oscar-winning songs for the past ten years were examined for each of these seven variables, then compared against songs that were eligible for an Oscar but did not win. The analysis included listening to each song multiple times, then checking findings such as tempo, key and lyrics using outside sources.

The data showed a clear pattern. Despite the subjective nature of how individual brains process music, there is a formula to writing music that is more likely to win an Oscar for best original song. This formula includes a 4/4 time signature for a slow pop song lasting more than 220 seconds, and being associated with a successful movie. Further research could include a larger control group, or even expand the test to include other awards. For the Oscars, it is possible to hit all the right notes!

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BE MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

L7

Project Number

2018

Title: Hydroponics – A World without Dirt

Student Name(s): A. Drago

## Abstract:

When I wanted to start a hydroponic garden, I wondered, when using the Nutrient Film Technique (NFT), which hydroponic medium; Rockwool, coco, or expanded clay works best to grow lettuce hydroponically. I hypothesized that if I use the NFT to test hydroponic mediums to grow lettuce then I will find that expanded clay works the best.

For my experiment, I built an indoor NFT hydroponic system. I used a grow light and added Nutrient Solution to the water to supply the nutrients that the mediums lacked. A pump was left on to provide a steady stream of water for the roots and I tested the pH of the water weekly. Each lettuce seed was treated with the same amount of Nutrient Solution, water, and light throughout the whole experiment. The growing mediums varied for each seed to determine which helped the lettuce to grow the fastest.

The results of this experiment proved my hypothesis incorrect. They show that Rockwool resulted in the fastest germination, the most leaves and the heaviest plant. Coco and expanded clay were very close behind.

In conclusion, Rockwool helped the lettuce grow the fastest, expanded clay was second fastest, and coco grew the slowest. However, there was not a large variance.

In the future I would like to conduct this experiment outside to see how the weather effects the results. I would also like to grow strawberries hydroponically.

I would like to thank the staff at Grow RI and my Father for assisting me.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

L7

Project Number

2019

Title: Rethink Your Drink

Student Name(s): A. Brogdon-Hill

## Abstract:

Our teeth are white by nature, but because of the food and drinks we consume are teeth become discolored. Just like an egg our teeth contain calcium and other similar minerals. A beverages acidity, chromogens, and tannins are the things in food and drinks that causes the stains. The acidity eats away at the enamel making it easier for the chromogens to stick to the surface of your teeth. Once the stains start and are not cleaned off right away the stains and damage gets worse. Toothpaste and mouthwash manufactures are always trying to come up with ways to sell products that are supposed to help remove the stains and prevent further damage. The purpose of this experiment is to find out which one of Americas favorite drinks will stain or cause the most damage to our teeth and the fastest. In this experiment I used egg shells to represent our teeth. In this experiment seven of Americas favorite drinks were used to put our teeth (eggs) to the test. The drinks that were used were black coffee, black tea, orange sports drink, grape juice, Coca-Cola, tomato juice, and water. At the end of the experiment the most damage was done by the grape juice followed by the sports drink and tomato juice. Out of all these drinks used in the experiment good old fashion H2O left no stains, or caused any damage to the egg. Water has again proved that it is the best drink for you.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

116

Fair Category

L7

Project Number

2020

Title: pH Filtered Mussels

Student Name(s): N. Hockley

## Abstract:

This project is about seeing blue mussels filter out algae in different set pH salt waters, pH 7 was filtered out best of the three pHs I selected. My hypothesis was said to be pH 8, I was proven wrong by a big difference in orange and a small difference in red and green. Ocean acidification is still a big problem that is wished to be slowed by hopefully mussels and their awesome ability to filter out algae and acid from the water. Although ocean acidification is breaking down mussels, they will fight and filter. To finish off the project blue mussels filter out best in base sea water (pH 7), are affected by ocean acidification.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AS EA EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

L7

Project Number

2021

Title: Can Pseudomonas Putida reduce pollution by biodegrading (VOC)'s

Student Name(s): K. Kothari

## Abstract:

The problem that my experiment is trying to solve is reducing the amount of pollution in the air by biodegrading (VOC)'s using pseudomonas putida. My hypothesis is that the pseudomonas putida will be able to biodegrade all the dosages of methanol.

In my experiment I placed 1ml of 10% methanol in nutrient agar plates with my pseudomonas putida in it three times. Then I did the experiment again except this time increasing the dosage of (VOC) to 1ml of 20% methanol and repeated that three times. After that I did the experiment one last increasing the dosage to 1ml of 30% methanol. Then I let the plates sit in a incubator for several weeks and observed them.

The results of my experiment were good overall as the pseudomonas putida biodegraded the 10% and 20% Methanol well and was able to make colonies on it as a food source. The third part experiment was a failure however though as I predicted that the pseudomonas putida would biodegraded all the dosages of methanol the pseudomonas putida could only handle the 20% methanol and could not biodegrade the 30% methanol. The results of my experiment show the capabilities of pseudomonas putida making the earth greener.

My experiment will help make the earth greener and a safer place for all living organisms.

Thanks to this experiment if this information get taken to account the world could a lot more cleaner therefore helping reduce the amount of pollution in the air.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MI EV ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

L7

Project Number

2022

Title: Green Tea: A Simple "Solution" for a Bananas Problem?

Student Name(s): G. Flynn

## Abstract:

Bananas may become extinct unless ways are found soon to control Panama Disease, which kills banana plants through vascular damage. The purpose of this experiment was to test if a green tea solution could protect the vascular system of a monocot (bananas are monocots). Because it is difficult to grow bananas in the winter in Connecticut, the experiment used wheatgrass, which has a vascular system comparable to the vascular system of bananas. The hypothesis was that antioxidants in green tea would protect monocot vascular systems. The experiment used salt water, which causes vascular damage, to simulate plant disease in three four-tray trials in which plants were watered twice daily with 20 ml of varying solutions. Tray A was watered with water, tray B was watered with water and green tea, tray C was watered with water and salt water, and tray D was watered with green tea and salt water. Plant height, color, and other observations were recorded twice daily for ten days. The results of three trials supported the hypothesis that green tea protects monocot plants from damage. The plants watered with green tea (B&D) grew more than the plants that were not watered with green tea (A&C). Significantly, green tea appeared to have a more beneficial impact on plant health in the salt water trays (D versus C) than in the control set where salt was absent (B versus A). Further research is needed to determine whether the protection green tea provided wheatgrass will similarly protect banana plants.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

247

Fair Category

L7

Project Number

2023

Title: Is That Granite Radioactive?

Student Name(s): S. Montalto

## Abstract:

Rocks such as granite, emit radioactive elements like radium, uranium, and thorium. If present these elements decay into radon which is released from the granite over time. Ionizing radiation releases so much energy it can affect atoms in living things. This radiation can damage cells, cause cataracts, interfere with human reproduction, and cause cancer. The granite bedrock making up most of Westerly is newer granite, which is high in radioactive material. The purpose of this experiment was to see if living in Westerly presents a potential health risk from increased radiation exposure. This was also my hypothesis. I found that my hypothesis was somewhat true since only one quarry had potential health risks. For this experiment, granite quarries in Westerly were visited on three different days, and radiation levels of granite were measured with a geiger counter. North Quarry had the highest average counts per minute (CPM) by far measuring 63.33. Bradford Quarry was next with 29.67 CPM and right behind was Quarry Hill with 29 CPM. North Quarry is an active quarry. Excavation and grinding of granite releases more radiation into the air resulting in higher counts per minute. When compared to the Environmental Protection Agency's safe radiation guidelines, it was determined that the North Quarry's radiation level of 63.33 CPM exceeds the safety threshold of 50 CPM. From this study, exposure to granite with higher than normal levels radiation are possible in Westerly therefore, chronic exposure to this granite may present health problems in humans.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

254

Fair Category

L7

Project Number

2024

Title: Artificial Turf

Student Name(s): A. Hall

## Abstract:

The problem/question being addressed in Artificial Turf is, does artificial turf used on athletic fields chemicals that can give people diseases such as cancer. If testing whether artificial turf can give people diseases such as cancer, I predict that it can, especially if soccer players are falling and swallowing some of the artificial turf. In this project, I will have water and 70% ethanol(alcohol) in separate containers to boil the artificial turf(fake grass)in. Then, I will take 10ml and 20 ml of each extract and put it each into separate containers of daphnia(water flea). I will observe the daphnia and look for adverse reactions, such as death of the daphnia, slowing down of heart rate, and slowing down of the movement. I will repeat these 2 additional times. The water and the artificial turf extract killed 0% of the daphnia after 10ml were added while the alcohol killed all the daphnia with 10ml. When 20ml of the artificial turf water extract was added, 60% of the daphnia were killed. Whereas, the alcohol and artificial turf killed all of them again. I concluded that my hypothesis is correct. My hypothesis states that the alcohol extract will hurt more daphnia than the extract made from water and artificial turf only. This is because alcohol pulls out more of the toxins and different toxins than just plain water. If I would do this next time, I would change the organism I used. I would use a more human like organism that could be compared to us more like a mouse.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV EM ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

L7

Project Number

2025

Title: An Analysis of Nitrogen and Phosphate Fertilizer on Algae Growth

Student Name(s): A. Lichtenberg

## Abstract:

Nitrogen and Phosphate are often used in fertilizers to promote plant growth. These nutrients can wind up in lakes and ponds when there is water runoff after it rains. The increased amounts of these nutrients can have devastating effects on the environment, creating algae blooms. When there are algae blooms, and the algae die, microbes break down the organic matter and take in oxygen. When this happens, the pond or lake can become anoxic (have a low oxygen concentration) near the algae blooms, harming the animals that live there. While both types of fertilizers have been implicated in algae blooms, Schindler et. al. (2016) found that in environmental studies, Phosphates are more harmful to the environment than Nitrogen. To further investigate the relative impact of the two fertilizers, the current study compared 1% solutions of Nitrogen and Phosphorus fertilizer to a control group with no added fertilizer. It was hypothesized that Phosphates would foster more algae growth than Nitrogen, and both conditions would create greater algae growth than a control group. Equal amounts of Chlorella Algae were added to the 1 % solutions and algae growth was measured over the course of 10 days. The algae population increased the most in the Phosphate condition compared to the Nitrogen condition and both fertilizer conditions showed a greater increase in algae growth than the control group, proving the hypothesis. It appears that Phosphate fertilizer increases algae growth more than Nitrogen fertilizer. Implications for the environment, environmental policy, and future research are discussed.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EM EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

187

Fair Category

L7

Project Number

2026

Title: The Effect of Music on Memory

Student Name(s): G. Allen

## Abstract:

Many people listen to music. About 79% of students usually listen to music even while they study for a test or when they do work. The purpose of this project is to find out if music actually helps you remember things. Classical music will most likely help the retainment of information. Each test subject was given 10 random words while listening to Rimani by Mattia Cupelli, wait exactly one minute, then the song was restarted, and the test subjects were asked to repeat the words. Then, the subject was given another 10 words, this time without music to remember it by. The subject waited a minute, then they recited the words they remember. The amount of words remembered with and without music was recorded. In 71% of the people tested, music did indeed help memory. In the other 29% people, there was no difference in the retainment of memory. Either way you look at it, music doesn't hurt memory. In some people, it helps. But you should listen to music while you study, because it can even give you motivation to do what you need to do.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

192

Fair Category

L7

Project  
Number

2027

**Title:** The Effect of an Acidic Environment on Flower Seed Germination

Relevance to Seed Dispersal by Animals

**Student Name(s):** R. Pelletier

**Abstract:**

Seed dispersal is a process where animals spread seeds, often fruit seeds, by eating them and depositing them in locations away from the plant in their feces. For successful spreading, the seeds need to be able to survive passing through an animal's stomach. In this project, the effect of an acidic environment on Zinnia seed germination was investigated to try to answer the question of whether flower seeds could survive when they are ingested by and pass through an animal and by spread by seed dispersal. Commonly available acidic liquids, orange juice and Coca Cola, were used to simulate the acidic environment of an animal stomach. Zinnia flower seeds were used because of their very quick germination time. Incubation of Zinnia seeds overnight in orange juice, Coca Cola, or water (control) was followed by germination in wet paper towels in plastic bags over several days. The number of seeds germinating in each bag was counted every day. Results from two experiments showed that incubation in acidic environments did not stop the seeds from germinating. This result provides support for the idea that flower seeds could survive being eaten and dispersed by animals

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS BI EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

L7

Project Number

2028

Title: The Investigation of Acidity on Zebra Mussel Shells *Dreissena Polymorpha*

Student Name(s): K. Crowe

## Abstract:

Species are being affected by the amount of acidity found in ocean and estuarine waters. Acidity affects species in different ways. The purpose of this experiment was to determine how acidic water affects mussel shells. To test this, I conducted an experiment on the invasive species Zebra Mussel, *Dreissena Polymorpha*. In order to conduct this experiment, I reached out to Dr. Wagener at West Connecticut State University to gather the Mussel shells. In the experiment, the 20 shells were organized into groups; Group A and B. Group A; the control, was put into spring water, while Group B was put into acidic Spring water with a higher pH. I made the water acidic by blowing through a straw into the plastic bag; the Carbon Dioxide from my breath creates acidity. Studying the effect of acidity, the most progress would show if these shells were left in plastic bags for 5 days. Group A was 2.5 grams all together before the experiment, and was 2.4 grams after. Group B was 5 grams all together before, and was 3 grams after (same). Moreover, the results of this experiment shows that the acidity does, in fact, affect *Dreissena Polymorpha* shells by dissolving them. Carbon Dioxide, once submerged in ocean water, turns into carbonic acid. The high levels in ocean water lower the pH and there's less carbon for the species to use for shell building. This dissolves Calcium Carbonate in the *Dreissena Polymorpha* shells. This experiment could've been improved by using salt water from the sound.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EA AS EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

183

Fair Category

L7

Project Number

2029

Title: The Effects of Weather on Warblers in Putnam CT

Student Name(s): C. Farquhar

## Abstract:

This project investigated the effects of weather (monthly average high temperature and monthly total rainfall) on warbler populations in Pomfret, CT from 2001 through 2010 in the months of June, July, and August. The hypothesis of this study was that higher monthly rainfall and lower daily average temperatures during these months would be associated with higher number of birds. The data used for this project was obtained from MAPS (Monitoring Avian Productivity and Survivorship) data acquired by Professor Carol Millard of the University of St. Joseph's from the MAPS station at the Connecticut Audubon Center at Pomfret. A total of eight warbler species were selected from the data for analysis. Average daily high temperature and average daily rainfall for the months of June, July, and August 2001 through 2010 were obtained from historical weather data on the website Weather Underground. The total number of warblers captured each month were graphed versus average daily high temperature and versus average daily rainfall. It was observed that the number of warblers captured varied most with the month of the year more than with rainfall or temperature.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

215

Fair Category

L7

Project Number

2030

Title: Extracting Carbohydrates From Tubers

Student Name(s): A. Joyner-Cross

## Abstract:

Which tuber has the highest level of starch? If I extract starch from white potato, yam, and cassava, then the cassava will have the highest level of starch because it is the most dense out of the three, which means that the Cassava is more likely to yield more starch. The purpose of this experiment is to see which out of the three chosen tubers has the highest level of starch. I decided to do this experiment as a result of my growing curiosity in learning which foods were rich in starch. When the Cassava was processed in the blender and strained, it tended to dry faster. The White Yam took a longer time to separate from the water and dry out. However, the Idaho Potato was slightly different, for when the water and the starch separated the water color would change from an off-white colour to a dark red. It was later discovered that when a potato is cut a potato, you are breaking the cell wall and a chemical reaction occurs when the acidic component (phenols) along with the enzymes meet the oxygen, the potato turns pink. My experiment proved my hypothesis correct because the Cassava yielded 76.67 ml, the Idaho Potato yielded 63.3 ml, and the White Yam yielded 60 ml of starch.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

227

Fair Category

L7

Project Number

2031

Title: WHICH HEALTHY SNACK HAS THE MOST DNA?

Student Name(s): H. Langer

## Abstract:

All living things contain DNA. The DNA is found in the cell nucleus. By extracting DNA you can find out how much DNA are in certain types of cells. The question I wanted to answer was which of my favorite fruits and vegetables have the most DNA? My favorite fruits are strawberries, and blackberries. My favorite vegetables are potatoes, onions, brussel sprouts and spinach. My hypothesis was that onions had the most DNA. The method I used was modified from a method by the University of Utah, and included the following steps: isolate cells, break up membranes with detergent, break apart the DNA from proteins with enzymes and precipitate DNA by adding alcohol. I ran the experiment using kitchen tools. In addition to my favorite fruits and vegetables, I used peas as a control. For each test I used the same starting weight of 100 grams. The results showed that spinach and peas had the most DNA. Sweet potatoes had no collectable DNA. Onions had a medium amount of DNA. My hypothesis was not correct. The peas are seeds and have a lot of DNA because they have very little water in the cell cytoplasm. Onions have less because they have a lot of water in the cytoplasm. Spinach is not a seed, but maybe spinach has a lot of DNA because it has lots of chlorophyll.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

L7

Project  
Number

2032

Title: Eco-Friendly Preservation of Vegetables

Student Name(s): B. Prusak

## Abstract:

The purpose of this project was to develop a simple and ecological way of drying vegetables for long-term storage without food preservatives. Dried food can be stored for a long period of time because it does not contain moisture; therefore it is not a good host for bacteria and mold, and it will not get spoiled. Based on the references, the mineral iron will not be reduced. The experiment was done using sliced carrots. When dried, there was no sign of mold development, rotting, or smell. They stayed orange, but turned a bit brown on the edges. Thin slices took less time to dry than thick ones because they contain less water, which evaporates through the surface. The experimental drying times were longer than those reported in the references, which indicates that the slices used in the experiment were thicker than the slices used in the references, which were not specific about the thickness. Drying speed, which was observed by weight loss, was fastest at the beginning of the drying process and was the same for all thicknesses investigated. It then slowed down until no weight loss was observed anymore. The drying time of a carrot slice depends on its thickness; the thinner the slice, the faster it dries. The experiment showed that preservation of vegetables can be accomplished in an eco-friendly way, using only ambient air and no special equipment or special sources of energy.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME BI EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

232

Fair Category

L7

Project Number

2033

Title: Pharmaceuticals in our water: How can these hazardous chemicals be filtered?

Student Name(s): K. Parikh

## Abstract:

The purpose of this experiment is to engineer a process to mediate the alkalinity and acidity levels in 20%mol pharmaceutical soluted water. Finite runs were performed on four samples each starting at 25deg-C but requiring constant exposure to heat to ensure the full solution of pharmaceuticals after each removal procedure was performed. Each sample contained 4%mol caffeine ( $C_8H_{10}N_4O_2$ ) 4%mol acetylsalicylic acid ( $C_9H_8O_4$ ), 4%mol ibuprofen ( $C_{13}H_{18}O_2$ ), and 4%mol acetaminophen ( $C_8H_9NO_2$ ). The exerted removal processes included cold water extraction (water temp reduced to 2.5deg-C), sedimentation using potassium aluminum sulfate ( $KAl(SO_4)_2$ ), adsorption using activated carbon, and distillation (water temp increased to 100-120deg-C.) The values obtained for each procedure was successful per each trial, which allowed the alkalinity and acidity to be mediated to a potential hydrogen level of 7, proving each method equally successful. The average time for each one was 25:46 minutes for cold water extraction, 15:45 minutes for potassium aluminum sulfate sedimentation, 10:00 for carbon adsorption, and 10:33 for distillation. The most time efficient method undeniably proved to be the carbon adsorption method proved to have no alternate major fluctuations with time rates ranging form 9:56-10:09 minutes. Carbon adsorption also was the most economically efficient, with an estimated cost of about 17% of the amount that is currently being spent on development and implementation of carbon based chemical filtration systems, about 2,300,000 USD.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

L7

Project Number

2034

Title: Accelerating Plant Growth

Student Name(s): J. Fields

## Abstract:

My science fair project was meant to test the effects of certain chemicals/plant foods on the growth of plants. The chemicals/plant foods I used were egg shells, coffee grounds, Miracle Gro, BioSafe, and a control group with nothing in the soil that the plants were growing in. I used two tablespoons of each plant food except for Miracle Gro, which I used one tablespoon of, as I thought that could stop the plant from dying. For the plants I decided to test on, I used 15 sugar snap pea plants, 3 with each chemical. I kept them in a closet and watered them every other day, starting with one quarter cup of water, and the a half cup as they proceeded to get larger. After I was sure that all of the plants that were going to grow had started to, I began measuring them every five days. The stronger chemicals, which were Miracle Gro, and BioSafe, killed the plants, though a couple did start to germinate, but died after that. I conducted this experiment in my closet, providing a confined space for the plants to grow, that would have no change in any variables except when I went in to water and observe them. I had three overhead lights with a twelve hour timer to represent a day/night cycle. The remaining plants which had eggshells and coffee beans in their soil, showed little to no difference to the plants without anything to speed up their growth.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EA EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

111

Fair Category

L7

Project Number

2035

Title: Meat Eater

Student Name(s): L. Tuck

## Abstract:

This project was performed to determine if the acidity in soda can dissolve meat. Four types of soda were used, first recording the pH of each. Then pieces of beef were placed in separate bowls, each filled with 236mL of Coca Cola, Root Beer, Pepsi, and Dr. Pepper. The meat will be inspected after soaking for 2 hours. Pepsi reduced the size of steak the most even though Pepsi did not have the highest acidity level. In conclusion, some sodas (Coca Cola and Pepsi) reduced the size of steak while the others did not. Although Root Beer had the highest acidity level, it did not reduce the size of the steak.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BI CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

181

Fair Category

L7

Project Number

2037

Title: Earth, Water and Flora: Reducing Soil Erosion

Student Name(s): A. Gutierrez

## Abstract:

Soil erosion can cost the world billions of dollars every year by washing pollutants into our streams and rivers and by causing the loss of farmland. This project looks at various plants to test if they have an impact on reducing soil erosion. Focusing specifically on erosion caused by rain. Three different methods were used in this erosion experiment. Method one used Radish plants. Method two used Cat Grass plants. Method three used only soil. This was the Control Group. The results were measured by the amount of soil (weighed in grams) that eroded from the container. My hypothesis was that the Radish plant would cause less erosion than the Cat Grass plant. The experimental results supported my hypothesis, meaning it showed that the Radish plant had an incredibly low soil mass average when compared to the control group's soil mass average. However, this experiment also showed that the control group had a lower soil mass average than the Cat Grass, which I did not expect. Soil erosion destroys plants, which are valuable to our ecosystem, this experiment can reduce it.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

158

Fair Category

L8

Project Number

2501

Title: Hydroponics: Floating or Flowing?

Student Name(s): C. Rego

## Abstract:

I conducted this experiment to observe the affects that two types of hydroponic systems, Raft and Nutrient Flow Technique (NFT), had on the growth rate of Romaine lettuce. I hypothesised that Romaine lettuce plants grown in the NFT system grow more leaves and gain more weight than the lettuce grown in the Raft system. I setup the two systems with 5 starter plants each. To determine the growth rate, I measured each plant's weight and counted the number of leaves on each plant, each week for four weeks. The average Raft plant gained 6.2 grams of weight and grew 6 leaves between weeks 1 and 4. The average NFT plant gained 0.6 grams of weight and grew 4 leaves between weeks 1 and 4. My hypothesis was not supported by these results, the lettuce grew better in the Raft system. The NFT system was homemade and I suspected that it did not supply enough water to the lettuce.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

153

Fair Category

L8

Project  
Number

2502

Title: The Effects of Smell Loss From Perfume Based on Age

Student Name(s): K. Casey

## Abstract:

The hypothesis of the experiment was that adults would be able to detect more perfumes before olfactory fatigue occurred than teens. Olfactory fatigue is the temporary inability to distinguish a scent after a long exposure to the scent. The purpose of this experiment was to test the difference in smells depending on age. There were two different groups used in this experiment. One group was made up of adults and the other group was made up of teens. All the test subjects were given six different perfumes and were told to smell each perfume for sixteen seconds. The test subject were asked to say when and if they could no longer detect a difference between the perfumes. There was a difference in the amount of perfumes adults and teens could smell before temporarily losing their sense of smell. Adults could smell more perfumes before they temporarily lost their sense of smell than teens.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH CB BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

186

Fair Category

L8

Project Number

2503

Title: How does Sodium Polyacrylate affect the growth of a plant?

Student Name(s): A. Cheela

## Abstract:

Sodium Polyacrylate (also known as waterlock) is the main chemical used in baby diapers for its water holding property. This super-absorbent polymer has enough power to hold about 200 to 300 times its mass in water. The same chemical is also mixed in many commercially available potting soil for containerized plants, assuming it will help grow the plant by holding water, but what if they're making a mistake. My project is to test whether this polymer can harm the growth of the plant in any way. I believe that although many people use this polymer to soak up water in the plant, I think it can harm it as well. The experiment was conducted by opening diapers and taking out the polymer and testing it on a plant. We put the substance in one plant and put an equivalent amount of water in both everyday. Then each day I recorded the data for each plant and compared it. I observed this for over a month and have seen that the plant with the Sodium Polyacrylate has a significant decrease in growth than the other plant.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

260

Fair Category

L8

Project Number

2504

Title: A Novel Method for Oil Spill Cleanup Using Biomass

Student Name(s): A. Bhagavatula

## Abstract:

Oil spills occur with an alarming frequency and have serious environmental and economic consequences, as witnessed in the BP Deepwater Horizon oil spill and other pipeline leaks. They severely damage aquatic ecosystems, while contaminating water sources. Current remediation solutions include the usage of synthetic sorbents and hard booms, in-situ burning, skimmers and dispersants. These solutions, while effective, are expensive, and have an adverse impact on the environment, as the materials are difficult to dispose.

I investigated the usage of biomass such as pomegranate husk (“PH”) and orange peels (“OP”) as alternative sorbents in booms. To simulate different oil spill environments, I tested oil removal ability in freshwater and saltwater at different temperatures: Cold(37F), Room(68F) and Hot(87F).

I first conducted tests using vegetable oil in freshwater and saltwater to find Optimal: (1)Size and consistency of biomass; (2)Time for maximum oil removal (3)Sorbent weights for PH, OP and PH&OP mix. Using the optimal conditions derived above, I tested motor oil removal ability at different temperatures.

PH, OP and the PH&OP mix removed oil very effectively, averaging about 2x to 3x their weight in freshwater and saltwater. Best results were obtained with ¼inch pieces of fresh biomass after 50 minutes. The PH&OP mix was most effective in removing motor oil, particularly at room and cold temperatures. Vegetable oil was removed most effectively in cold temperatures. All sorbents performed better in saltwater.

In conclusion, biomass like pomegranate husk and orange peels can be used as an inexpensive, environmentally friendly solution for oil spill remediation.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV EM EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

L8

Project  
Number

2505

**Title:** Conserving Food in the Desert  
Ecological Refrigerator

**Student Name(s):** M. Grajales

**Abstract:**

This project will test the conservation of fruits in two different environments. The intention of this project is to create an ecological refrigerator to save energy and at the same time use this device in places where you might not find electricity. In this experiment oranges, tangerines, limes, and grapes were used. What you do is take two clay pots and fill the large pot with sand one fourth of the way full so that when you put the other clay pot in it they will both be leveled. Continue filling the container up with sand, moisten the sand with water, put your fruits in, and finally take a wet cloth and put it on top of this container so that the whole thing is covered. Use the same type of fruits placed in the container and put them on the plate. You want to do this so that you can see which one of the two, either the container or plate, conserves the fruits the best. The ecological refrigerator will resemble a cold refrigerator type of environment for the fruits because the moistened sand will make the other pot cooler. While the plate will just expose the fruits to the environmental conditions of a hot and dry atmosphere. A conclusion obtained in this project shows that the most effective way to keep your fruits fresh is to use the container built because it is a cooler environment for the food despite the hot and dry climate around it.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

L8

Project  
Number

2506

Title: Are You Throwing Away Your Money

Student Name(s): G. Fanelli

## Abstract:

The purpose of this experiment is to determine which garbage brand/type can hold the most weight before reaching its critical breaking point. For this experiment, a custom made bag holding apparatus was created to lift a bag off the ground without damage in any way. Sand was used to represent the weight added to each bag which was in 1.5lb increments. This experiment was a time consuming process. For every bag tested that didn't rupture, a new bag (on ground) was placed underneath the bag that was currently holding the sand to essentially start the experiment over with a new bag. Then, a hole was popped into the bag with the sand and it drained into the new bag below it. This process was repeated with the different bag types/brands until each individual bag broke. As a result of this experiment, it was discovered that the Husky Contractor Clean Up Bag was able to carry the most weight at 420lbs. The HDX Drawstring Kitchen Bag carried the least amount of weight at 40.6lbs. This was the outcome because the Husky bag was the thickest bag out of every bag tested (3mil) and it has the most surface area; therefore it held the most weight. The Husky Contractor Clean Up Bag, Hefty Ultra Strong BlackOut Tall Kitchen Drawstring Bag and the HDX Extra Large Trash bag are great for their purpose depending on what you need them for and how much weight is intended on going inside the bag

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

L8

Project  
Number

2508

Title: Lights! Beans! Action!

Student Name(s): D. Vieira

## Abstract:

Lights, Beans, Action! discovers which light wavelengths creates fastest bean plant growth aiding farmers in providing quicker growth rates of plants without using chemicals.

My hypothesis was bean plants under UV light would grow fastest. UV wavelengths are shorter, rendering more energy, therefore stimulating growth and height.

I built a terrarium and grew kidney bean plants under five different wavelengths: red, blue, UV, green, yellow and a natural light control. Plants were watered and measured as they grew.

Plants under red or blue lights didn't grow. Plants under control, UV and yellow grew slightly and plants under green grew most. The green light, which was expected to have no effect, yielded the largest plants.

In conclusion, although research supports my hypothesis, my results did not, as the green light provided the greatest growth, not UV. Learning from errors makes me believe if I repeated the experiment, I would find success. I learned how different lights provide different wavelengths, which have different effects on growth rates. I also learned how to perform an experiment, troubleshoot for errors and create a better experiment in future trials, as my experiment didn't provide the expected researched results.

In the future, greenhouse-like buildings would have lights in only wavelengths installed over plants assisting in faster growth. Additionally, natural sources, i.e. solar panels, wind turbines or hydropower would provide electricity powering the lights. This way, no harm comes to the environment, plants grow faster and farmers and consumers are happy!

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

170

Fair Category

L8

Project  
Number

2509

Title: Growin' in the wind

Student Name(s): T. Schloss

## Abstract:

In my experiment, I tested how mechanical stress due to exposure to wind affects the growth of *Ocimum basilicum* plants over a 5 week period. I subjected the plants to mechanical stress by placing a fan in front of them. Upon doing background research, I found that the term 'thigmomorphogenesis' is the process through which plants react to wind and structural stress by altering their growth patterns, causing the plants' stems to become thicker and shorter to aid in staying upright. At the beginning of the testing period, I had hypothesized that the plants that were subjected to wind would respond to altering their growth patterns in order to grow their stems thicker and shorter, in order to be more structurally sound and adapt to their conditions. My data showed that on average, the plants exposed to wind grew up to 8.12% taller and 3.52% taller. I came to the conclusion that my hypothesis was correct and found that growing plants while they are under stress mechanically promotes stem growth.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EV EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

214

Fair Category

L8

Project Number

2510

**Title:** Ecological Consequences of Artificial Night Lighting on Drosophila and Their Nocturnal Predators

**Student Name(s):** E. Heaphy

**Abstract:**

Recently, many towns in the New Haven area have begun using LED bulbs in street lighting. However, it is unknown if this type of lighting can have harmful effects on the environment. In this experiment, drosophila were used to examine whether this type of light can affect the nocturnal food chain. Drosophila are a food source for frogs, bats, spiders and other insects. If the drosophila and other prey are drawn towards this type of light, then it might take them away from their nocturnal predators that are unwilling to go near the light. I hypothesized that the LED lights would attract the most drosophila because of their blueish tint and their non-sunlight appearance. For this experiment, I set up a container that would effectively hold the drosophila and separate the eight different types of light. They could simply fly to whichever light attracted them the most via holes in the dividers. At the end of the experiment, most drosophila flew towards the eco-halogen and florescent lightbulbs, while staying away from the LED and tinted bulbs. It can be concluded that the LED night lighting will not draw drosophila to it, and though it may have other effects on the environment, it will not take drosophila away from the nocturnal food chain.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV EM AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

185

Fair Category

L8

Project  
Number

2511

Title: How age affects memory

Student Name(s): A. Jindal

## Abstract:

Thousands of memories are created and remembered during the whole lifespan of humans. I conducted a research study on how age affects memory. I chose this topic because the vast interpretations of memory really fascinate me. My hypothesis was, as the age of humans increase, then their memory capacity will decrease. I did a lot of research finding just the right game that would assess how sharp a person's memory is. I went from classroom to classroom meeting new people and having participants play the game. I simply collected their score and age for my data to later create a chart. After analyzing the information, I was able to see that fourteen year old kids had the highest percentage, thirteen year old students had the lowest score, and the older adults were in the middle. I learned that there is a specific turning point where the ability to remember begins to slow down. That age is somewhere in the thirties depending on person to person. To make this project more successful next time, I will try to attain data from a variety of age groups.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

187

Fair Category

L8

Project  
Number

2512

Title: Digesting Medication

Student Name(s): A. Guzauckas

## Abstract:

The purpose of my project is to help educate other people with myself included on how long to expect regularly taken NSAIDs to start working. If I test how long it takes for Naproxen, Ibuprofen, and Aspirin to dissolve in lemon juice then, Naproxen will take the shortest amount of time. For my experiment I will heat up lemon juice to the temperature of the bodies stomach acid and then in each separate jar I will put my three different pills and time to see how long they completely dissolve. The quantitative data I collected was the times that each pill took to dissolve. This data helped me to conclude that Aspirin took the shortest amount of time and also Naproxen took the longest amount of time. The qualitative data I collected was what happened during the time dissolving and then what it looked like after. The next step is to see how different types of pills such as gel and coated take to dissolve, or also different brands of the same kind of pill to see if these kinds of brands and pills affected my experiment.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

L8

Project Number

2513

Title: Hydroponics vs. Fogponics

Student Name(s): R. Abirached

## Abstract:

The purpose of my experiment is to prove whether pea plants grow faster using Fogponics or the Hydroponic Kratky method. Fogponics is an advanced form of aeroponics, which uses water in a vaporized form to transfer nutrients and oxygen to enclosed, suspended roots. Hydroponics is the process of using a nutrient rich solution of water where plants roots are submerged in the solution. My hypothesis was that Fogponics will have better growth results than the Hydroponic Kratky method. The advantage of using both Fogponics and Hydroponics is that they use less water versus traditional soil gardening, and the fertilizer can be better controlled. There are various benefits reaped from growing plants using Hydroponics and Fogponics - there is no need for soil, water can be recycled, and the amount and type of nutrients required can be specifically controlled to suit the plant. For my experiment, I grew four pea plants in each system over four weeks. The data collected indicated that Fogponics was more efficient and had better growth results than the Hydroponic Kratky method and soil (control). The pea plants grown using Fogponics had the growth height average of 8.45 cm and the Hydroponic Kratky method averaged 8.15 cm. The control group with soil had the shortest growth height average of 7.3 cm. My hypothesis was supported. In places with insufficient arable land, fruits and vegetables can be grown in sufficient quantities. As our global population increases, the concern over water and soil quality continues to grow.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

171

Fair Category

L8

Project Number

2514

Title: Lactobacillus In Yogurt

Student Name(s): J. Campisi

## Abstract:

The Purpose of the experiment was to find out what yogurt is the healthiest for you. When I did the project I first used 4g of NaCl and 18g of KH<sub>2</sub>PO<sub>4</sub>, and 500g of water and mixed it all together for our buffering. After that I put one ml of the buffer in fifteen test tubes. Then I used a syringe to take one ml of the yogurt, then put the one ml of the yogurt into a test tube with the buffering and shook it. After that I took the same test tube and took out another one ml out of the test tube and put it in a new tube. I repeated this five times for each yogurt. Then I took the syringe and put one ml of each yogurt and put it into a nutrient agar plates then put all the tubes in the incubator. In conclusion the three yogurts I used Siggi's had the most probiotics in it they're for making it the healthiest out of the three.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MI ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

L8

Project Number

2516

Title: Homemade RC Plane

Student Name(s): M. Krauss

## Abstract:

If you have ever had children that lived in your house then you probably have had a remote control helicopter or plane that is barely used. So I decided to create an RC plane out of a broken RC helicopter that I had in my house. I wanted to do this because I thought it was a fun way to create something out of materials that you can find in your house that could have no purpose and have a fun educational time at which you create your own plane. To do this I had to understand how a plane flies and how a plane should be created to allow the best performance. After learning the necessary information about planes, I had to physically express what I learned in an actual plane. To do this I carefully extracted the motors from one of my helicopters and attached propellers to it to represent the turbines. Then I attached it to my plane model that is made out of a corrugated sheet and finally took it outside for a test run which didn't really go so well as the plane moved vertically instead of horizontally. Though this was a failure I created multiple prototypes until one of them was successful and created the one I have today. This experience gave me the opportunity to understand more about engineering and I feel it is a very interesting topic that I would love to look further into.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

226

Fair Category

L8

Project Number

2517

Title: Will It Decay Or Will It Stay?

Student Name(s): M. Cardenas

## Abstract:

My project is about where its best to keep your avocados from ripening so fast. In this project I tested 3 avocados, 1 in a paper bag, 1 in a plastic container, and 1 in a plastic bag. My hypothesis was that the avocado in the plastic container would ripen the slowest. For my project I placed 3 avocados in a certain bag or container. This project was made to help people know where it is best to keep their avocados safe. I collected by data by keeping my avocado in their certain bag or container for 2-3 weeks checking them every 2 days, I took pictures and recorded my data in a notebook. For this project I needed, 3 avocado's, a plastic bag, a plastic container, and a paper bag. Data and results: The avocado in the plastic container ripened the most, it lost water and grew mold. The avocado in the paper bag ripened the slowest, and finally the avocado in the plastic container ripened in between the other 2 avocados, it was more ripened then the one in the paper bag but less ripened then the one in the plastic container. After testing my results I found that my hypothesis was wrong, the avocado that ripened the slowest was the one in the paper bag instead of the one in the plastic container.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EM EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

117

Fair Category

L8

Project  
Number

2518

Title: Chemical Vs Organic

Student Name(s): J. Hussey

## Abstract:

I conducted an experiment to test the affects of chemical and organic fertilizers on the height of rosemary plants. To test this, I had three plants getting an organic fertilizer, three getting a chemical fertilizer, and three plants getting no fertilizer. I gave them fertilizer once a week and watered and measured them twice a week. At the end of the experiment I learned that the plants getting fed a chemical fertilizer grew the most. I concluded that chemical fertilizer can be great for a quick and easy grow but, there can be complications in the future of the soil and environment. Not to mention there are chemicals in the plant you will most likely be consuming.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

237

Fair Category

L8

Project Number

2519

Title: Is That Enough Salt For You?

Student Name(s): A. Lopez

## Abstract:

This experiment tests whether the salinity of water affects the amount of brine shrimp eggs that hatch. Brine shrimp can be very important in the aquatics lab, as they can be used as part of a diet for many of our fish and other organisms. By testing this, I will be able to find which salinity level is the best for hatching brine shrimp eggs, helping those who work in the aquatics lab by being able to hatch the most amount of eggs in a short amount of time. In order to find out if salt levels in water affect brine shrimp hatching rate, I mixed water with sea salt mix to create waters with salinities of 30, 40, and 50 ppt, then added eggs to each. I used a microscope to find the amount of hatched brine shrimp. I collected two samples from each container to get more accurate results. After five days of collecting samples, the water with the salinity of 40 ppt hatched the most eggs and the water with the 30 ppt salinity had the least amount of hatched brine shrimp eggs. From this experiment, I learned salinity levels of 40 ppt are the best for hatching brine shrimp eggs. However, my results aren't 100% accurate, due to the fact that I only took small random samples from 600 ml of water, so the actual results to my experiment can't be fully conclusive.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AS EV BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

76

Fair Category

L8

Project Number

2520

Title: Do the Eyes Have It?

Student Name(s): B. McConnell

## Abstract:

Some people have photographic memory and can memorize almost anything they see. Wouldn't that be great? Some people are the complete opposite and can memorize almost anything they hear. In this experiment volunteers of different ages and genders were tested to see whether they have better visual memory or auditory memory when remembering a random sequence of numbers. The results showed the test volunteers had better visual memory, which had proven the hypothesis to be correct.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

250

Fair Category

L8

Project Number

2522

Title: Antacid Potency

Student Name(s): K. Grassia

## Abstract:

For my project I chose antacid potency, and my question is: Which antacid is the most potent? I chose this experiment because I have acid reflux, and liking chemistry, seemed like a perfect fit. My hypothesis for my experiment is that Pepto-Bismol will be the most potent because many people think it works the best, and that the Care One brand will do the worst because most people think store brands usually work poorly. My experiment puts that hypothesis to the test. For my experiment, I put grape and lemon juice into a test tube to make a fake stomach acid since both of these juices naturally separate. Then, I proceeded to run my tests, which had three different test tubes with three different amounts of antacid added to them. The first one having 10 drops, the second one having 7 drops, and the last one having 3 drops of antacids. I observed what happened and recorded it. Two out of five antacids acted the same way: they sank to the bottom of the test tubes. One of the acids just broke down into smaller pieces. Another dissolved quickly, but only into the lemon juice. The final one fully dissolved at a normal pace. Pepto-Bismol was the only antacid that dissolved fully, proving my hypothesis correct. What I found surprising was that the Care One brand antacid was the second best antacid tested. If I had to recommend an antacid, I would recommend Pepto-Bismol or Care One.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

142

Fair Category

L8

Project Number

2523

Title: Video games doesn't changes the short term memory

Student Name(s): Y. Kim

## Abstract:

Video games are known to have a negative effect on the brain. However, new findings show that video games can actually help the brain. To test this theory I designed an experiment to test people's short term memory after playing video games. My research involved a pre and a posttest on a selected group of participants ages twelve to fourteen. In the pretests they were shown fifteen images and they had to recall all the images after three minutes to the best of their abilities. After collecting the result from the pretest, the participants played Microsoft Flight for five minutes. After playing the game, the participants took a similar test with different objects. In the end, the results came out inconclusive because there were people who had an increase in retention, a decrease in retention and neutral retention result in the experiment.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

197

Fair Category

L8

Project  
Number

2526

Title: Sweet Smarts!

Student Name(s): C. Baldini

## Abstract:

The purpose of my experiment was to evaluate the amount of glucose in four different variables, raw agave nectar, pure maple syrup, raw honey, and molasses. I decided to conduct this experiment because diabetes is a very prominent problem in our society today, and for those who are trying to cut back on their glucose intake, this experiment provides important insight on which products contain the most amounts of glucose. Many products contain the variables I tested, especially honey which is used for a sweetener in many products such as baked goods. Another favorite in which almost everyone eats is pancakes with syrup. But, one very important thing forgotten is that syrup contains an excessive amount of sugar. My goal in this experiment was to find the products that contain the least amount of glucose but still contain the same taste and appeal to consumers. What I concluded is that pure maple syrup contains a very small amount of glucose making it a healthy choice. Raw agave nectar is also a healthy as well as molasses. Raw honey contains the most glucose but it was tested in its most natural state making it a healthy choice also.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME PS ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

229

Fair Category

L8

Project Number

2527

Title: The Effects of Commonly Used Fertilizers on Decomposition

Student Name(s): A. Bonat

## Abstract:

One of the biggest environmental issues at this point in time is the amount of waste in landfills. There is a simple way to reduce the amount of waste that builds up and pollutes the air. This is through composting kitchen scraps and other biodegradable waste. The question is, what speeds up the decomposition of your composted materials? The purpose of my experiment was to investigate the effects of commonly used fertilizers on decomposition. I used five different materials and of those five I hypothesized that the ammonium sulfate would cause the most decomposition. In order to conduct my experiment, I filled plastic bags with equal parts of topsoil and one of my fertilizers (ammonium sulfate, alfalfa meal, soybean meal, and rabbit pellets) as well as a control group with only topsoil. I then placed a coffee filter in each bag and left it to sit in a dark, warm place. I checked the filters every seven days and found that although no measurable decomposition occurred, each coffee filter absorbed different amounts of moisture, ammonium sulfate being significantly greater than the rest. I found that ammonium sulfate works by pulling water molecules away from proteins. In the experiment, the coffee filter absorbed more water because the ammonium sulfate pulled the water molecules from the proteins in the soil. This experiment demonstrated ammonium sulfate's different characteristics under these particular conditions.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EA EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

142

Fair Category

L8

Project Number

2528

Title: How does Roundup affect wild grown plants vs. GMO plants?

Student Name(s): R. Vipparla

## Abstract:

The average amount of Genetically modified corn can cost up to \$150 while wild grown corn can cost \$20. The difference is shocking. Therefore I am testing whether or not there is a big enough difference to make up for the wide price range. My hypothesis was that the roundup will harm both plant because the chemical is very strong. In order to test my theory I ordered GMO basil seeds, and normal wild grown basil seeds and planted them in two separate pots. After spraying it twice a week for eight weeks my results were clear. I observed that the wild grown plant was not growing as well as the GMO plant and was around four times as less of the Wold grown basil. Although my hypothesis was incorrect, I learned that GMO plants, though stronger, have environmental rand health risks.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EA EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

189

Fair Category

L8

Project  
Number

2529

Title: Conventional v. Organic Fruit

Student Name(s): J. Blackwood

## Abstract:

My purpose is to test and research to determine if conventional farming methods effect how long fruits will last compared to organic farming. The first step I used was I separated the organic fruit from the conventional fruit. I then labeled each piece of fruit as such in its own bowl. Then, place a labeled organic and nonorganic pear, an organic and nonorganic apple, and 10 organic and nonorganic raspberries in thee refrigerator. Next, put the same number of items on a table that is able to attract sunlight. Check them daily for browning. Compare and analyze the results. In the end, the apples had a slight variation between the four. The organic is slightly softer from both places. The refrigerated pears are a lot firmer than those left on the table. The organic are a lot riper when compared to the nonorganic pears. The raspberries had the most significant change. The most rapid change was in the nonorganic room temperature fruit with mold all around them and started to shrivel by day 3. The nonorganic refrigerated ones also shriveled, while the cooled organic have not changed so dramatically.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH ME PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

154

Fair Category

L8

Project Number

2530

Title: Bacterial Growth

Student Name(s): E. Casey

## Abstract:

The experiment tested what surface would have the most bacteria. The surfaces tested were a keyboard, a door knob, a sink and a phone. The hypothesis of the experiment was that the sink would contain the most bacteria, the phone would be next, then the keyboard, and last would be the door knob. Each object was swabbed with a cotton swab which was then gently rubbed in a zigzagged formation onto the petri dish containing agar. Each petri dish was labeled and placed into an incubator. The petri dishes were checked for the growth of bacteria each school day for a week. The experiment supported the hypothesis. By the end of the experiment, Object Three had the most amount of bacteria on it. Object Four was next. Then it was Object One. Object Two was last. The experiment showed what types of bacterias were found on the objects that are touched by humans everyday.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB MI ME

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

L8

Project Number

2531

**Title:** Does Intra-articular Hip Steroid Injection Increase The Rate of Infection With Subsequent Total Hip Replacement Surgery?

**Student Name(s):** A. Kennon

**Abstract:**

**PURPOSE:** Do intra-articular corticosteroid injections in an osteoarthritic hip for pain relief in the months prior to hip replacement surgery increase the risk of periprosthetic infection after eventual joint replacement surgery? Although determining this risk is crucial to the more than 300,000 patients undergoing hip replacement in the US each year, many of whom get steroid injections prior to surgery, existing studies are conflicting and most of them review a limited number of patients, often less than 100. This study examines the outcomes of 1726 total hip replacement patients, of whom 729 had an injection prior to surgery. To the author's knowledge, this represents the largest single series reported to date.

**PROCEDURES USED:** A retrospective review was performed using de-identified coding data for 1726 patients. No personally identifiable information was included in compliance with HIPAA. Lists of de-identified hip replacement patients who underwent previous hip steroid injection and those who developed a postoperative deep infection were used to determine the incidence of infection with and without a previous steroid injection.

**OBSERVATION/DATA/RESULTS:** The incidence of post-op infection in patients undergoing total hip replacement with a prior steroid injection was 0.41%, compared to 0.58% for patients who did not have a prior injection.

**CONCLUSIONS:** This study supports intra-articular hip steroid injection as a safe procedure for conservative non-operative pain management in patients eventually undergoing hip replacement, and in fact, patients who had steroid injections had a lower incidence of infection.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

250

Fair Category

L8

Project Number

2532

**Title:** How does the ratio of gala apple DNA to winesap apple DNA affect the speed the plants grow at?

**Student Name(s):** C. Densk

**Abstract:**

I chose this topic because I saw a GMO apple with unusual traits and thought it was interesting. My hypothesis is if the ratio of gala apple DNA to winesap DNA increases, then the speed the plant grows at increased because the DNA from the winesap apple helps increase the speed the hybrid plant grows at. First created the extraction solutions. I then created the hybrid extraction solutions. I then created 6 hybrid seeds. 5 of the seeds are our gala and the other pure winesap. I planted the seeds in the pots and watered them each day for 21 days and documented the growth. In the results the hypothesis was correct because both of the hybrid seeds with more gala DNA than winesap DNA grew while others grew less nor not all of them grew. The hybrid seeds with less gala DNA and more winesap DNA did not grow at all. Some of the pure winesap and pure gala seeds grew. Because both of the more gala little winesap grew a lot that lead me to thank that as the ratio of gala to winesap increased the speed it grows at increases. My reflection is that it was a hard process. It was challenging to learn all of the biology in a short amount of time out of school and then creating a project. If the project were to be extended I would add more species of apple to add to the ratio of apple species DNA being combined.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

116

Fair Category

L8

Project Number

2533

**Title:** The Effect of Martian Regolith on Vegetable Germination for Extra Terrestrial Colonization

**Student Name(s):** A. Shipman

**Abstract:**

In the future, Earth will eventually become too heavily populated and overcrowded. This will lead to a need for more food and more space to grow food. Over 40 percent of Earth's land today is used for agriculture. One solution to this problem would be to grow food on the planet Mars rather than growing food on Earth. This experiment investigates the possibility of growing plants in Mars Regolith Simulant. The results show that beans, radishes, onions, squash, and cucumbers are able to germinate in Mars Regolith Simulant. The lettuce, however, was not able to germinate in Mars Regolith Simulant or Earth soil, perhaps because lettuce takes a longer time to germinate than the other seeds.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

200

Fair Category

L8

Project Number

2534

Title: Diet Preference in Swordtail Spawning: A Study of Breeding Triggers

Student Name(s): N. Reeves

## Abstract:

Does the type of food that Swordtails (*Xiphophorus hellerii*) are fed affect their breeding and the spawning of their fry? In this experiment, I thought that the omnivorous diet would yield the most offspring because it is the most nutritious and varied.

During my experiment I set up four tanks with the same amount of water, a filter, and heaters. I then put three female and one male Swordtail into each tank. Three times a week each tank was fed a different diet. Over the weeks I continued to feed them, and I looked for fry everyday. My results showed that the omnivorous diet produced the most offspring, with three fry. Much like my hypothesis, the Swordtails produced the most fry in the tank that offered the most nutrition. This is similar to their diet in the wild where they eat practically anything that fits in their mouth. <sup>4</sup>

Overall, I learned that if you want to breed Swordtails (*Xiphophorus hellerii*) then you should give them an omnivorous diet. They preferred to breed when fed this diet, and seemed to be the most excited when fed. The combination of meat and vegetables would be my recommendation for anyone breeding Swordtails.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AS EV BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

231

Fair Category

L8

Project Number

2535

Title: The Effects of Music on Memory

Student Name(s): C. Lihar

## Abstract:

Many students listen to music while studying or doing homework. However, does listening to music help the memorization process? In addition, do different genres of music impact short term memory? This project determines which genre of music was able to aid students in memory recollection the most. The hypothesis was that classical music would aid memory recollection the most. In the experiment, four volunteer students, tested separately, were given an arbitrary collection of 10 numbers and letters that they could look at for 10 seconds. After the 10 seconds, the student would be asked to recall as many characters as possible. In addition, a different genre of music would be played and tested twice while the student memorizes the symbols. The results of the experiment proved the hypothesis incorrect. It showed that instead of classical music, the genre that supported memory recollection the most was hip hop music, and the genre that supported memory recollection the least was rock music. This may be due to hip hop having a distinct beat in which listeners can easily place and use to remember material while listening. Finding the effects of music on memory is relevant to today because music is part of the lives of many students who must remember and recall a lot of material, sometimes in a short amount of time, and different types of music can help with this process.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

120

Fair Category

L8

Project Number

2536

Title: Love Me Tender

Student Name(s): A. Klancko

## Abstract:

Being an aspiring chef, I wanted to see how different methods of cooking affected different types of food. I cooked squash, chicken, and potatoes four different ways (sous vide, pan searing, boiling, and oven roasting) to an internal temperature of 165°C for the chicken, 170°C for the squash, and 190°C for the potatoes. Which method will hold in the most moisture and how will the physical characteristics be affected? The experimental results supported my hypothesis by showing that the sous vide held in the most moisture and was more tender and juicy than any other cooking method except for the chicken in which the plastic bag couldn't withstand the length of time the chicken was cooking for.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

177

Fair Category

L8

Project Number

2537

**Title:** Testing CNT (Carbon Nanotubes) to filter E.Coli K12 Affected Water Samples.

**Student Name(s):** L. Josyula

**Abstract:**

This study will help show applications of CNT in water purification. Because CNT has a high surface area to diameter ratio (aspect ratio) and porosity, it is a perfect candidate for use in water filters. Many people in third world countries suffer from not having access to clean, disease-free water, which is why in third world countries 38% of newborns die within 1 year of birth. Although filters have been made for this specific issue, they are not nearly as affordable as they should be and are most commonly just faulty prototypes, or have cartridges that need to be replaced often, which is not ideal in terms of cost effectiveness. The goal of this project is to create a cheap filter that can be accessible to third world residents. In order to achieve this, a 3D printed double candle water filter will be created, in which each of the candles will be infused with antimicrobial MWCNTs (Multi Walled Carbon Nanotubes). Once the filter is completed, it will be tested with E. Coli K12 Bacteria infected water.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

221

Fair Category

L8

Project  
Number

2538

Title: How does the sugar content of a banana change over time?

Student Name(s): R. Fontenelli

## Abstract:

Managing people's sugar levels is an important part of a healthy diet, that was the purpose for conducting this experiment. Procedure: 1-Pick one of the three bunches of bananas and take one banana off of it. 2-Mash the banana up in a bowl. 3-Cut a six-inch square of cheesecloth and put a scoop of mashed-up banana into it. 4-Bring the four corners of the cheesecloth together so that the cheesecloth is tight around the banana. 5-Squeeze the cheesecloth until a clear juice comes out of the banana. 6-Smear the juice on the refractometer and record your data. 7-repeat steps 1-6 but use a banana from a bunch separate from the one you just used, keep repeating steps 1-7 for four more days. Observations: It could be observed, during this experiment, that bananas become easier to mash as they ripen, the bananas also changed in appearance and gained a stronger smell. My observations proved my hypothesis correct. Conclusion: I do believe that it is possible that if I had better tools and a whole room dedicated to conducting this experiment, my answers may have been slightly different, but I still think they are correct for the most part. The results showed that the sugar content of a banana grows as the banana ripens.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

L8

Project Number

2539

Title: Phototropism: In Indoor Germinated Seedlings

Student Name(s): M. Malloy

## Abstract:

My experiment tested if Ejote silvestre (Golden Wax Improved) bean seedlings exhibited less phototropism when grown in a reflective environment compared to the seeds grown directly in a windowsill. Typically, seedlings grown indoors without supplemental lighting bend towards the source of light exhibiting phototropism, making them appear tall and spindly. The purpose of this experiment was to grow seedlings exhibiting less phototropism without buying expensive materials, such as supplemental lighting, but to use every day common items. My hypothesis was that the reflective environment would produce seedlings that were straight and shorter, thus exhibiting less phototropism. The experiment consisted of a box (independent variable), with the top and one side removed, lined in aluminum foil facing a southern facing window (constant). Inside the box were five pots with bean seeds. Another five pots with beans seeds were grown directly in the window sill (control). Measurements were taken every four days after germination on the first three plants grown in each condition. The measurements (dependent variable) consisted of the angle of the stem (degrees) and the height of the stem (cm). Averages of data, based on days after germination, across replicates, concluded that the angle of the plants in the box had very minimal angle of growth away from  $90^{\circ}$ , and slightly shorter, compared to the plants on the windowsill. According to my data my hypothesis was proven correct, the plants in the reflective environment grew straighter, and on average shorter, exhibiting less phototropism.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

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4. Is this project a continuation?  Yes  No

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- Yes  No



# CSEF Official Abstract and Certification

Word Count

159

Fair Category

L8

Project Number

2541

Title: Well Water vs. Tap Water and it's Effect on Plant Growth

Student Name(s): S. Cross

## Abstract:

Water is necessary for plants to grow, in this experiment tests were done to see if there was a difference in the quality of growth due to the type of water used and how it would affect growth rate in plants. I wanted to look at different sources of where people get their water, and I decided to limit it to two types of water (well and tap). During the school year, both types of water were tested on two different species of plants during two different trials. I used a cucumber plant the first trial and a fern the second trial. I determined which water source was better on plant growth by measuring the growth and changes in the plants. The first trial resulted in no significant growth to measure. The second trial showed increase in both color quality of the plants and steady growth, but not enough measurable difference between water sources to give any significant results.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project  
Number

3001

**Title:** Investigating Murine Humoral Responses to Tick-borne Pathogens to Develop a Confirmatory Diagnostic Tool

**Student Name(s):** E. Criscuolo

## Abstract:

An infection with the relapsing fever spirochete, *Borrelia miyamotoi* could easily be confused with the Lyme Disease vector, *Borrelia burgdorferi*. There is a need for improved methods of diagnosis of *B. miyamotoi* which can only be done by expanding our knowledge of the host's interaction with the pathogen. To investigate this, sera from laboratory mice experimentally infected with *B. miyamotoi* was evaluated for cross reactivity of antibodies to *B. burgdorferi* and vice versa. *B. miyamotoi* infected sera, from many days since acquisition of the pathogen, was evaluated against *B. miyamotoi* lysate. An SDS-PAGE assay separates the proteins contained in each lysate. Then an Immunoblot assay indicates if antibodies bind to these proteins. There was ample reactivity between the *B. burgdorferi* infected sera and the *B. miyamotoi* lysate and limited reactivity the opposite way. The Immunoblot using *B. miyamotoi*-infected mouse sera and *B. miyamotoi* lysate revealed the presence of two crucial protein bands in the lysate suggesting that the cultured *B. miyamotoi* contained at least two distinct populations (serotypes) of *B. miyamotoi*. The discovery of the two serotypes is extremely helpful because the two proteins that are expressed by *B. miyamotoi* allow it to escape complement killing by the mouse's immune system. Additionally, because of the unexpected amount of reactivity between the *B. burgdorferi* infected sera and *B. miyamotoi* lysate, there is a need to identify specific proteins that can differentiate between the two infections so that patients aren't misdiagnosed. The two proteins mentioned also serve as differentiating proteins.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME MI

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project Number

3002

**Title:** The Effect of Collect Nutrient Powder on Mus Musculus Lewis Lung Carcinoma Cells Confluence, Growth Rate, and Viability

**Student Name(s):** M. Guzzo

**Abstract:**

There is no simple answer to cancer containment, let alone an affordable, accessible, and safe one. Collect, an affordable, sustainable proprietary mineral blend, claims to reduce the proliferation of cancer and even stimulate apoptosis in affected cells may be the answer to slowing or stopping cancer growth. This investigation observes cancerous mouse lung cells being cultured in different concentrations of Collect made to emulate typical human conditions along with normal lung cells in order to evaluate the effect Collect has on the cell confluence, growth rate, and viability. There has been minimal research on Collect, which is why it was selected as the testing entity. After in-depth research of the powder, it was determined that multiple websites and testimonials from consumers contain positive feedback and excellent reviews, yet the question arose about its functions at the cellular level numerous times. After learning sterile culturing techniques, an experiment was devised in order to research the effects of the powder on both cell types. The findings of the research are still in progress. The current observable trend is as the Collect dose increases, the cancer cell growth increasingly is inhibited. Yet the most important finding is it is currently being observed that the normal cell growth is unharmed and proceeds at a healthy rate within each concentration. These preliminary findings are essential in the evolution of cancer treatment as Collect powder is easily accessible to consumers, comes in many varieties, and may have significant effects on cancer growth inhibition.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB ME BI

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

204

Fair Category

LS

Project  
Number

3003

Title: The Investigation of Electrolytes: Scientific vs. Natural

Student Name(s): K. Alveranga

## Abstract:

The purpose of the experiment is to determine whether sport drinks like Gatorade and Powerade that are designed to hydrate and replenish electrolytes lost during strenuous body exercising, has more electrolytes than 100% natural drinks that were not scientifically designed to do so. To test this, beverages that were 100% natural and scientifically designed were gathered. Various waters were also used as a control. The construction of a nine volt circuit that would use the beverage as a bridge to close what was once an open circuit was done. The conductance of the liquid can be calculated using this circuit; and conductance is directly proportional to electrolyte concentration. Therefore conductance created the perfect numbers for comparing these liquids.

Controversy of sports drink and their ethics has been a wide spread argument that I have failed to see tested. In this experiment it was hypothesized, if drinks scientifically designed to replenish electrolytes are compared to 100% natural drinks, the scientifically designed drinks would consist of more electrolytes. Analysis of data showed that all the natural drinks actually had a higher conductance. This means they have a higher electron concentration than sports drinks like Gatorade. 100% natural drinks are actually a better choice for replenishing electrolytes.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH BI ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project Number

3004

**Title:** The Ameliorating Effects of Biochar and Fertilizers on the Amount of Organic Matter and Organic Carbon in Native Connecticut Soil

**Student Name(s):** L. Cerbin

**Abstract:**

Biochar application is emerging as a potential way to manage properties of soil through its potential in carbon sequestration, soil quality improvements, and plant growth. The purpose of this experiment is to test the effects that biochar has on the amount of organic carbon in the soil. In addition to biochar, an organic fertilizer (OF) derived from feather meal, bone meal, processed poultry manure, and sulfate of potash; and a chemical fertilizer (CF): urea phosphate (UP), was added to some soil in order to test how it reacts with biochar. OF was added in one dose to the soil, of one tablespoon in all the soils requiring it, while UP was mixed into an aqueous solution and took the place of water for the trials. The purpose of this experiment is to see how biochar captures carbon in soil and if fertilizer is able to increase this amount, and which type is more effective at it. A simple loss on ignition test will be used to test for the amount of organic carbon in the soil. This is a short-term study lasting 35 days, it is expected that the chemical fertilizer will show very positive effects on the soil and the organic will not show as good positive effects. More specific data will be available within the next few days, that will either support or refute this claim. Chemically treated plants are also expected to undergo the best changes for plant growth, however negatively impact the pH.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS EV EM

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project Number

3005

**Title:** Bioassay Investigation of the effects of chemical and organic fertilizer on Daphnia and Tardigrades.

**Student Name(s):** B. Clark

## Abstract:

Worldwide, millions of tons of chemical fertilizers are used to promote the production of crops, development of flowers, and green grass. A recognized problem of chemical fertilizers is their negative effects on aquatic ecosystems when they enter the water through runoff. The nitrogen in chemical fertilizers causes algal blooms leading to the depletion of oxygen in the water. The resulting condition, called hypoxia, causes the death of many aquatic organisms. Organic fertilizers are considered to have fewer negative effects on the environment.

The purpose of this project is to determine if chemical and or organic fertilizers have a direct toxic effect on aquatic organisms. The hypothesis is that the chemical fertilizer will cause death to the organisms at a lower concentration and in a shorter amount of time than the organic fertilizer.

To test the hypothesis daphnia and tardigrades were used as bioassays, organisms used to detect toxins in the environment. Daphnia are small aquatic crustaceans found in freshwater systems. They are used as bioassays due to their size, transparent bodies, and easily observed organs. Tardigrades are small transparent extremophiles able to survive the most extreme conditions. The organisms were exposed to varying concentrations of both chemical and organic fertilizers. The direct effect of the fertilizers on the organisms was observed and recorded. Both organisms survived the highest concentration of organic fertilizer tested while the chemical fertilizer caused death in < 2 minutes to both organisms at the same concentration. Testing of lower concentrations of each fertilizer supported the hypothesis.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EV EM MI

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

LS

Project Number

3006

**Title:** Dissecting the Role of Desmosterol in Regulating Macrophage Immune Activation During Atherogenesis

**Student Name(s):** A. Dixit

**Abstract:**

Atherosclerosis is a disease which afflicts more than 3 million people yearly, wherein there is plaque buildup in the arteries that leads to a stroke, myocardial infarction, and death. The goal of this project is to understand how loss of protective desmosterol lipid intermediate in macrophage foam cells removes the anti-inflammatory breaks leading to chronic inflammation. The methods were to perform a bone marrow translation in Ldlr<sup>-/-</sup> mice using wild type (WT) and DHCR24 TG bone marrow cells and assess atherosclerosis after feeding mice three months of high-fat containing Western diet. At the end of the feeding period, lipid accumulation, size of the atherosclerotic plaques, and inflammatory markers in the artery wall were determined, by looking at cross sections of the aorta and analyzed using ImageJ. Results suggest that desmosterol mediates the anti-inflammatory response, thus showing that buildup of plaque in the aortas of mice with elevated levels of desmosterol are significantly lower than that of control mice. The implications of this projects are grand. It shows how desmosterol plays a crucial role to stop or lessen the plaque buildup in atherosclerosis. Since it has suggested that it does play a significant role to stop atherogenesis, then it can be used in combatting the disease and for therapy options instead of invasive surgery. The prediction would be that elevation of desmosterol in macrophages by drugs will protect against inflammation and heart disease.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME MI CB

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

LS

Project Number

3007

**Title:** Prevention of Zika Virus and Other Mosquito-borne Diseases Using Environmentally Sound Control Methods.

**Student Name(s):** B. Kerr

**Abstract:**

Mosquito-borne diseases have become a major worldwide health and environmental issue. Though typically limited to equatorial regions, mosquitoes which cause some diseases such as the Zika Virus have spread to broader ranges, including the United States. Current control methods include using pesticides to eliminate mosquitoes which are not cost efficient, sustainable, and are harmful to the environment by negatively affecting non-target species. In order to solve this problem, I set out to test the feasibility of biological control of mosquito populations which would be effective at preventing disease, sustainable, and environmentally safe. I used a two-pronged approach to control both mosquito larvae using entomopathogenic nematodes (microscopic roundworms) and adult mosquitoes using the *B. bassiana* fungus. Nematode treatment over a five day period lead to a dose dependent reduction in mosquito larvae survival of 67% at the highest dose tested. In addition, treatment of adult mosquitoes using fungal spores also lead to a dose dependent reduction in survival reaching 100%. Both treatments were similar to the effectiveness of the larvicide Altocid and the pesticide Malathion, used as positive controls. These results suggest that this method of biological control could be very effective at preventing diseases harbored by mosquitoes. This technique could be useful to prevent serious global diseases, such as that caused by the Zika Virus, and to reduce the substantial environmental consequences caused by pesticides.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM ME MI

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

127

Fair Category

LS

Project  
Number

3008

Title: Exoskeleton Apparatus For Osteogenesis Imperfecta

Student Name(s): C. Kasak

## Abstract:

Osteogenesis Imperfecta is a genetic disease where the mutation or mutations are located on chromosome 17 affecting COL1A1 and chromosome 7 affecting COL1A2. This affects the production of type 1 collagen. Collagen is responsible for the production of a protein that creates bone structure. Patients suffering from this disease options are limited to being confined to a wheelchair or having to get surgery to have metal rods supporting their bones. This project is predominantly focused on creating an exoskeleton to support the bones of a patient with OI. This will be accomplished by constructing an exoskeleton out of cardboard to get the general idea of the design. Then moving on to research other materials to make a final prototype that will then be tested at outside facilities.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN ME

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

194

Fair Category

LS

Project  
Number

3009

Title: iProxemics

Student Name(s): S. Moran

## Abstract:

This project looks at cell phones effect on proxemics. 22 people were surveyed about their cellphone usage and proxemics. To gather their view of different spatial zones, the definition of a space was read to them and then they told the surveyor how far away to stand in order to fit that definition. These distances were recorded and used to compare these to the proxemics chart made by Edward T. Hall Edward T. Hall, one of the founders of proxemics claims that many cultural factors will affect proxemics. His research was done before cellphones became as common as they are today. Cellphones decrease the amount of face-to-face interactions people have. Interactions is a large part of what makes up culture. Taking for a culture to take out interactions would likely lead to altered proxemics. It was found that people with extreme cell phone usage had smaller intimate zones while every other zone became larger. This could imply that because phones are used so close to the face that meaningful interactions would need to happen closer. With something as unpredictable as another person, people would be more comfortable if they were further away.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

260

Fair Category

LS

Project  
Number

3010

**Title:** Rapid Colorimetric Field Monitoring System for Zika Virus in Mosquito Populations via DNAzyme-Functionalized Gold Nanoparticles

**Student Name(s):** R. Subramaniam

## Abstract:

The Zika virus (ZIKV) epidemic has emerged as an urgent global health crisis. While molecular techniques (RT-qPCR, ELISA, etc.) for detecting ZIKV have been established, a cost-effective, in-field mosquito population-wide monitoring system usable in rural communities as an early warning system for virus spread would greatly help in reducing infections. A mosquito trap system is described to detect virus in saliva of live mosquitoes deposited in situ into a one-step gold nanoparticle-based rapid color detection system. A DNAzyme directed against a unique and highly conserved region of the ZIKV genome was coupled to 15nm gold nanoparticles, and the salt-induced aggregation of the gold particles followed in the presence of a synthetic fragment of ZIKV RNA containing the DNAzyme binding site. Only ZIKV RNA promoted a color change from red to colorless because of the specific binding of the DNAzyme to the ZIKV RNA fragment. To demonstrate insect salivation, live *Aedes aegypti* mosquitoes were collected in a low-cost updraft trap and induced to starve-feed on a sucrose solution to capture saliva. Over a 24-hour period in the trap, mosquito salivation was detected non-invasively via salivary apyrase activity on ATP added in the feed solution and bioluminescence detection; a 42% reduction in measured luminescence confirmed positive saliva detection. Coupled with in situ virus lysis and the nanoparticle assay system, this trap system can be used to directly detect ZIKV in saliva of live mosquitoes, filling a significant gap in current frontline virus detection efforts in the wild without extensive laboratory resources.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME BI

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project  
Number

3011

**Title:** The Effect of Plasmid on the Transformation Efficiency of Competent Escherichia Coli To Increase the Cost Effectiveness of the Hepatitis C Test

**Student Name(s):** S. Johnson

**Abstract:**

Gene cloning has a wide range of applications ranging from medicine to agriculture, but arguably it's most practical aspect is that it forms the backbone of the Hepatitis C test. The test currently costs anywhere from \$240-\$500 (called "Hepatitis C RNA by PCR"). Gene cloning is facilitated by plasmids, allowing for recombinant DNA, which the Hepatitis C tests are composed of, to replicate rapidly inside bacteria. Plasmid, however, is very costly and the quantity significantly varies the results. The goal of my experiment is to find the amount of plasmid that results in the highest Transformation Efficiency (TE), the highest ratio of cells containing the recombinant DNA. The Hepatitis C test commonly uses plasmid pT7-IRES-GFP, which is similar to the plasmid pGLO-GFP-3UAG that replicates in competent E. coli cells. In order to imitate the gene cloning aspect of the Hepatitis C test, I inoculated different amounts of plasmid into the cell mixture and placed on ice for 30 minutes. I then pipetted 950  $\mu$ l of LB media into the mixture and performed multiple 10-fold serial dilutions. I spread 75  $\mu$ l of each dilution overnight and repeated this procedure with varying amounts of plasmid. The experiment is in progress, and conclusions have not yet been drawn. Thus far, however, 1  $\mu$ l would yield the highest TE. Ultimately, my project seeks to determine the amount of plasmid that would induce the highest Transformation Efficiency, and, in turn, significantly lowering the cost of Hepatitis C tests.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB ME MI

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2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

237

Fair Category

LS

Project Number

3012

Title: Self Defogging Ski Goggles

Student Name(s): R. Cleaves

## Abstract:

For a skier, one of the biggest risks on the mountain is produced by oneself; goggle fog. Resulting from the influx of cold air onto the skier's heated goggles lens, a product of the skier's normal body heat, this layer of condensation possesses a hazard to any skiers visibility and awareness. To combat this, my project focused on developing a ski goggle that would be able to defog independently, while still in use of the skier. The first means of the experiment was to find a design for the project. Building off a pair of old goggles, the hopes of the experiment were to use wires from a car defroster across the upper and lower bounds of the goggle lenses and then attaching solar film strips across the sides of the goggles elastic as a power source. In theory, this would allow the skier to operate the device without the means of a finite energy source such as a lithium ion battery. Ultimately, it was determined the size of the solar strips that could potentially be positioned on the goggles would not be nearly as cost efficient, reliable, or obtainable as lithium ion options already available on the market. Additionally, with the defogging wires intended use to be fixed onto a glass windshield, the wires themselves maintained the risk of melting the plastic lenses of the goggles upon use, presenting a considerable safety hazard for the user.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

265

Fair Category

LS

Project Number

3013

**Title:** Formulation of a Bovine Gelatin Cross-Linked Scaffold for Potential Human Tissue Applications: A Patient Specific, Cost-Effective Alternative Treatment of Acetabular Labral Tears of the Hip

**Student Name(s):** S. Edelstein

## Abstract:

Acetabular labral tears comprise 22% of reported groin pain. Repairs involve suturing torn tissue to the bone via anchors, or removing inflamed tissue. Both prevent the body from healing naturally. The Bridge-Enhanced ACL Repair piloted by Boston Children's Hospital, a collagen-based scaffold, reduces pain, recovery time, and osteoarthritis by letting ACL heal naturally. This research seeks to design a gelatin-based scaffold for the hip labrum composed of hyaluronic acid, a Glycosaminoglycan, cross-linked with glutaraldehyde and glycerinaldehyde producing similar results.

A 2% gelatin was chosen and mixed with .5% (w/v) hyaluronic acid. Six gels were cross-linked with glutaraldehyde and D-L glycerinaldehyde at concentrations of .1%, 1%, and 10% (w/v). Young's Modulus for each scaffold was recorded via ball bearing apparatus, ImageJ, and equation (Ju & Liu 2001). With a general Young's Modulus (E) of various tissue and acetabular labrums at  $\pm 44.3$  MPa, candidate gel was 2% bovine gelatin/hyaluronic acid blend cross-linked with 10% glutaraldehyde solution, having the closest properties to the given E of an actual acetabular labrum, 41.21 MPa. As cells prefer firm growing conditions, an interface was produced by making a gel with a thin 10% gelatin outer layer for bone adherence, and another layer with the candidate 2% gel. The layers were cross-linked with the 10% glutaraldehyde solution. Using researcher's CT scan data, the human hip joint was 3D printed. The scaffold described was set in acetabulum making scaffold patient-specific. Molded device was frozen/freeze-dried to determine preservability. Gelatin-based scaffold, rather than collagen, is less expensive, making device cost-effective.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

227

Fair Category

LS

Project  
Number

3014

**Title:** Examining variations in specific immunity related genes of bananas from different geographic regions through genotyping

**Student Name(s):** S. Park

**Abstract:**

Banana diseases have been a continuous problem for many years. Bananas are easily susceptible to diseases because most commercial bananas are clones of each other. This study looked into the variation of genes related to the immunity of the bananas from different geographic regions. It is hypothesized that there will not be significant variations in the immunity related genes because most bananas are clones of each other. Bananas from different regions were collected from available stores, and DNA samples were extracted from each. Then, specific genes related to the immunity of bananas from the chitinase family were identified and primers were designed. Two genes in the chitinase family was used. One gene was Ma01\_g20320~ acidic endochitinase-like~ unknown\_gene~ missing\_functional\_completeness in chromosome 1. The second gene was Ma08\_g33300~ Putative Class III acidic chitinase~ XIPI~ fragment in chromosome 8. Next, the samples were ran through a genotyping test, Sanger's sequencing, to see the variations of the specific genes identified before.

The sequencer software was used. The sequence data collected will be uploaded to a software program that aligns the sequences obtained with the known sequences. The data will be presented with allele frequency table or figure. If the data supports the hypothesis, the range of the regions can be taken into consideration to suggest the lack of genetic variation in such range of area.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

202

Fair Category

LS

Project  
Number

3015

**Title:** An Investigation of Natural Alternatives to Chlorine When Treating Microbial-Contaminated Water

**Student Name(s):** A. Porphy

**Abstract:**

The purpose of this project was to investigate the effectiveness of substances that can behave chemically as natural antibiotics in microbial-contaminated water. It was hypothesized that various spices and seeds will impede bacterial growth in contaminated water samples. Potential, all-natural antibiotics including mint leaves, cardamom pods, anise seeds, fennel seeds, sage leaves, mustard seeds, parsley leaves, and coriander were obtained from a local grocery store. Samples were individually homogenized using a mortar and pestle and added to a melted nutrient agar solution. Heated agar was then poured into plates and placed in the incubator at 32 degrees Celsius. Contaminated water samples were collected in sterile containers from local waterways. Sterile spreading wands were used to inoculate poured plates. Two controls were used: plates with only nutrient agar and plates with nutrient agar and chlorine. Two plates were made for each of ingredient in each of the 3 trials. Colony data was analyzed for statistical relevance of the impediment of overall colony growth. Initial trials produced mixed results, with the peppermint and spearmint plates having the least amount of growth. Future studies may include more complicated mixing of the natural antibiotics to sufficiently impede bacterial growth in the absence of chlorine.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV ME CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

257

Fair Category

LS

Project Number

3016

Title: The Use of Copepods as a Mosquito Control System

Student Name(s): S. Wang

## Abstract:

*Aedes aegypti* mosquitoes are the primary carrier of the Zika and Dengue viruses, which threaten global health. Current mosquito control methods are high-maintenance, expensive, or harmful to the environment. This project aims to develop an alternative mosquito-control method by using copepods, small aquatic crustaceans that are abundant in rivers and lakes. Cyclopoid copepods, sourced from both North Carolina and Connecticut, were tested for their capabilities to destroy *aegypti* larvae, preventing them from maturing into adult mosquitoes. The results showed that copepods from both states ate on average 16 larvae in 48 hours. Even in the presence of their natural food source, algae, the copepods' larvae-feeding rate did not change significantly. Different mosquito trap designs were tested in cages containing live *aegypti*. Their effectiveness was measured by counting the number of eggs laid on filter paper. Optimum conditions for a copepod-based mosquito trap were found to include a black trap color and avoidance of hay infusion. The findings demonstrate that *aegypti* are attracted to and will lay eggs in copepod-based mosquito traps, in which copepods will destroy the larvae once the eggs hatch. Copepods are practical for mosquito control for two reasons. First, they are low-maintenance as they feed on natural algae in the absence of larvae. Second, copepods are cheap and environmentally friendly as they can be easily sourced from local fresh water bodies. In conclusion, transferring local copepods from their natural environment into traps, or adding them into stagnant water where mosquitoes breed, would provide an effective mosquito-control system.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM AS AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project Number

3018

**Title:** IgM Expands Regulatory T Cells and Demonstrates Therapeutic Potential for Type 1 Diabetes

**Student Name(s):** C. Morr

**Abstract:**

The immune system is able to combat all types of potential threats to health, but not all of its cells are beneficial. Autoimmunity can occur if cells of the immune system recognize the body's own tissues as foreign and attack them. Several regulatory mechanisms exist to protect the individual from this danger, such as regulatory T cells (Tregs), a type of cell in the immune system essential for maintaining immune self-tolerance by identifying and eliminating autoreactive cells. However, this regulatory mechanism sometimes fails, and harmful cells remain active in the body. Type 1 diabetes (T1D) is an autoimmune disease which occurs when autoreactive lymphocytes attack and destroy the insulin-producing beta cells of the pancreas. IgM, an antibody produced naturally by B cells, has been previously demonstrated to prevent T1D in non-obese diabetic mice, though the mechanisms by which this result was achieved are unknown. This research studied the effects of IgM on Treg numbers and percentages in samples of human PBMCs and mouse splenocytes in an attempt to better understand how the antibody works. It was found that incubating the cell samples with IgM expanded Tregs significantly, indicating that IgM likely reestablishes self-tolerance through the correction of defects in regulatory mechanisms and the elimination of autoreactive lymphocytes. Based on its ability to restore immune homeostasis, IgM seems to have substantial therapeutic potential for T1D. This research on IgM therapy gives hope to the millions who live with the burden of T1D or other autoimmune diseases.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CB ME

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

LS

Project  
Number

3020

**Title:** The Comparison of Metal Absorption of Microparticles from Various Face Washes

**Student Name(s):** K. Yanagisawa

**Abstract:**

Exfoliating microplastics from facial washes in the environment are becoming less abundant because manufacturing companies switching from plastics such as polyethylene to more natural exfoliators such as walnut shells, apricot pits, and cellulose. The main purpose for this switch was due to the microplastic beads absorbing toxins and elements, such as copper, lead, and zinc, and once filled with toxins and metals, can be ingested by animals, introducing toxins into the food web. This can cause biomagnification of the toxic elements, eventually making their way to the top of the food web at extremely high concentrations. Natural microbeads are more biodegradable, but it is unknown if they absorb more or less toxins than plastic microbeads. It is hypothesized that the natural microbeads will absorb less metals than polyethylene microbeads because of their ability to degrade at a greater rate.

In our experiments, walnut, apricot, cellulose, and polyethylene microbeads were sieved from facial washes, and once cleaned and dried, the microbeads went through several trials. After the microbeads absorbed the metals, they were put into an acidic solution to break down the microbeads so the metals they absorbed could be analyzed. All analysis was done in an inductively coupled plasma mass spectrometer.

Data trends so far show that natural microbeads absorb more copper, lead, and zinc than polyethylene microbeads. Even though natural microbeads can degrade faster than polyethylene microbeads, in almost all trials, natural microbeads absorbed greater amounts of metals than the polyethylene microbeads.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

MI EA BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

202

Fair Category

LS

Project  
Number

3021

**Title:** Novel Approach of Lumbricus terrestris in Increased Carbon Dioxide Soil for Conversion to Organic Carbon

**Student Name(s):** D. Brey

**Abstract:**

In a world where the concentrations of greenhouse gases are rising, it is important to research how rising greenhouse gases affect the annelids that are attempting to slow down climate change. Increased levels of carbon dioxide in the soil were examined to determine the productivity of Lumbricus terrestris while reducing the amount of carbon in the soil. Four chambers were used and contained “Espoma” organic garden soil and three of the tanks contained 4 Lumbricus terrestris inside. To represent increasing carbon dioxide levels for five and fifty years, various pressures (0.0000540 atm and 0.000905 atm) were introduced to two of the chambers. A soil sample will be taken from each of the four tanks after fourteen days. The samples were combusted and used loss on ignition to calculate the amount of organic carbon in the soil. Analysis allowed for comparison of the soil before and after the two tanks had increased carbon dioxide levels. The analysis of this measurement could support increased or decreased carbon content in the soil. This analysis can be followed by the same research, but with a different greenhouse gas. Also, it can proceed to research that involves comparisons between the productivity of Lumbricus terrestris and other earthworms.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV AS EM

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

173

Fair Category

LS

Project  
Number

3022

**Title:** The effects of environmental factors on overexpressed tau genes in *Drosophila Melanogaster* in regards to neurodegeneration

**Student Name(s):** N. Arellano

**Abstract:**

The number of deaths due to neurodegenerative diseases has recently been on a rise. Alzheimer's disease is currently the fifth leading cause of death and the root of sixty five percent of dementia cases in the United States. This has prompted research in treating and/or curing these diseases. A protein called tau plays an important role in the structure of neurons, or the cells of the nervous system. In a neurodegenerative disease, tau is mutated, accounting for the symptoms seen in neurodegenerative diseases. Studies revealed that, when overexpressing mutant forms of human tau in *Drosophila Melanogaster*, a species of fruit fly, the flies exhibited symptoms similar to those of neurodegenerative diseases in humans. This study sets out to minimize and/or suppress the expression and accumulation of the mutant tau. UAS-Tau *Drosophila* and C155-GAL4 *Drosophila* will be crossed to produce flies that have mutant human tau overexpressed in the neurons. Motor skills will be measured through a bang test for two groups, one of which will be administered a heat shock.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME CB

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project  
Number

3023

**Title:** Interaction between USP7 and Hdm2 at the Secondary Binding Site Using NMR Spectroscopy

**Student Name(s):** S. Kale

**Abstract:**

p53 is a tumor suppressor whose presence triggers cell apoptosis. Hdm2 is responsible for destabilizing p53 levels in healthy cells. USP7 can deubiquitinate, or stabilize, either Hdm2 or p53, depending on the condition of the DNA. When DNA is damaged, USP7 stops stabilizing Hdm2 and starts stabilizing p53. However, in successful cancers, p53 levels do not rise significantly enough to trigger apoptosis. It is hypothesized that blocking the interaction between USP7 and Hdm2 will lead to more p53 and therefore trigger apoptosis. However, before drugs can be made to block this interaction, we must know how USP7 interacts with Hdm2 specifically at the binding site: blocking the catalytic site of USP7 would destabilize all cells. Previous studies have identified the UBL3 domain of USP7 to contain the binding site. This study analyzed UBL3 using NMR spectroscopy, which measures the magnetic atmosphere of an atom in every residue of the protein. However, each 'peak' or magnetic shift cannot readily be assigned to a specific residue on the polypeptide chain. Using various NMR experiments, peaks can be sequenced and assigned to their respective residues. Previous experiments have failed to fully complete residue-peak assignment. After repeating experiments and developing a computer algorithm to assist in assignment, I was able to complete assignment for the overwhelming majority of peaks. These data can be used in the future to analyze exactly which residues interact with Hdm2 and develop drugs to inhibit the reaction and potentially increase p53 levels and trigger apoptosis in cancerous cells.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB BI

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

LS

Project Number

3024

Title: The Effects of Blue Light Technology on the Circadian Rhythms of Adolescents

Student Name(s): A. Ziobron

## Abstract:

Circadian rhythms, which include the sleep-wakefulness cycle, are behavioral changes that occur during a 24-hour period. An area in the hypothalamus manages circadian rhythms and melatonin production, the hormone that causes humans to feel tired. Cell phones which generate blue light suppress melatonin and affect circadian rhythms of humans, especially adolescents who already experience a shift in circadian rhythms during puberty. An experiment was designed to compare the circadian rhythms and alertness of teens to blue light exposure. The original experiment plan included 8 human participants, who would wear actigraphy watches over three weeks. Actigraphy is a method which assesses circadian rhythms over time. Due to complications in obtaining these watches, the experiment was modified to include 8 human test subjects that performed a psychomotor vigilance test twice daily for three weeks while being exposed to different concentrations of blue light from phones. The PVT is a test used to determine alertness by measuring the speed someone responds to a stimulus. For the first week of experimentation, each person was totally exposed to blue light. However, for the second and third weeks, blue light was blocked. It was hypothesized the PVT results would reveal a change in the alertness of at least one of the participants. The experiment supported the hypothesis as multiple participants demonstrated an improvement in the PVT from the first to third week. Overall, the experiment revealed the significant effect blue light has on the alertness of adolescents and how their alertness correlates with their sleep patterns.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME BE

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project  
Number

3025

**Title:** Novel Active Immunization Approach for Preventing Substance Addiction via High Density Trypanosoma brucei Surface Glycoprotein Arrays

**Student Name(s):** A. Roitman

## Abstract:

Each day more than 3,200 US teens smoke their first cigarette. Furthermore, drug overdose (many cases of which are due to opioids) is the leading cause of accidental death. Addiction not only poses grave health issues, but is a major burden on global economies. The progression of the disease of addiction disease is due to persistent behavioral and neurobiological changes, which, as a result of the complexity of the biological changes, make treatment difficult. Methadone maintenance is currently one of the few moderately effective pharmotherapeutic treatments for opioid addiction. Due to the lack of other more effective pharmotherapeutic treatments of addiction, one possible approach that has emerged is a vaccine to raise neutralizing monoclonal antibodies against a particular drug target. However, current approaches suffer from the general lack of efficient methods with which to generate neutralizing antibodies, especially against small molecules. This novel approach co-opts the surface coat (made up of ~11 million Variant Surface Glycoprotein (VSG) structures) of the African trypanosome Trypanosoma brucei, and uses it as a platform to generate antibodies through active immunization. These parasites routinely elicit high affinity/high avidity antibodies. By manipulating its coat, using a bacterially derived class of enzymes called Sortases, such that it “displays” foreign molecules, a similar robust response was elicited against a model molecule, FAM-G fluorophore, in mice. The results of this investigation determined by ELISA assay suggest that this approach can therefore be generalized to any small molecule, including drugs of abuse and addiction.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB ME BI

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

211

Fair Category

LS

Project Number

3026

Title: Cognitive Strengths and Weaknesses of Adults with Reading Disabilities and Dyslexia

Student Name(s): C. Gorey

## Abstract:

Dyslexia and Reading Disabilities (RDs) are cognitive-based neurodevelopmental conditions that are rooted in biological and genetic neurological differences that are characterized by deficiency in the acquisition of language skills. RDs and Dyslexia affect 10-15% of the school-aged population. RDs have been linked to differences in cognitive abilities, brain functionality, and neural anatomy. Many studies that evaluate the core deficits of dyslexia using longitudinal studies of younger children; however, there are few studies that evaluate reading disabilities in older populations. WAIS scores of several populations affected by RDs were used to evaluate the effect of age and education on cognitive abilities in adults with reading disabilities, and examine the core cognitive weaknesses associated with reading disabilities. The results of this study suggest that working memory is the core deficit of reading disabilities. The data suggest that deficits in processing speed can be improved with education. The results indicate that education and age have a positive effect on cognitive function, with education being the most important factor in compensation for associated weaknesses. Overall this study presents important findings for the underlying cause of dyslexia, how RDs present themselves in adulthood, and provides important information for special educators and policy makers when developing education plans to target these deficits and diagnostic tools.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE

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2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project  
Number

3027

Title: Determining Genetic Mutations in Gitelman Syndrome

Student Name(s): A. Chen

## Abstract:

Gitelman syndrome (GS) is an autosomal recessive genetic disorder that impairs the kidney's ability to reabsorb salt and causes imbalances in electrolytes. GS is caused by a mutation in the SLC12A3 gene, and symptoms vary widely. The purpose of this study is to determine genetic mutations in the SLC12A3 gene that cause GS for diagnostic purposes and to see if the type or location of mutations affects severity of symptoms.

The sequence of exons from GS patients were provided by mentor Dr. Weizhen Ji. The codes of the exons from GS patients were compared to the DNA of healthy controls using the program Sequencher. Clustal Omega was used to check if the DNA sequence at the mutation was highly conserved across multiple different species and determine if the DNA changes were deleterious mutations or single nucleotide polymorphisms.

4 missense mutations were found, with 3 different mutations in total: mutations R209G, A264G, and G461D, with the mutation A264G having been found twice in two different patients. This confirms the hypothesis that there are mutations in the SLC12A3 gene which lead to GS.

GS is mostly diagnosed through phenotypic symptoms, though symptoms can be similar to other diseases. Phenotypes of GS are similar to those of diuretic abuse and bulimia as well as extremely similar to Bartter syndrome. The similarity of GS symptoms with these diseases suggest the need for genetic testing to accurately diagnose GS in patients. Identifying these mutations which cause GS will aid in diagnosing GS through genetic testing.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

254

Fair Category

LS

Project  
Number

3028

**Title:** The Future of Bio-Sand Filtration: The Incorporation of Water Hyacinths To Remove Arsenic From Contaminated Drinking Water

**Student Name(s):** R. Uddin

## Abstract:

Millions of people around the world do not have access to clean, safe drinking water and are exposed to bacteria, pathogens, and arsenic on a daily basis. There are numerous countries, such as India and Bangladesh, where there are dangerously high levels of arsenic in their water source. The consumption of arsenic has been linked to serious, and sometimes fatal, health problems, such as skin lesions, swelling, developmental issues, and cancer. Certain areas drink water that contains a concentration of arsenic 30 times more than the WHO guideline value for arsenic in drinking water of 10 micrograms/L. Over 60% of the groundwater in Bangladesh have concentrations greater than the WHO guideline. The use of water hyacinths as an effective means of absorbing arsenic from water has been supported in the literature, yet there is no practical system that can be installed and utilized in rural areas. There are currently water filtration systems that are able to effectively remove pathogens from drinking water, such as bio-sand filters, but cannot remove arsenic compounds. A simple solution to this problem is a water filtration system using sand filtration and water hyacinths as a means of water disinfection and arsenic remediation. In order to efficiently remove arsenic as well as water-borne pathogens, a simple modular system was incorporated into the bio-sand filter where water hyacinths can be placed and phytoremediate contaminated water that can be used the next day. This easy system has the potential of saving the lives of millions across the globe.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV CH PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

239

Fair Category

LS

Project Number

3029

Title: Raynaud's Phenomenon Noninvasive Treatment Through Breathing and Meditation

Student Name(s): J. MacIntyre

## Abstract:

Raynaud's phenomenon is a common and painful vascular response to the cold in which a person's extremities become numb, and follow by becoming white, green, and eventually purple. This occurs in minor temperature changes, and interrupts many daily activities. The goal of this research project was to find a noninvasive treatment that minimizes the effects of this phenomenon.

The method utilized in this experiment was one similar to the Wim Hof method. The method contains three aspects: breathing exercises, training of mindset and concentration, and exposure to the cold. I tested a combination of these three variables. My control group was only exposed to the cold, the second group was exposed to the cold and completed the breathing exercise, my third group was exposed to the cold and completed the four minute body scan meditation technique, and my fourth group completed all three. Vital signs such as heart rate, respiratory rate, capillary refill, pain index, pulse index, and temperature were then recorded after the cold exposure. This was continued over a period of four weeks.

Preliminary data shows no significant trends in data. Although, it is expected that with a more intensive and continuous routine of breathing and meditation over a longer period of time that this technique could have an impact on the symptoms of Raynaud's phenomenon. The insignificant data is likely due to the limited time frame for testing and uncontrolled the temperatures in the available environment.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

242

Fair Category

LS

Project Number

3030

Title: A Halophytic Approach to Bio-Thermic Desalination through Transpiration

Student Name(s): J. Mo

## Abstract:

Water desalination holds the potential to end current struggles to find clean water sources and to mitigate the current strain put on this finite resource. This project investigates the use of halophyte plants to filter the salt out of water, and then to harness the water from the plants by harvesting it through the plant's natural transpiration process. This method is called Bio-desalination. In the proposed model, the feasibility of halophytes is explored to act as a desalinizing agent to mitigate and provide mobile relief for droughts, water insecure communities, and emergency relief in temperate and tropical areas.

The foundation of the new technology revolves around halophytes. The specific halophytes examined are various mangrove trees. These trees have evolved to burgeon in waters of high salinity and can filter salt out of water. The tree is left to grow, but transparent encasements will encompass the canopy to collect the condensation of fresh water emitted by the trees during their natural transpiration process. The condensation is then collected and drained through a valve so that it can be piped into water storage before it is distributed.

Our experiments yielded measurements of 1.63 kg/h/m<sup>2</sup> compared to the projected baseline of 1.4 kg/h/m<sup>2</sup> from previous experiments. The water production is contingent on the size of the trees the project is able to procure. With larger trees, it is possible to produce in excess of 155 liters a day.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EN EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

259

Fair Category

LS

Project  
Number

3032

**Title:** Crowd-Sourced Detection and Mapping of Nitrate Water Pollutants via a Mobile Web-Based Image Analysis System

**Student Name(s):** L. Barcelo

**Abstract:**

ABSTRACT OF RESEARCH

Countless fertilizers and plant-conditioning products utilize nitrates, which when presented into an ecosystem with surrounding bodies of water, catalyze the dangerous process of eutrophication. Eutrophication is both a rapid process and difficult to detect for due to the volatility of nitrate influx into bodies of water. During the day phytoplankton populations grow exponentially where nitrates are present in abundance, while at night most die off, which results in a serious drop in dissolved oxygen levels during the night because of decomposers. To combat this drop in dissolved oxygen levels effectively, a crowd-sourcing detection method is essential in order to accurately, efficiently, and rapidly tag problematic zones. Furthermore, by introducing both a Sulphanilamide coupled with N-(1-naphthyl)-ethylenediamine dihydrochloride compound, and zinc powder into the water sample, and by measuring the color emitted from the solution, through image analysis and supervised machine learning—once both compounds are added to the water sample—the mobile platform will be able to measure the quantity of nitrates that are present in the given water source. The mobile image analysis system uses a picture's RGB values to correlate color intensity to nitrate concentration through an R-based shiny web-based application. Through the implementation of colorimetric analysis of given solutions by the utilization of the user's phone camera, one may attain information on nitrate concentration levels in the tested body of water, which will be uploaded to a database that all contributors may access, thus allowing for the general population to acquire knowledge about their surrounding aqueous environments.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

76

Fair Category

LS

Project Number

3033

Title: Shell Shock Effects of Ocean Acidification on Shelled Marine Organisms

Student Name(s): H. Wronski

**Abstract:**

The oceans have many environmental concerns and absorbing excessive carbon dioxide could significantly increase acid levels and affect shelled saltwater marine organisms.

To test this concept, three sample sets of two pH specific saltwater contained environments, monitored for twenty-eight days, under two temperature conditions with pre and post weighted shell fragments from clams and oysters could provide support regarding the impact of global warming leading to ocean acidification and its effects on shelled marine organisms.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

BI EM MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project Number

3034

Title: The Effect of Saline Content on the Growth of Poaceae (Grass)

Student Name(s): M. Slusarz

## Abstract:

The purpose of this experiment was to determine the effect that different concentrations of saline will have on the total measure of biomass produced of grass because of the effect of salt on plants that are near the ocean. This is a concern because as the ocean crashes against the shore, it sends a salt water spray into the air, which the wind will take and distribute it upon all of the plants within a few miles of the ocean. The grass was used because of its popularity, obtainability and its prosperity in growth along with the fact that it is commonly found on properties. It was expected that the grass that was watered with the highest concentration of saline would have the least overall growth. In this experiment, the total biomass produced was measured for the each of the concentrations by cutting the grass and using a scale to measure the biomass produced under that concentration of salinity. The result was that the highest salinity, thirty-four parts per thousand (ppt) had the highest overall biomass at 1.74 grams while the lowest salinity, at zero ppt, had the lowest overall production of biomass at 0.48 grams. When salt is in the soil, then it absorbs the water and grows in mass with the absorption of the water, blocking the water from entering the plant, unlike with the sea spray. This is important because it will help us to understand the full impact the ocean has on our environment.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

235

Fair Category

LS

Project  
Number

3035

**Title:** Identifying Small Molecule Translesion Synthesis Pathway Inhibitors Targeting Rev1-CT Protein-Protein Interaction

**Student Name(s):** S. Chow

**Abstract:**

Chemotherapy remains one of the most widely used first-line cancer treatments to date. The translesion synthesis (TLS) pathway has been shown to promote the proliferation of cells containing damaged or defective DNA during DNA replication, thus aiding in cancer cell mutations and chemoresistance. In the context of TLS, Rev1 coordinates the switch between DNA and TLS polymerases, initiating TLS. All interactions between Rev1 and TLS components occur at Rev1's C-terminus (CT). This research aims to identify and develop small molecule inhibitors of these interactions as anti-cancer adjuvant agents. Initially, 2,000 compounds from the ChemBridge collection underwent high throughput screening using a fluorescence polarization assay to identify potential Rev1-CT protein-protein interaction disruptors. These compounds were then retested at varying lower concentrations through a series of dilutions paired with fluorescence polarization to remove false positives and narrow the initial group of compounds to the compounds displaying the most promising IC50 values. I successfully identified two small drug-like molecules which yielded low IC50 values and were then further tested on osteosarcoma cancer cells in partnership with cisplatin through an MTS anti-proliferation assay. The two compounds showed promisingly low IC50 values for the cellular assay at 50uM and the potential to be further evaluated at lower concentrations in the hopes of eventually developing small molecules with the potential to be distributed as drugs to help combat the pressing issue of chemoresistance.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

236

Fair Category

LS

Project Number

3038

Title: An Investigation on the Potency of Sunscreen in Protecting Against UV Radiation

Student Name(s): V. Estacio

## Abstract:

The purpose of my research on the potency of sunscreen in protecting against UV radiation is my interest in becoming a dermatologist. Before my experiment I predicted that the level of SPF would not have as much of an impact as commonly thought.

I investigated my hypothesis by using a UV index meter and several different SPF levels. Covering the meter with plastic wrap, I put a small amount of sunscreen on it and tested it from September to February. I tested SPF levels: 15, 30, 30 (spray), 45, 60, 85. I also used social media to survey a wide range of community member in Trumbull. My questions included:

When do you apply sunscreen frequently?

Do you know what the term "SPF" means?

Do you buy the sunscreen with the higher SPF?

Do you reapply sunscreen or do you believe one application enough?

From the data I gathered, I observed that as the SPF level of sunscreen increased, the UV index meter did not decrease by much. Also, the spray version of sunscreen was prone to not being as effective as the lotion version by 1 UV level.

At the end of my experiment, I concluded that past SPF 30, the potency in protecting against UV rays is the same. From the survey, I concluded that most people are unaware or uneducated about the effects of sun damage and how to properly protect against the sun.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

234

Fair Category

LS

Project  
Number

3039

Title: Quantitative analysis of Apple Strains through measurement of Vitamin C Concentration

Student Name(s): M. Coleman

## Abstract:

The project presented in front of you is a chemical analysis of different apple strains, two specifically researched we 'Red Delicious' and 'Granny Smith' apple strains. This project was developed to find which apple strain would be healthiest to a consumer based on Vitamin C (ascorbic acid) levels because of Vitamin C's antioxidant and immune boosting properties. The strains were specifically chosen to give the consumer an idea about which apples may generally have greater Vitamin C levels based on similar sized, shape, and especially color. These generalizations will be especially relevant because the apple samples will contain the 'skin' tissue allowing for more accurate analysis. This information would be vital for consumers because if buying apples, consumers would value knowing they are buying the 'best' one in terms of Vitamin C. This research was carried out in the Chemistry Laboratory at Central Connecticut State University and data was obtained through comparing the apple samples to pure concentrations of Vitamin C by means of a single beam Spectrophotometer. The apples samples were frozen in liquid nitrogen then macerated, and created into a solution. This solution was compared to a pure solution in which oxidized, and acidified a solution to result in pure Vitamin C concentration. Both strains had three samples to be compared to the pure form of Vitamin C for more accurate analysis and the results are recorded in the data charts below.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS ME CH

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project  
Number

3040

**Title:** An Investigation of Halophilic Microbes to Bio-remediate Brine Backflow in Soil Adjacent to Hydraulic Fracking Wells

**Student Name(s):** J. Driscoll

## Abstract:

The purpose of this project was to investigate the ability of halophilic microbes to bio-remediate brine backflow in soil adjacent to hydraulic fracking wells. It was hypothesized that the halophiles would consume significant amounts of each salt, therefore reducing the salinity of the soil by 25% within the first 2 weeks. Halophiles were cultured at 42°C. Sixteen containers were established, each with 50g of soil and 20g of sand (including controls). Salt solutions (1%) included each salt alone, mixed in doubles, and mixed in triples. Depending on the combination, salt solution added to each container was 10mL. Each container was inoculated with 10mls of halophilic broth. The containers were placed under a light rack in order to maximize efficiency of the halophiles. Data was collected by creating a slurry and measuring the salinity, moisture, and temperature of the slurry. To make the slurry, 2.5grams of the soil was mixed with 20mL of distilled water. The slurry was left alone for 10 minutes to allow the salts to dissolve. After 10 minutes, the salinity, moisture, and temperature of the slurry was calculated using their respective probes. The process was repeated every other day for 2 weeks. Data was analyzed and at the conclusion of the experiment and the original hypothesis was supported with statistical significance in most containers. The halophiles consumed the salts by lowering the salinity of the soil over time. Although overall salinity was reduced it future studies should include determining individual rate of consumption for each salt.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM BI MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

LS

Project  
Number

3041

**Title:** A Novel Approach to the Ease and Accessibility of Early Detection of Chronic Kidney Disease (CKD) to Prevent Onset of End Stage Renal Disorder Through Examination of Urinalysis

**Student Name(s):** S. Gunawardana

**Abstract:**

The Center for Disease Control estimates that 10% of the global population suffers from chronic kidney disease (CKD). It takes several years to develop through its five stages and is most treatable in the initial stages when the kidney has had the least significant damage with few symptoms. Currently, the best forms of detection are limited to biopsies and imaging tests - both expensive and only available in specific locations. The goal of this research was to find a chemical reagent color indicator for the high-protein urine of those with varying degrees of kidney failure that could be placed on an accessible and inexpensive dipstick test. A Spectronic-20 was used to create an absorption spectrum for bromothymol blue to find its optimum wavelength (595 nm). This was then used to create a Beer's law calibration curve based on the indicator's color change in solutions increasing in acidity from a pH of 7 to 4. A similar procedure was then repeated, albeit with increasing amounts of albumin (protein) solution corresponding to CKD's five stages. The measured color change of the indicator was significant between a sample with/ without acid. As acidity increased, the spec-20 was able to measure changes (-.004) in the indicator's color intensity. In all of the albumin solutions, there was no measured significant change. Although bromothymol blue will form a color change reaction with acidic solutions, it's not sensitive enough to be used as an indicator for CKD. Therefore, further research on alternative indicators needs to be explored.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME CH BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

239

Fair Category

LS

Project  
Number

3042

**Title:** Genomic Analysis of Osteosarcoma To Identify Novel Key Regulatory Pathways in Tumorigenesis

**Student Name(s):** S. Menta

**Abstract:**

In children and young adults, approximately 400 new cases of Osteosarcoma (OS) are diagnosed in the United States each year, making it the eighth most common malignancy of childhood (Ottaviani & Jaffe, 2009). In patients who do not respond to chemotherapeutic treatment, it is believed that there are certain genes that are expressed in their tumors. The cancer stem cell hypothesis states that tumors are maintained and evolved by stem cells. There are also bulk cells in OS tumors, which are limited in their replication ability and play a minimal role in proliferation. The aim of this project was to compare gene expression in OS cell lines (which includes stem cells and bulk cells) and non-OS human bone cells. Using a bioinformatics approach, I searched for coordinately regulated genes and hoped to find the master regulatory switch(es). The two gene sets that were analyzed were available from the Gene Omnibus Database on NCBI. After extensive analysis, the only viable gene candidate was CCNB2, also known as Cyclin B2, a cell cycle regulator. It was highly expressed in tumor cells vs. the non-tumor cells and specifically, it was highly expressed in the stem cells compared to the bulk cells. Future studies in the laboratory will test this gene to validate or reject this meta analysis. If validated, targeting CCNB2 may create new options for complete treatment of OS through the eradication of the stem cells, which perpetuate tumorigenesis.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

Yes  No

# CSEF Official Abstract and Certification

Word Count

191

Fair Category

LS

Project  
Number

3043

Title: Cilantro and plants with ester functional groups purify copper(II) from water

Student Name(s): V. Gerig

## Abstract:

Today, the heavy metal contamination of drinking water poses a threat to several countries' safety. People afflicted by heavy metal poisoning resulting from contaminated drinking water have high risks of respiratory disease, nausea, paresthesia, weakness, and hepatomegaly. In many third world countries people do not have access to water filtration systems because of expense and availability. In this study, plants were tested to see if they were capable of removing copper from water. Several plants that had similar chemical structures were tested. These plants were: celery, broccoli, cabbage, basil, black tea, kale, parsley, pineapple, apple, pear, banana, peach, strawberry, grape, blueberry, lemon, watermelon, tomato, mango, and orange. Overall, 20 mg samples of the plant removed 20-60% of a 20 ppm, 10 ml copper solution that was shook for 20 minutes. Through studying cilantro it was found that: amount of plant used, shaking time, and surface area of cilantro all had a significant effects on the removal percentage of copper. In regions where plants grow abundantly, this way of purifying water is affordable and easily accessible. This idea could be useful in third world countries as an alternative way to purify water.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM CH PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project Number

3044

Title: Determination of the Period Between Influxes of Talent in Professional Baseball

Student Name(s): A. Chandy

## Abstract:

The objective of this project was to determine the period of time between influxes of superstars or the lack thereof for different positions in baseball. It was hypothesized that there would be a period of 20 years between peaks and valleys of talent, forming a sinusoidal graph. This would be due to the fact that the difference in age between an aspiring child and their role model superstar is approximately 20 years. Data for the average Wins Above Replacement (WAR), a statistic that encompasses a player's true value, was collected for each position from 1956 through 2016. The data was graphed for each position with year being the independent variable, and average WAR being the dependent variable. The period between influxes of talent was deduced by visually determining the distance between peaks or valleys of the sinusoidal trend line that was attached to each plot. It was discovered that the period of the sinusoid varied for each position. This is due to the fact that the peak age in a player's ability differs based on their position, and also that some positions draw young talent at an age closer to their debut into professional baseball. This pattern of highs and lows on a given interval can be applied to other situations in sports, such as the performance of a whole team. It is also relevant to other aspects of life, as there are stretches of time where there are explosions of technological advancements, such as the Renaissance and Industrial Revolution.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project Number

3046

Title: Effect of Nutrient Source on the Growth of Mint Lettuce

Student Name(s): K. Roman

## Abstract:

In recent years, there's a shift in focus on healthier diets in common places like school and work. In order to do that we have to be able to increase production of healthier food, in this case, through systems like hydroponic and aquaponic based growing. Studies like "Science Direct" have shown that hydroponic and aquaponic based production systems have the ability to increase both demand and quality of the food being produced. There has been a corresponding shift in recognition by both corporations and communities for locally grown and produced food that can create the avenue to produce these desired results. One of the variable that is a concern when growing hydroponically is the source of the nutrients, therefore we evaluated the effect of the quality of nutrient sources on the growth and development of mint lettuce. Over the course of one month in this study, the plants that were grown under natural nutrient sources from fish waste grew significantly faster producing almost twice as much biomass, opposed to the plants that were grown with synthetic fertilizers ( $p < 0.05$ ). Therefore, the implications of this study are that somebody, some company, or some school group that are considering growing their plants and their food this way really should consider the use of aquaponics because the fish (waste) water shown through this study to generated twice as fast of a growth rate for plants so interested groups would not have to put out or minimize the expenses associated with synthetic fertilizers.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PS EV EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project Number

3047

**Title:** The Role of Rigosertib Treatment in the Expression and Localization of RASSF1 in RASSF1 Transfected Cancer Cells

**Student Name(s):** W. Brandon

## Abstract:

Rigosertib is a small chemotherapeutic molecule that has shown promising results in clinical tests. Rigosertib functions by inhibiting two pathways that are overexpressed in many strains of cancer (PI3K and PLK) by allosterically inhibiting the RAF's phosphorylation. The drug temporarily arrests healthy cells, while inducing apoptosis in cancerous cells. RASSF1 is a protein involved in tumor suppression that prevents the buildup of cyclin in unhealthy cells, disabling replication. RASSF1 has been known to localize to the cytoskeleton and centrosomes of both healthy and cancerous cells. This experiment explored the impact of Rigosertib treatment on the localization and expression of RASSF1 in lung cancer cells to ascertain RASSF1 expression's impact on Rigosertib treatment efficacy. If Rigosertib treatment lowers RASSF1 expression or alters the protein's localization, Rigosertib treatment on RASSF1 expressing cancers would be counterproductive, because the drug would be working against the cell's natural anticancer mechanism. RASSF1 localization was studied by transfecting lung cancer cells with a plasmid that expressed RASSF1 fused to a green fluorescent protein tag. Cells were divided into untreated and Rigosertib treated groups. After treatment, cancer cells were fixed to coverslips and analyzed under a fluorescence imaging microscope. Although Rigosertib treatment led to cytoskeletal irregularities, treatment had no noticeable effect on RASSF1's characteristic localization to the cytoskeleton and centrosomes. The specific cytoskeletal protein to which RASSF1 localized is currently unknown. This experiment provides valuable support to RASSF1 expression's non-impact on Rigosertib's efficacy. Information of that nature will become more important as individualized treatment becomes more accessible.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

209

Fair Category

LS

Project Number

3048

**Title:** Investigation and Analysis of similarities between intrinsic variable stars, extrinsic variable stars, and Exoplanet Transit light curves

**Student Name(s):** T. Kimberlin

**Abstract:**

The purpose of this project was to identify the differences (if any) of light curves from different types of variable stars and exoplanets. It was hypothesized that by studying the differences between the various light curves created by intrinsic variable stars, extrinsic variable stars, and exoplanet transits, it can be deduced how to identify each system. The bulk of this project entailed detailed analysis of light curve data obtained by electronic instruments. The pulsating light curves of intrinsic variables, the eclipses of extrinsic variables, and the slight flux in luminosity of exoplanet transits were all observed in the numerical data when reduced in a the program MaximDL. With this data, properties of the systems were determined by analyzing the light curves. The data gathered and taken from other sources was analyzed and the hypothesis was partially supported. It was seen that different systems of stars i.e (Intrinsic and extrinsic variable stars, and exoplanet systems) all have commonalities in their light curves but also major, identifying differences. There, of course, could be exceptions to these differences, but none that were seen in the data. Future research might include an investigation of other properties of the analyzed systems such as orbital period or semimajor axes in comparison to their light curves.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

PH MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

149

Fair Category

LS

Project  
Number

3049

Title: The Effect of Book Age on Surface Bacterial Growth on Textbooks

Student Name(s): A. Desjardins

## Abstract:

A study was conducted to investigate if there was a relationship between the age of a textbook and the amount of bacteria present on the surface of said textbook in order to determine whether or not textbooks pose a risk as a fomite. The spines of 4 groups of textbooks were swabbed for bacteria. The samples were then incubated for a 72 hour period; afterwards colony counts were taken. It was found that the oldest group of textbooks contained the most bacteria (averaging 26 CFUs/plate). Although the difference in data was considered to be not significant (averaging  $p=.3382$ ), there was a trend that as the samples got older, the data became more significant ( $p=1$  vs.  $p=.0012$ ). Based on the results of the study, textbooks could be considered to be a common fomite and their contamination should be taken under consideration in educational and scientific settings.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB ME EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

244

Fair Category

LS

Project  
Number

3050

**Title:** The Effect of Sleep Deprivation on Verbal and Visual Memory Retention in High School Adolescents

**Student Name(s):** R. Bingham

**Abstract:**

Sleep deprivation is a plague often observed in any American high school. Many studies suggest a linkage between amounts of sleep impacting a person's memory, however none look at its impact in a high school setting or in relation to learning. This study examines a population in a small suburban high school, while limited by small population sizes the study can provide insight into future more in depth analyses. A survey was sent out to the entire upper school, in the total student population of around 320 students of fifteen to eighteen year olds there were one hundred and sixty-eight responses. Out of those who responded to the survey, 56.6% fell asleep at eleven o'clock or later and 51.8% reported getting sleep in the range of 5-6 hours, 4-5 hours less than the recommended amount for adolescents. More so 63.7% of students report dozing off in class due to their sleep deprivation, which is taking away from their time learning. And this is in part due to the unhealthy school traditions of heavy homework loads and early start times, 84.5% of students report being overwhelmed by their homework load and 79.2% believe they would benefit from a later start time to school. Combined with memory tests performed on individual students to discover if there is a correlation between sleep and memory performance in adolescents, this study concludes adolescents by and large are in need of more sleep in a growingly fast-paced world

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME BE MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project  
Number

3051

Title: Starch in Leaves

Student Name(s): F. Mikailou

## Abstract:

Testing leaves for starch is an experiment that shows that photosynthesis has taken place. Glucose is the main product of photosynthesis, which converted immediately to starch. Green leaves demonstrate that photosynthesis has most likely taken place and that there is chlorophyll. Chlorophyll describes the green pigments found in chloroplasts of leaves.

Leaves were collected to be tested after being on a tree under a full sunshine for a 24-hour period. Pour some boiling water into a large beaker. Use forceps to hold the leaf in the hot water for 1-2 minutes (to soften the leaf and kill the living cells). Take out the leaf from the hot water. Insert the leaf in a test tube, push it to the bottom and pour ethanol in the test tube to cover the leaf. Place the test tube in boiling water. Hold on for a few minutes to see the chlorophyll being removed. Remove and put it in warm water again to wash off the ethanol. Pick the leaf with forceps and rinse it in cold water to cool it off. Place leaf in petri dish and drop iodine solution on it. Wait to see when the leaf changes blue-black.

In some cases, the leaf did not change because there might not have been enough starch or photosynthesis did not take place at all. In daily life applications, one can pour a few drops of iodine solution on starch powder to see how difficult it is to change its color with chlorophyll

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

260

Fair Category

LS

Project  
Number

3052

**Title:** FLU INDUCED ALTERATIONS IN MUSCLE CYTOKINE EXPRESSION DUE TO AGING

**Student Name(s):** R. Mahatme

**Abstract:**

Despite being a respiratory infection, influenza (flu) is one of the leading causes of catastrophic disability in the elderly. The muscular component of flu infection, however, is under researched as the majority of research focuses on the respiratory system and immune responses. This research sought to determine the influence of aging on flu-induced muscle localized inflammation by examining cytokine expression within the gastrocnemius muscle. Young and aged C57BL/6 male mice were intranasally infected with a sublethal dose of influenza. The gastrocnemius muscle was harvested from euthanized mice on days 0, 1, 7, 10, and 12 following infection. Muscle was homogenized and protein was extracted and analyzed via BCA Assay for total protein concentration and multiplex for concentration of each cytokine. Cytokines are small proteins that can be largely classified as pro-inflammatory or anti-inflammatory. Cytokine concentration was normalized to total protein content. It was hypothesized that flu induces prolonged inflammation within the skeletal muscle of aged mice. Results indicate that aged mice had dramatically increased pro-inflammatory response, upregulated CXCL-10, on day 12 post infection when compared to young mice. Contrarily, young mice had increased anti-inflammatory cytokines, IL-10 and IL-4, that encourage muscle repair, on days 10 and 12 post infection compared to aged mice. Taken together, young mice had a stronger anti-inflammatory response later in infection, while aged mice had prolonged pro-inflammatory signals, signifying delayed repair responses. It is possible that these specific cytokines can be targeted for therapeutic use to develop preventative medication against inflammation and resultant muscle degradation.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CB ME AS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

172

Fair Category

LS

Project  
Number

3054

Title: Effects of the Enzyme Bromelain on Raw Ground Beef at Varying Temperatures

Student Name(s): J. Nye

## Abstract:

The bromelain enzyme has medical applications such as the digestion of scar tissue from burns and to act as an anti inflammatory. In this study the effects of temperature catalyzation of the enzyme's ability to digest protein tissue was tested to determine whether or not an increase in temperature can increase the enzyme's efficiency. Raw ground beef was used to simulate protein tissue, similar to human tissue, to be digested by the enzyme. The results derived from this experiment supports the fact that an increased temperature can be used to catalyse the enzyme's reaction. The data can be used to further this study and locate this enzyme's peak temperature of performance and the point at which it may be denatured. If the 9 peak of performance is determined, the digestion of human scar tissue may be more efficient and complete allowing the maximum growth of healthy cells to replace dead cells. Also its ability to act as an anti inflammatory could be enhanced and result in a lower inflammation and support healing.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project Number

3055

Title: The Effect of Oxidative Stressors on Cultured Lung Epithelial Cells

Student Name(s): U. Dubovik

## Abstract:

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide. It is caused when the respiratory alveoli are exposed to external stressors that are no longer mitigated by cellular stress responses, thus leading to chronic bronchitis and emphysema. It's unknown precisely in what way and when the stressors become too severe for the cells to mitigate. Therefore, this research determined the effects of an oxidative stressor: cigarette smoke extract. It was hypothesized that at 5% cigarette smoke extract concentration cell damage will be irreversible. To test this, cigarette smoke extract was acquired and augmented into one sample of cultured BEAS-2b cells. After 3 and 7 days, a trypan blue assay was performed in order to see the effect of the oxidative stressors. The cells dyed blue were indicative of those that died. The numbers were used to see change over time and formulate a growth curve that is related to the concentration and the oxidative stressors implemented, in order to see the specific effects on cell viability. This was compared to the control growth curve, showing the extent of the negative effects. This research contributes to the overall goal of seeing the mechanics of how COPD is caused. It shows the phases cells go through and at what point the cells are unable to battle with the stressors, thus leading to COPD. Since this disease is a frequent cause of death, finding out the mechanisms by which it begins on a cellular level is crucial towards curing it.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB BI ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

244

Fair Category

LS

Project  
Number

3056

Title: Cellular Cultivation Matrix Created from Collagen Found in the Sea Star Asterina, sp.

Student Name(s): T. Saunders

## Abstract:

The purpose of this experiment was to create a cell cultivation matrix using the collagen substructure of the sea star Asterina. It was hypothesized that collagen can be successfully isolated from Asterina, washed of all xenophilic DNA markers, and repopulated with Asterina cells. Initially, Asterina was euthanized using an anesthetic of 5% and a lethal bath of 95% of ethyl alcohol respectively. After homogenization with a mortar and pestle, the samples were washed with distilled water and repeatedly centrifuged. The samples were then combined, centrifuged, and placed into a 37°C hot water bath with .5% Sodium Dodecyl Sulfate for 6 hours. This did not yield the critical mass of collagen needed to create a matrix that would promote cell growth. A secondary methodology was employed by dissolving 40 g of collagen powder and 1g of agarose powder in 100mls of distilled water to create agarose plates to serve as collagen-matrix proxies. Several Asterina were then euthanized, their central discs removed, and placed on the collagen infused agarose. The plates were incubated for 48 hours at 37°C. Growth was observed and recorded in a photographic timeline for 10 days using stereo and compound microscopes. Trials were repeated using increased amounts of collagen in the agarose plates. Results indicate unorganized, cellular growth around the central disc. Viability of the cellular growth was confirmed using staining. Future research might include more advanced cellular viewing techniques or tests in which cellular respiration of said cells is measured.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CB BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project Number

3058

**Title:** An Application for Teaching the Fundamentals of Java Programming to Increase Computer Programmers and Coders for the Workforce

**Student Name(s):** M. D'Ostuni

**Abstract:**

To create cost effective and customized solutions, government, industries and service organizations need coders. While the ability to write code is one of the top value-added skills for today's workforce, only one in ten high schools provide coding courses. Current employees must learn outside the traditional classroom setting, but face issues: reading websites full of random code or a lengthy book with no physical programming being completed. Lack of awareness or time-consuming options are factors leading to greater than 7,000,000 coder open jobs in the United States. The problem is how to expose students, particularly in high school, to programming in an engaging way. This project provides a different approach to acquiring coding skills by creating an application for students to learn how to program the commonly used language Java. The application was required to be less time-consuming, more engaging and easier to understand than current options. Once basic concepts to code were determined, lessons were coded with short explanations, examples for user review, and mini-projects for the user to apply their skills. This project is currently being tested by students at the high school level who have little to no programming experience. The results will be used to modify the lessons. Users of the project will be able to write code for a beginner to intermediate program in Java and share insight into new ways to program a certain task. Many programs can be written completely differently and result in the same output in the console.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CS AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project Number

3059

**Title:** Least Positive Outcome: Health Service Use in a Longitudinal Study of Autism Spectrum Disorders

**Student Name(s):** C. Borecki

## Abstract:

Autism is a neurodevelopmental disorder defined by sociocommunication deficits and repetitive behaviors. Young adults with autism have higher incidences of psychotropic medications, seizures, hospitalizations, health service dissatisfaction, and service limitations. Some people within this longitudinal study of autism have had a "very positive outcome," or lost their diagnosis with age. This group has been studied. However, a "least positive outcome" is undefined.

This study was conducted at the Center for Autism and the Developing Brain within a 24-year ongoing longitudinal study of over 100 participants. Participant parents completed surveys about the participant's health. Data points were counted for frequency within the longitudinal group.

Only 4 participants had a psychologist/psychiatrist/neurologist in primary care despite high medication reporting. Care satisfaction was low, although few reported limits on services, implying that the highest area of need is within services themselves. The most reported limit was behavior. Small percentages of participants had extremely high medication use, seizures, no primary care, hospitalizations and behavioral issues. Almost all participants with no primary care had no autism services, a sign of total disengagement. Small percentages of participants had extremely high medication use, seizures, no primary care, hospitalizations and behavioral issues: a "least positive outcome." More analyses are being run on this group. This will allow examination of factors that contribute to a negative outcome, as the childhood data of this group can be examined retrospectively due to the nature of the longitudinal study. This would allow provision of better intervention to avoid such a "least positive outcome".

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

265

Fair Category

LS

Project  
Number

3060

**Title:** Low-Cost, Portable Paper-Based Diagnosis of Alzheimer's Disease: Targeting A $\beta$  Oligomers in the Brain Using Polymeric Nanoconjugates as Artificial Biomarkers

**Student Name(s):** W. Yin

**Abstract:**

Alzheimer's disease (AD) is a neurodegenerative disorder frequently characterized by deficiencies in reasoning, memory, and cognition. As the most common neurodegenerative disorder, AD affects over 35 million people around the world, two-thirds of whom reside in developing countries. Despite its high incidence, there currently exists no affordable means for early detection of AD. This work details the development of a low-cost, paper-based urine test for AD early detection. The test utilizes the sequential administration of artificial biomarkers (Curcumin-PAGE-PEG HRP-AuNPs) and curcumin-tetrazine to target soluble A $\beta$  oligomers. These oligomers are indicative of AD formation within the brain, and may appear up to two decades prior to onset of external symptoms; thus, they serve as suitable targets for early diagnosis. In vivo, the artificial biomarkers are first to be administered into the bloodstream, crossing the blood-brain barrier via transcytosis and then binding with oligomers within the brain. After four hours, curcumin-tetrazine is administered, and binds independently to the same oligomers, inducing the local microenvironment to become hydrophobic. The curcumin-tetrazine acts as a small-molecule trigger in selectively disrupting the hydrophobic/hydrophilic balance of the artificial biomarker polymeric membranes, thus initiating the release of HRP-AuNPs for eventual excretion in urine. HRP-AuNPs may then be detected in urine via an enzymatic reaction with the TMB-stained paper test and a visible color change. In control cases, artificial biomarkers and curcumin-tetrazine will be independently excreted without reaction, and thus will not react to produce a color change. Experimentation indicates successful colorimetric determination of AD conditions within solution.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME BI EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

197

Fair Category

LS

Project Number

3061

Title: The Influence of Wildebeest Carcass Inputs on the Diet of Fish in the Mara River

Student Name(s): K. Handler

## Abstract:

The Mara River is a vital component of the Serengeti Mara Ecosystem. Frequent wildebeest mass drowning events provide an abundant source of organic matter for fish to consume directly or indirectly. The purpose of this research is to determine wildebeest carcass influence on fish diet. I hypothesize that the closer to the wildebeest inputs the fish are, the more the gut contents will relate to the carcasses. I analyzed the fish gut contents from two sites: above and within the region influenced by wildebeests. Fish collected in field research were stored in ethanol. We removed the gut track, emptied the gut contents, and analyzed them. The data was analyzed in a volumetric method by comparing the percentages of area each gut content group (insects, hippo excrement, other detritus). Results thus far show that fish without wildebeest carcasses present are not eating invertebrates, but the diet of fish with wildebeest carcasses in the area is 29% invertebrates. The results will help to chart a food web of the Mara river ecosystem, allowing us to determine the intricate relationships between aquatic and terrestrial ecosystems. They will also help to predict the effects should one species population decrease (or increase).

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM EV MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project Number

3062

**Title:** The antimicrobial efficacy of probiotics with homerus americanus exoskeleton fauna to control the impacts to sell rot disease.

**Student Name(s):** S. DiBella

**Abstract:**

An experiment was conducted to determine if growth of experimental cultures from the American lobster *Homerus americanus* could be controlled with the use of probiotics. An experimental group and control group (*E. coli*) were then compared to each other. A probiotic capsule was used to form a slurry with dH<sub>2</sub>O, which was then saturated in a 2mm disk which was placed onto the lawn streaked *E. coli* plate and the plate of lobster epibiont. The plates were put in an incubator of 37°C where it was observed/inspected every 24 hours for 72 hours. After 72 hours of incubation the samples were analyzed for zones of inhibition. The control culture of *E. coli* was grown under the same conditions and exhibited zero inhibition zones. Whereas a zone of inhibition was formed on the culture with probiotic and *E. coli*. The probiotic, in plate #1, grew 2mm and the the probiotic in plate #2 grew 3mm. With the disk of probiotic and lobster epibiont a zone of growth was formed. On plate #1 of the lobster epibiont and probiotic, the probiotic grew 5mm from the probiotic disk onto the lobster epibiont and on plate #2, the probiotic grew 4mm onto the lobster epibiont. Based on this data, the probiotic proved to control the growth of *E. coli* demonstrating a zone of inhibition, therefore concluding that putting probiotic in the feed of an American lobster can control the growth of the epibiont and thus create a higher health vitality.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

AS EM MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

LS

Project Number

3063

Title: Application of low voltage, irreversible electroporation in hindering microbial growth.

Student Name(s): M. Pillari

## Abstract:

The purpose of this project was to investigate the use of electricity to kill bacteria in a household or hospital setting. It was hypothesized that if 1v, 9v, and 12 volt currents were run through 2000 Series Aluminium sheets inoculated with E. Coli, the aluminium 12v sample would have the lowest survival rate due to increased damage to the cell wall and DNA caused by electroporation, however lower, more practical voltages will kill bacteria as well. Escherichia coli was applied to sterilized, aluminum sheet squares (3cm) using aseptic techniques and incubated for 48 hours. Aluminum squares were inverted on top of nutrient agar, removed, and both the Aluminum squares and the inoculated plates were incubated for another 48 hours. Colonies were counted to ascertain growth on the agar plates and the Aluminum plates were attached to a DC regulated power supply. Current was run through the post-incubated aluminum plates for one minute. Inoculation of second set of plates occurred using the "shocked" aluminum squares. Colonies were counted after 48 hours. Several trials were conducted and repeated at various voltage settings. Results were analyzed and support the hypothesis that metal surfaces exposed to electric current will reduced overall bacterial growth. Further testing is required to clearly define the minimum required voltage. In the future, types of metals like copper can be tested to see if there is synergistic effects of electricity and the natural antibacterial properties of copper.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MI ME EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

263

Fair Category

LS

Project  
Number

3064

**Title:** A New Precipitate Assay Relating to Palladium Blood Contaminants for Early Detection of Chagas.

**Student Name(s):** M. Lopez

**Abstract:**

Chagas disease is a Neglected Tropical Disease that affects millions in South America. These diseases are often overlooked by the medical community and, unfortunately, this negatively impacts treatment and testing options for those that are potentially infected by Chagas. The most potent and successful window of treatment for Chagas occurs during an onset, acute stage, however high cost and sophisticated laboratory analytics normally limit timely detection for the impoverished. Chagas disease is caused by the Trypanosoma cruzi antigen, which is transmitted primarily by triatomine bugs. Once infected, the acute phase of the disease is characterized by a rise in palladium blood content from (normal) 50.2ng/L, to 4.2mg/ml. This research takes advantage of the acute rise in the blood's Pd-content, and seeks to devise a quick, portable, and inexpensive method for Chagas detection, visible as a precipitation reaction within the patient's serum. To create the RhodamineB-derived detection probe, o-iodophenylspirolactam (o-IS) was first synthesized as per Jun, et al., and characterized via FTIR. To develop the novel test, 3 drops of 11.8 $\mu$ mol o-IS was added to 3 drops of 6.8 $\mu$ mol PdCl<sub>2</sub>, in the presence of 3 drops of tetrafluoroborate catalyst, at room temperature. In 5secs, a yellow precipitate formed, providing a positive test result for Pd, based on (FTIR-supported) insoluble complexation of o-IS with the metal. To devise the Chagas-specific test, the same reaction was performed for 4.2mg/ml Pd in human serum, at room temperature. In 5secs, a positive test result for Chagas was visible as a newly formed, insoluble Pd-o-IS product.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project  
Number

3065

**Title:** Evaluation of Potential Outer Membrane Protein Candidates for the Serological Diagnostic of Leptospirosis

**Student Name(s):** S. Balaji

**Abstract:**

Leptospirosis, a major zoonotic disease with more than one million cases and 60,000 deaths annually, lacks a vaccine for prevention and has symptoms that can be mistaken with several other febrile-illness diseases. Since antibiotic therapy is most effective in the disease's early stages, there remains a crucial need for better laboratory tests to diagnose early infection. In order to help develop an improved early diagnostic, this investigation evaluated six recombinant protein candidates derived from the *Leptospira* bacteria that could stimulate a strong immune-response from human patients infected with leptospirosis. Once the best concentrations of each protein candidate and secondary antibody were established using an ELISA, sera from patients in the acute and convalescent phases of the disease were tested in these concentrations alongside control sera from negative patients. This aimed to confirm the effectiveness of the established assay protocols in differentiating between sera of positive patients in different phases of the disease and healthy control individuals. The majority of proteins were able to differentiate between convalescent sera and the controls, and few could differentiate between acute sera and the controls, particularly protein F ( $p < 0.02$ ) and protein D ( $p < 0.026$ ) paired with the IgM. Such proteins are good candidates that can be used in future point-of-care assays for an early diagnostic of leptospirosis. This could not only allow for a rapid diagnostic of leptospirosis in regions with at-risk populations and without ample medical resources, but also provide for better and quicker treatment support.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME MI CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project Number

3066

Title: Maximizing Energy Production from MudWatts

Student Name(s): B. Bosworth

## Abstract:

There are up to one billion microbes found in each gram of soil, which include microorganisms such as *Shewanella oneidensis* and *Geobacter sulfurreducens*, which produce electrically conductive appendages under anaerobic conditions. These microbes release electrons that can be collected to produce electricity. The type of environment can change the amounts and types of microbes found. By testing the soil samples from different locations in Connecticut and enclosing them in a Mudwatt, which collects the released electrons and produces a flashing light, it is possible to find the prime location where the mud produces the most electricity. After constructing the Mudwatt fuel cell, soil samples are taken from three different locations, of different terrain, and are contained in the Mudwatt for a week each while collecting data. The prime soil will then be compared with different additives to see how to optimize the production of electrons from the microbes. It can be concluded that soil from pond location two sustained the most microbes and produced the most energy, of an average of  $20.5\mu\text{W}$  compared to the woods and field results. The results of the three different additives showed that adding 10g of powder glucose created a higher electron production rate than the salt and vegetable oil additives. The results of this data demonstrate that the pond two location with the addition of glucose produces the highest rate of electrons. This information can be used to create large scale microbial fuel cells that can produce electricity to be used by humans.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project  
Number

3067

**Title:** Sex Determination in Ostriches Through the Foramen Magnum and Implications for Dinosaurs

**Student Name(s):** K. Cunningham

**Abstract:**

One of the most puzzling questions of paleontology is that of sexual dimorphism. Currently, the only way to determine the sex of a dinosaur is via presence of medullary bone. The issue with testing for medullary bone is that it requires using precision tools to take a cross-section of the fossil, which destroys the integrity of the specimen. The aim of this research was to find an alternative to destructive sampling methods. The focal point of this study was the foramen magnum, which has been shown to be dimorphic in human specimens, as it is typically larger in males than females. Prior to this experiment, the accuracy of the foramen magnum in sex determination had not been tested outside of humans. This study looked at the paleognathous bird *Struthio camelus*, since they are some of the closest living relatives to the dinosaurs. Linear discriminant analyses (LDA) of the data showed high accuracy levels in using the foramen magnum for sex determination, although the small sample size in most cases did not allow for statistically significant results. Most LDA tests predicted with 88.89% accuracy the specimen's sex, though there were results as high and low as 100% and 55.56% respectively. Only one test, which utilized only the anteroposterior foramen magnum diameter, was found to be statistically significant. Nevertheless, this study offers a promising new alternative to destructive sampling and opens the doors to analyzing a wide variety of species in regards to sexual dimorphism through the foramen magnum.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AS EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project  
Number

3068

**Title:** Phylogenetic Analysis for Potential Adaptation of The LSD1 Protein in *Spartina alterniflora* Due to Sea Level Rises

**Student Name(s):** A. Hernandez

**Abstract:**

Coastal wetland communities are delicate ecosystems, sea level rises can and have disturbed the balance in these areas by exposing marsh plants to elevated levels of salinity. In order to develop a prediction on how the marsh grass *Spartina alterniflora* will genetically respond to prolonged levels of high salinity, the model organism- *Oryza sativa* was used to compare a fresh water halophyte to a salt water halophyte (*S.alterniflora*). The Lysine-specific histone demethylase 1 (LSD1) protein gene of 15 different organisms were mapped using a rooted minimum evolution phylogenetic tree. After establishing the phylogenetic tree, a series of statistical analysis were conducted which included pairwise distance modeling, which showed *S.alterniflora* to have the shortest evolutionary distances to *Zea mays*, *Sorghum bicolor*, *Setaria italica*, and *Oryza sativa* all of which had a distance less than 0.1 nucleotide substitution per 100 amino acids. Statistical analysis included Tajima's Rate test; using the generation time of the taxa to determine if a difference in mutation rate is present. The test failed to reject the null hypothesis of equal rates between lineages. Based on this data set it can be concluded that the LSD1 protein remains fairly similar throughout different species of plants; this means that the most probable type of mutation would be a silent mutation changing the rate of its expression to one most similar to the nearest evolutionary neighbor. Future research can involve using polymerase chain reaction to detect the concentration of LSD1 in *S.alterniflora* when exposed to different levels of salt.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV AT PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project Number

3069

**Title:** Effect of Regulation of Autophagy on the Hedgehog Signaling Pathway in Paget's Disease of the Bone

**Student Name(s):** R. Homma

**Abstract:**

Paget's disease of the bone (PDB) involves an imbalance in homeostatic bone remodeling, thus causing skeletal deformity and potential development of bone cancers. Current understanding of the disease's pathogenesis is limited; however, studies have identified a mutation in the sequestosome-1 (SQSTM1) gene that is prevalent in PDB patients. This mutation is also correlated with defective autophagy in PDB, a mechanism that recycles organelles in response to oxidative stress. Furthermore, the Hedgehog (Hh) signaling pathway, which is involved in the activation of osteoclasts in bone turnover, is upregulated in mutant pagetic cells. Thus, it was hypothesized that a correlation between autophagy and Hh signaling exists. In order to confirm this, the expression of Hh signaling genes Sonic Hedgehog (SHH), GLI-4, and GLI-1 were analyzed in pagetic cells versus normal bone cells that were cultured and treated in different drugs that affect autophagy regulation: simvastatin, vitamin D, and LPS. Quantitative Polymerase Chain Reaction (qPCR) was used to quantify gene expression. Analysis of the qPCR data revealed differentiation in SHH expression in pagetic cells versus normal bone cells and upregulation of SHH expression in pagetic cells treated in simvastatin. This concludes that upregulation of autophagy amplifies SHH signaling in pagetic cells. GLI-4 was observed to be underexpressed in pagetic cells, whereas GLI-1 and GLI-4 signaling were not significantly affected by autophagy regulation. However, the difference in expression of GLI-1 and GLI-4 homologs shows promise for future research on their specific functions in Hh signaling in PDB.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

211

Fair Category

LS

Project  
Number

3070

**Title:** 3-D Printing an Intramuscular Auto Injector to administer a Mixture of a Human-Derived Protein and Pharmaceutical-Grade Drugs to Counteract The Effects of Organophosphorus Poisoning

**Student Name(s):** L. Duffy

## Abstract:

In the realm of defense against chemical agents, devices such as atropine auto-injectors are not common practice, and for the user, this medicine may not always have a quick enough onset to be effective. This research aims to fill the hole in chemical defense technology and provide an easy treatment for patients in a readily available form. A treatment being tested by scientists in England in 2013 involving a human derived protein denoted as huBuChE and a mixture of three drugs: Atropine, Diazepam, and Asoxime Chloride was researched. Prototypes of the devices were modeled using TinkerCad and the prototypes were printed with completion of each iteration. Each iteration improved upon the previous, mainly in regard to changes in the handle, and to sizing the moving parts correctly. They were assembled by inserting syringes with blunt-tip needles filled with a dense oil or sugar water to test the efficacy of the injection mechanism. To test injections, the device was used on blocks of ballistics gel, a water/gelatin mix that represents the density of the human thigh, and where this device would be administered. Before and after testing, the device was weighed to ensure the injection of the fluid was successful by determining the percent delivered to the ballistics gel

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME EN BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

144

Fair Category

LS

Project  
Number

3071

Title: Effects of Stimulants on Heart Rate

Student Name(s): A. Perez

## Abstract:

One out of every three adults in the U.S. suffers from high blood pressure related problems. There are many causes of high blood pressure in the U.S., however a big contributor to high blood pressure and other physiology related issues is thought to be an excess ingestion of caffeine and sugar. I designed a study to determine which of the two stimulants have a bigger impact on physiology measured by pulse. I gave high school students caffeine and sugar to see which would raise their pulse the most. Each of the participants' pulses were recorded before and after ingestion of a source of sugar and a source of caffeine. The sources tested were table sugar, brown sugar, honey, green tea, black tea, and coffee. On average, all sources of caffeine raised the participants' pulses, while only one source of sugar raised the participants' pulses.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

212

Fair Category

LS

Project Number

3072

**Title:** Developing a Minimally Invasive Form of Enhancing the Growth of Cells via Ultrasonic Frequencies

**Student Name(s):** E. Luciano

**Abstract:**

The average human hearing capability is typically between 20 and 20,000 Hz which is why ultrasonic frequencies are classified as wavelengths at or above 20 kHz. Just as sound waves cause eardrums to vibrate, wavelengths can cause cells to oscillate. Oscillation can have varying effects on cell growth, shape, and motion. Yeast cells (*Saccharomyces cerevisiae* Type II) which grows at the same rate of cells inside the body, was used to stimulate growth of cells with 30 kHz being applied to the samples, to test if the growth rate would be deterred or catalyzed. Ultrasonic frequencies were applied to cultures of yeast for 7 minutes and incubated to continue growing for 48 hours after. When the frequencies were applied cell growth had increased an average of 64.7%, going from a mean count of 91,425 cells/ $\mu$ l to 150,583 cells/ $\mu$ l. The results of the yeast growth was analyzed through a chi square test where the rejection tail fell under 9.48 and the null hypothesis was rejected. Applying frequencies to cells is a noninvasive method to potentially increase needed cell count of red blood cells, white blood cells, or skin cells as needed. Future research can be done to test how different frequencies affect growth below and above ultrasonic levels for maximum efficacy.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME AT EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project  
Number

3073

**Title:** The Effects of Artemisinin and Ferrous Iron on Mouse Lewis Lung Carcinoma Growth

**Student Name(s):** A. Shafran

**Abstract:**

The goal of my research project is to test the effects of increasing the artemisinin and ferrous iron concentration in cell media on the growth of Mouse Lewis Lung Carcinoma. If carried out correctly, the rate at which the lung cancer cells grow should decrease as the the artemisinin iron mixture increases. The arteminism and ferrous iron should induce apoptosis in the cancerous cells.

Arteminism has endoperoxide links which can be broken in the presence of iron. Cancer cells exhibit a high amount of transferrin receptors which transport iron into the cell. Cancer cells require iron to allow proliferate to occur. However, the addition of iron activates the arteminism to create the free radicals which then travel through the cell by the transferrin receptors. The high reactivity can induce apoptosis in the cancer cells. As studies have demonstrated, artemisinin kills most harmful cells while maintains healthy cells.

The experiment will be carried out by growing normal mouse lung cells and cancerous mouse lung cells. In this experiment, the amount of ferrous iron is going to stay constant at 0.68  $\mu\text{g/mL}$  throughout the varied artemisinin concentrations. Artemisinin concentrations of 0  $\mu\text{g/mL}$ , 0.6  $\mu\text{g/mL}$ , and 1.2  $\mu\text{g/mL}$  will be tested on the cancerous lung cells as well as the healthy lung cells. My concentrations were determined based of an experiment that tested the effects of different concentrations of artemisinin-iron combinations on cancerous canine kidney cells. The data measurements will consist of counting the number of cells present using a hemocytometer.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project  
Number

3074

Title: Remediation of Beryllium Heavy Metal via Phaseolus Vulgaris Hyperaccumulation

Student Name(s): M. Carballo

## Abstract:

Using plants for bioremediation has less impact on the ecosystem versus using chemicals to take out heavy metals. During bioremediation plants that absorb large quantities of heavy metals in the soil are planted and, once fully grown, removed to rid the soil of contaminants. Most heavy metals have several hyperaccumulators, but Beryllium does not. According to "McCutcheon & Schnoor 2003, Phytoremediation. New Jersey, John Wiley & Sons pg 891" there are no known hyperaccumulators for Beryllium. Plants do absorb Beryllium though, and some more than others. Kidney beans (*Phaseolus vulgaris*), when tested for metal content, contain 2200 µg/kg of Beryllium. Could *Phaseolus vulgaris* be the first known effective hyperaccumulator of Beryllium? To test this hypothesis, *Phaseolus vulgaris* specimens were grown, some exposed to Beryllium Sulfate and others not exposed to any heavy metals. Control plants, in this case Ryegrass (*Lolium perenne*), were also grown and tested the same way. The plants were then dried and digested for Atomic Absorption Spectroscopy testing. Results from the Atomic Absorption Spectroscopy showed that the kidney bean plants absorbed 8324.2 µg/L of Beryllium Sulfate while the ryegrass absorbed 77.9 µg/L. This would deem *Phaseolus vulgaris* an effective hyperaccumulator of Beryllium. Other methods of cleansing Beryllium out of soil involve toxic chemicals that are worse than the Beryllium itself. The use of *Phaseolus vulgaris* as a hyperaccumulator of Beryllium in soil could be very helpful in remediation of areas that have suffered heavy metal pollution from mines and industrial activities in an environmentally friendly way.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM EV PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

211

Fair Category

LS

Project Number

3076

**Title:** The Efficacy of topical Ascorbic Acid Application to Packaged Produce to Prevent the Spread of Mold and Microbial Growth

**Student Name(s):** C. Fawcett

## Abstract:

Escherichia Coli and different variants of mold can infest packaged produce and leads to roughly 1 in 6 Americans (or 48 million people) becoming ill each year by the Center for Disease Control, CDC estimates. It is proposed that ascorbic acid can inhibit mold and microbial growth thus making packaged produce safer for human consumption. To determine this ascorbic acid analysis, experimentation was conducted by culturing microbial and mold cultured plates and measuring the zone of inhibition. Blood agar plates were streaked with E. Coli, inoculated with a 10% ascorbic acid 5mm tab and incubated at 37°C for 24 hours. Controls were established with untreated plates. Under the measurement of the E.coli, three zones of inhibition were measured to be  $\geq 1$ mm. Sabarad agar plates were streaked with mold and inoculated with a 10% ascorbic acid 5mm tab and incubated at 37°C for 24 hours. Controls were established with untreated plates. Under the measurement of mold, three zones of Inhibition were measured to be 1.8mm, 2mm, and 2.3mm. This experimentation has determined the efficacy of a topical ascorbic acid application to packaged produce in order to prevent the spread of mold and microbial growth. Ascorbic acid can be applied in future methods of prohibiting mold growth through a topical application.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

MI BI PS

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

LS

Project Number

3077

**Title:** Evaluating the Potential of CRISPR gRNA Sequences to Target HIV Patient Isolate Sequences

**Student Name(s):** A. Kachru

**Abstract:**

Human Immunodeficiency Virus [HIV] attacks an individual's immune system, specifically their CD4 cells- which typically help fight infections. If left untreated, HIV reduces the number of CD4 cells in an individual's immune system and makes them more prone to contracting infections or infection-related cancers.

With the recent discovery of the CRISPR/ cas9 system, it seems as if a cure may be viable. HIV Long Terminal Repeat sequences (LTRs) have been targeted in recent years because these identical sequences of DNA are used by viruses to insert their genetic material into a host's genome. As such, excising this part of the HIV genome will prevent the replication process from exacerbating the disease's pathogenesis.

Past research has been able to effectively edit HIV-1 LTR U3 region, which serves as a promoter for viral transcription, to prevent the infection, allowing for gradual excision. It is necessary for this approach taken in the past to be broadly applicable because targeting patient isolate sequences will allow for real-world application.

If gRNA sequences are able to excise the LTR sequences in patient isolates, then it can be confirmed that they are a viable option for practical usage. Using the NIH's Basic Local Alignment Search Tool (BLAST), I tested whether or not particular gRNA sequences have potential for targeting patient isolates. This was done through identifying the percentage of identities that match between the gRNA and patient isolate. gRNA-A, originally designed by Khalili et al., has the highest full nucleotide match rate with patient isolates.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME MI CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project Number

3078

Title: The Effect of Acid Rain on Lolium Perenne

Student Name(s): S. Scutt

## Abstract:

My research explored the question of how acid rain affects plant life and the amount by which pH of rain affects the growth and development of plants. The study was specifically done with Lolium perenne, a common grass.

I took 4 groups of 3 pots, 2 in each group with 25 seeds each, spaced evenly in a 5x5 pattern, and 1 in each group with 50 seeds, spread randomly. Each group was assigned a different solution to be watered with, each solution having a different pH (4.2, 4.8, 5.2, or 6.0), and were watered every few days in a consistent pattern which covered most of the pot evenly. The height of every blade was subsequently measured and recorded.

After taking data for 21 days, the results were interesting. In the 25-seed pots, the blade height averages and pH of solutions used to water the pots were positively correlated (higher pH, higher growth). The 4.2, 25-seed pots grew no grass at all. In a surprising turn of events, the 50-seed pots showed no correlation between pH of the solution and growth; the results were entirely random. I explained this by accounting for error caused by not controlling for the pattern by which the seeds were spread in the 50-seed pots.

I concluded that while the pH of rain may affect the rate of growth, it does not affect the overall ability of the grass to develop, as late into the experiment, they began to grow leaves, a sign of maturation.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS CB CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

216

Fair Category

LS

Project  
Number

3080

**Title:** An Investigation of the Effects of Solid Road De-Icers on the Early Development of Zebrafish Embryos

**Student Name(s):** N. Keegan

**Abstract:**

Sodium Chloride- also known as just "salt"- is the most widely used solid road deicers. Municipalities and states use millions of tons of it during many winters. Keeping roads free of ice is, of course, vital, however in many areas, especially around large amounts of impermeable ground (like in cities) it can get to absurd concentrations, sometimes even up to almost 6 grams per liter. This is an issue, since high enough concentrations of salt can cause serious harm to both fish and their eggs. The purpose of this experiment is to compare the damage that two other solid road deicers cause in comparison to sodium chloride and its controls. I will be testing over the course of 4-5 days on newly laid zebrafish eggs, with 10 different groups. There will be one for each of the deicers. They will be sodium chloride, magnesium chloride, calcium magnesium acetate and a control group. Each of the deicers will also have the three concentrations that will be tested. They will be checked on with a microscope at least once every day for the duration of the experiment to detect damage and any other effects. Unfortunately there have been numerous delays, so there is not yet any data to report. This will be collected in the next 1-2 weeks.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AS EV

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

193

Fair Category

LS

Project Number

3081

**Title:** The Effectiveness of American Beachgrass (*Ammophila breviligulata*) for Coastal Restoration

**Student Name(s):** T. Rock

**Abstract:**

Coastal erosion is a serious threat facing beaches worldwide. Climate change has increased the intensity and frequencies of hurricanes hitting our coasts and eroding them. A number of prevention methods are used to minimize erosion impact, such as methods that promote dune formation. Dune formation has proven to trap and hold the sand on the beach, reducing heavy erosion during a storm (Carter, 1991). A way to form a dune is through vegetation, specifically beachgrass. Beachgrass holds characteristics that make it ideal to form dunes, notably its root system.

This study compared the influences of American beachgrass (*Ammophila breviligulata*) and Native plant species in promoting dune formation. Data were collected on four beachgrass plots and four native plots every two weeks from August until November. The results obtained found that the native species plots had a steeper slope than the American beachgrass plots. This is expected because the beachgrass was planted in March 2016 and the native plants had been established for some time. However, the slope in the beachgrass plots show promise that in a couple of years it will become an established plant and create a greater slope in the dunes.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM EV PS

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

243

Fair Category

LS

Project Number

3083

**Title:** Analysis Of Prey Composition And Feeding Success In Ninespine Stickleback (*Pungitius pungitius*) Infected With Cestode Parasite (*Schistocephalus pungitii*)

**Student Name(s):** M. Johnson

**Abstract:**

There is a population of Ninespine Stickleback in Alaska that is heavily parasitized, but still somehow manages to reproduce. Diet may be a factor that contributes to this unique ability by increasing the stickleback's available energy. Increased consumption or a high protein diet may compensate for energy lost from the parasite which would lead to available energy for nonessential activities such as reproduction. I am investigating the analysis of prey composition and feeding success in Ninespine Stickleback (*Pungitius pungitius*) infected with cestode parasite (*Schistocephalus pungitii*). To do this, I dissected about 25 pre-euthanized Ninespine Stickleback and removed their gut and stomach content. During dissection, I determined the sample's sex and if the samples had parasites. I examined the gut contents under a microscope to determine each fish's diet composition. Diet composition at the time of capture was quantified by counting the number of items in each diet category to find the proportion of each category to the total diet. The volume of gut content was also estimated to determine the instantaneous feeding success. This is an indicator of how much the fish are eating which may add to the parasitized individuals' available energy and therefore aide in their ability to reproduce. Feeding success and diet composition will be compared with parasitism, sex and fish size. Results are still currently pending, but will be available for the science fair. This study could add to knowledge about the relationships between parasites and their hosts.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

AS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

192

Fair Category

LS

Project  
Number

3084

**Title:** The Effects of Global Climate Change on the Production of Oxygen Gas in the Chlorophyll f Pigment and with fischerella Cyanobacteria.

**Student Name(s):** A. Boczar

**Abstract:**

The newly-discovered pigment Chlorophyll f discovered in various cyanobacteria has been linked to several mechanisms of photosynthesis (Aris, 2014), with the main function and purpose of the pigment unknown (Chen, 2010). The chlorophyll f pigment has been observed to be incredibly efficient and the chlorophyll aids tremendously in energy storage for the cyanobacteria at this stage (Li, 2014). But under certain environmental conditions, the pigment may not function efficiently at an optimal rate. As Global Climate Change continues with the consequences of sea level rising and global temperature increase, the cyanobacteria may show a difference in the rate of photosynthesis between various temperatures. In this experiment, fischerella cyanobacteria were cultivated under natural light and near-infrared light (700 nm), and the volume of evolved oxygen gas was measured where the cyanobacteria were cultured under different temperatures to represent the increase in global heat. Further application research should involve the examination of the ways the pigment is utilized for different species as a mechanism for the photosynthetic process. Discussing the adaptations and the ways the pigment are utilized as the environment shifts for the cyanobacteria is a strong topic for future study.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

MI BI EV

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project Number

3085

**Title:** Taste Perception in Obesity: Understanding the Role of Physiological State, Macronutrient Intake, and Flavor Preference

**Student Name(s):** A. Fischman

**Abstract:**

Excess consumption of dietary fat and sugar is associated with dopamine signaling deficiency and altered reward processing and executive function in humans and animals. Supplementation with the fatty acid oleoylethanolamine (OEA) increases striatal dopamine levels in high fat diet-fed rodents and shifts preference towards lower calorie food stimuli. 70 overweight to obese individuals from ages 18-45 participated in a 6-week supplementation with OEA or a placebo. The following purposes were proposed: 1. To test the effect of flavor choice on taste intensity, liking, and wanting ratings of fat and sweet food stimuli, 2. To test the effect of dietary intake of foods high in fats and/or sugar on the same ratings, 3. To test the effect of internal state on the same ratings, and 4. To investigate correlations between eating styles, mood and perceptual ratings for fat and sweet food stimuli. The independent variables were stimulus type, flavor, and concentration, dietary intake, internal state, and questionnaire scores. The dependent variables were perceptual ratings of stimuli (intensity, sweetness, saltiness, fattiness, creaminess, oiliness, liking, and wanting). There was no control group in this experiment because there is no standard or baseline to which the data could be compared. This study was focused on analysis of data collected at baseline, prior to intervention. There were significant effects of flavor choice, satiety, dietary intake, and depressive symptoms on stimuli ratings. Hunger, disinhibited eating, and dietary restraint were correlated with dietary intake. There was a strong positive correlation between sugar intake and BMI.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME BE CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

255

Fair Category

LS

Project Number

3086

**Title:** Detection of Premalignant Pancreatic Cancer via Computational Analysis of Serum Proteomic Profiles

**Student Name(s):** S. Sundaram

**Abstract:**

Pancreatic cancer (PC) is currently one of the deadliest cancers, with a 5-year survival rate of just 7%. Detecting PC while it is localized increases the survival rate to 30%, however to date, such a diagnostic tool is nonexistent. In this project, I proposed the development of a computational classification model that can accurately detect premalignant PC from patient blood mass spectrometry (MS) data. A database of 181 MS samples was used: 80 from test-subjects with premalignant PC, and 111 controls from healthy test-subjects. Preprocessing was performed using non-classical statistical techniques to eliminate chemical noise and extract true signals. Detected peaks were analyzed to determine the most discriminative biomarkers. Prior research used univariate feature selection methods to measure each variable's importance. In this research, a novel hybrid approach was developed, combining univariate and multivariate methods to analyze interactions between protein markers, and how interdependencies impact predictive value. Using this method, several machine learning algorithms were trained to produce diagnostic models. The highest-performing model achieved an ROC accuracy of 80%, demonstrating significant improvement over prior research, which was limited to 69%. For each of the selected biomarker proteins, intensity levels were found to be significantly elevated or suppressed in the pre-cancerous samples, compared to control samples. These results suggest that a hybrid approach to feature selection can discover new biomarkers, and lead to development of superior tools to diagnose premalignant pancreatic cancer, thus allowing doctors to treat it while the disease is still localized, and curative surgery is still possible.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CS ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

189

Fair Category

LS

Project  
Number

3087

**Title:** The Effect of An Allelopathic Chemical (*Juglans nigra*) on Coastal Aquatic Java Moss (*Vesicularia dubyana*)

**Student Name(s):** R. Ledoux

**Abstract:**

Black walnut trees release an allelopathic chemical called *Juglans nigra* (Juglone) which can inhibit the growth of another organism in order to increase its chances of surviving (Calhoun, 2011). Recent studies have also shown this chemical to be useful as a method of pest control for aquatic organisms such as zebra mussels from water intake pipe. This study conducted to evaluate the effectiveness of juglone on a common coastal aquatic plant (*Vesicularia dubyana*) (Cutler et. al., 2000). Serial dilutions were used to create a gradient of concentrations which were applied to replicated samples of java moss. Due to the exposure of the juglone, it was hypothesized that the java moss would result in a negative effect however, statistically, the java moss did not have a significant impact on growth ( $p>0.05$ ). The implications for this, combined with other studies, tend to suggest the applications of juglone may serve better as a pesticide than an herbicide. That is interesting because most allelopathic chemicals produced by plants are known to affect plants who would be competing with them for space and this one seems to be more of an animal deterrent.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

223

Fair Category

LS

Project  
Number

3088

Title: Effect of Literature Point of View on Lasting Empathy

Student Name(s): W. Du

## Abstract:

Studies show that literature has great influence, even when fictional, and can even increase in effect over time. In fact, strong narrative immersion makes readers more empathetic to the text. However, while some research has been done on what kind of point of view creates the strongest immersion, but none looks at how POV impacts empathy over time. Research will be done comparing first and third person narratives and how they affect the level lasting empathy. Due to the greater amount of immersion experienced when reading first person narratives, it is hypothesized that first person narratives will cause greater and longer lasting empathy. Participants are all high school students. Participants first take a short questionnaire measuring the subjects' empathy. After some filler tasks, participants will read a short story written in first or third person. Participants will retake the empathy questionnaire, and take it again a week later. There will also be questionnaires assessing understanding of the narrative. Results before reading, after, and a week later are compared to see if the subjects' empathy has shifted, measured using the IRI for empathy. Data is still being collected, so no conclusions can be drawn so far, but data from the first person, third person, and control groups from before, right after, and a week after reading will be averaged and analyzed for statistical significance.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

256

Fair Category

LS

Project  
Number

3089

**Title:** The Effect of Added External Chemicals on Inhibiting Population Growth of Cyanobacteria Microcystis Aeruginosa Within a Fertilizer-Runoff Environment to Prevent Cultural Eutrophication

**Student Name(s):** A. Srivastava

## Abstract:

Due to the runoff from agricultural fertilizers, an overabundance of nutrients flow into neighboring bodies of water, stimulating cultural eutrophication, where rapid population growth amongst photosynthetic aquatic life occurs, most commonly cyanobacteria. This population spike creates a harmful algal bloom (HAB), which leads to many detrimental consequences, including blocking other photosynthesizers from sunlight, depleting the water body of oxygen, and releasing an excess of cyanotoxins such as potentially carcinogenic microcystins. These changes negatively impact the ecosystem, offsetting its proper function and developing an aquatic dead zone. To prevent this phenomenon from occurring, an experiment was conducted determining which chemicals could react with and render nitrogen-based and phosphorus-based compounds (being the most influential runoff nutrients leached) into a form to which Cyanobacteria cannot use for its stunted reproduction, essentially preventing eutrophication and its damages. A mock fertilizer runoff was fabricated by diluting commercial fertilizer containing key agrarian growth chemicals  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{KNO}_3$ ,  $\text{CO}(\text{NH}_2)_2$ , and  $\text{KH}_2\text{PO}_4$ , which was mixed in separate reactions with chemicals  $\text{NaOH}$ ,  $\text{Ca}(\text{OH})_2$ , and  $\text{KOH}$ . Then, cyanobacteria *Microcystis aeruginosa* was grown in each solution for five days, and the change in number of cyanobacterial cells will show whether the nutrients were still able to be used for growth and reproduction, although chemical pathways suggest that the nutrients will be inaccessible. This data could be applied to prevent cultural eutrophication by fashioning a dispenser which would release inhibiting chemicals at an appropriate concentration based on runoff flow through the dispenser, rendering fertilizer nutrients harmless when they reach a water body.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

BI MI EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project Number

3091

**Title:** Utilization of Q-2 Pressure System in Preventing Pressure Ulcers for In and Out-Patient Therapies

**Student Name(s):** R. Patel

**Abstract:**

Pressure ulcers are identified as a common and worldwide health problem that continues to inflict pain and discomfort to patients with increasing the cost of healthcare, even though most cases are predictable and preventable. Pressure ulcers affect 2.5 million people each year, and medicare estimated each treatment added \$43,180 to a hospital stay. The root cause is not implementing constant pressure relief to affected skin on the body. I will be analyzing the data collected on braden score, BMI, length of stay, and age, to come to a positive conclusion on the Q-2 system. To start, patients will be recruited as per the standard requirements. All patients are randomly selected for the control (no Q-2) or the experimental (with Q-2) group, and evaluated at end of study. There were 187 experimental patients and 213 control patients in the study, along with 31 withdrawal patients (withdrew while in the study). It seems to be that the patients that underwent treatment using the Q-2 system had the best outcomes. Further analysis is needed for conclusive results on the critical pressure ulcer factors. The Q-2 air mattress system incorporates support and cushion surfaces. Air is pumped into the mattress, and pressure is redistributed upon user needs, the data is digitally captured and documented, and the sensing and redistribution continue – keeping the user consistently comfortable and the staff aware at all times. The Q-2 system provides a greater alternative for pressure ulcer prevention, while being a cost-effective treatment for hospitalized patients.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

240

Fair Category

LS

Project Number

3092

Title: Caffeine's Effect on Anxiety in Teens

Student Name(s): Z. Bassett

## Abstract:

Caffeine levels in teenagers have previously been linked with an increase in anxiety and depression. This study investigated the linkage between the reported anxiety levels and caffeine intake of Hamden High School students. Students ranging between the ages of 14 and 18 were given self-report surveys where they recorded their past caffeine intake as well as their current caffeine consumption levels at the time the survey was taken. They also rated their anxiety symptoms (at school) in relation to how much caffeine they drink on a given day. A slight increase in anxiety levels with caffeine was recorded as age increased. 0% of 14 year old students reported that they feel tense when they drink more caffeine than normal. In contrast, 29% of 18 year old students reported feeling tense when caffeine levels increase. Data was pooled by regular consumption and intermittent consumption of caffeine. 0% of students who have been drinking caffeine regularly for less than a month reported having trouble concentrating in school when they drink more than normal, whereas 13.3% of students who have been drinking caffeine regularly for more than 12 months have reported always having trouble concentrating when they drink more than normal. In conclusion, data supports that older students who have been drinking caffeine on a regular basis for more than a year show slightly more symptoms of anxiety in school than younger students who do not drink caffeine on a regular basis.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE ME

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project Number

3094

**Title:** Using Pyrethrin from the Chrysanthemum cinerariaefolium as an Organic Systemic Insecticide

**Student Name(s):** B. Tormey

**Abstract:**

Using pyrethrin as an organic insecticide is a more natural and effective alternative to conventional insecticides used in agriculture. Today, about 10 percent of all agricultural crops are lost due to consumption by pest insects, causing damage to the agricultural economy. A topical application of insecticides are much less efficient and requires multiple treatments over a short succession. A systemic application would be much more effective, requiring very few treatments to the plants due to its introduction to the soybeans through the soil. This experiments consists of two trials and one control; both trial plants were given 10mL of pyrethrin diluted in 100mL of water daily, while the control was given 100mL of water without any insecticide. Crickets were chosen as the pest insect for this experiment as they are a very common nuisance in the destruction of agricultural crops. Leaves were removed from both the treated and untreated plants and their weights were measured before and after being introduced to the crickets. After the test period ended, it was observed that the treated leaves sustained significantly less damage than that of the control. The treated leaves suffered a loss of 33 percent (Pyrethrin 1) and 37 percent (Pyrethrin 2), while the untreated leaves lost 78 percent of its original mass. The crickets mainly refrained from eating the treated leaves, choosing to eat the control instead. The crickets that did choose to eat the plants treated with pyrethrin died shortly after the consumption of the soybean leaves.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS EM EV

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project  
Number

3095

**Title:** The Epigenetic Effects of Elevated Atmospheric Carbon Dioxide Levels on Body Size in *Drosophila melanogaster*

**Student Name(s):** A. Singer-Freeman

**Abstract:**

Global climate change is rapidly altering abiotic conditions of ecosystems, such as atmospheric carbon dioxide levels, precipitation levels, and temperature levels. These altered conditions are forcing populations to respond at a faster rate than ever before in recent history. In order to understand the nature of populations in the future it is critical to understand the responses of these populations. Previous studies have shown that increased temperature causes a decrease in body size in *Drosophila melanogaster*. In this study, the effects of elevated atmospheric carbon dioxide levels on body size were examined, in order to understand more fully the effects of climate change on *Drosophila*. Flies were cultured in vials containing either 400 ppm or 800 ppm carbon dioxide, and were harvested after they reached maturity. After the flies were sacrificed, one wing was extracted from each fly. These wings were photographed using a Nikon Eclipse E200 microscope at 40x magnification, and the wing length was measured using ImageJ. It was hypothesized that if atmospheric carbon dioxide levels are elevated, then the *Drosophila* should grow to have an increased body size because of increased transposon activity. No statistically significant correlation was observed between atmospheric carbon dioxide level and body size, however, an unexpected association was found between carbon dioxide level and variation in wing length. These results could lead to a better understanding of epigenetic response to stress, because the same correlation between wing size and cell density has been observed in epigenetic response to other variables.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EV EM

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

LS

Project Number

3096

Title: The Effect of Mutations on *C. elegans* Resistance to Intoxication

Student Name(s): R. Stollman

## Abstract:

Alcohol is one of the most widely accepted and abused drugs. Many genes have been linked to addiction, among which being the *faah* gene. The *faah* gene has been shown to affect other types of substance addiction, but its role in alcohol addiction remains unclear. The fatty acid amide hydrolase (FAAH) protein is related to the addiction receptors in the brain. In this experiment the role of the fatty acid amide hydrolase (FAAH) protein in alcohol addiction will be tested in a *C. elegans* model system. *C. elegans* is a type of nematode that is used widely as a model organism for its genetic similarity to humans. We will use an RNAi construct to lower the expression levels of the FAAH-encoding gene. A line of *C. elegans* with a specific mutation in the Slo-1 protein will be used as positive controls and the wild type will be used as a negative control. The *C. elegans*' alcohol preference as well as their levels of intoxication will be gathered and quantified as data for the mutant and wild type *C. elegans* strains. It is expected that all of the *C. elegans* will eat and get addicted to the alcohol in the food, but that the mutant *C. elegans* will want to eat less and exhibit lesser sensitivity to the alcohol. The goal of this experiment is to learn something about this gene's involvement in the drug addiction pathway, and to explore possibilities of using it as a drug target in human models.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME MI CB

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

148

Fair Category

LS

Project Number

3097

**Title:** The Effect of Increasing Water Temperature and Decreasing pH on Vibrio cholerae Cases

**Student Name(s):** S. Ballas

**Abstract:**

Cholera is an acute diarrhoeal disease that can be fatal if left untreated . Cholera is a disease caused by Vibrio cholerae bacteria, that has become a worldwide issue, especially in countries without access to clean water and healthcare. Since it is a bacteria it is extremely vulnerable to changes in pH and temperature and can kill the bacteria if it falls out of the range necessary for survival. The purpose of this project is to determine how the increasing water temperature and decreasing pH caused by global warming will affect the number of reported cases through a statistical analysis using data from current research. This project will focus on developing nations to attempt to account for access to healthcare and access to water treatment. After the research if a correlation is found then I will attempt to project case numbers to aid the healthcare system of the country

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

MA ME EV

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2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project Number

3098

**Title:** Establishing a Quantitative Forest Model to Determine Environmental Livability of Connecticut Forest Types

**Student Name(s):** T. Koeck

**Abstract:**

Most states in the US have forest records, Connecticut has little to no research on the overall environmental livability of those forests. To obtain the environmental livability of Connecticut's mixed and young growth forests, the effective method is to utilize i-Tree™ modeling. By setting up a 50x50 foot plot in a forest space, and measuring the diameter, height, crown width, and percent dieback, a model can be run to find the environmental livability of that forest type. Using this model, it was found that second generation young growth forests have a lower environmental livability than that of first generation forests. Although the second generation young growth forest had 8.31 m<sup>3</sup>/year opposed to the first generation's 3.33 m<sup>3</sup>/year, the sheer amount of trees concentrated in the first generation young growth made it so there was 70.78 tonnes of carbon storage opposed to 33.67 of carbon storage from the second generation. Due to the close proximity that young growth forest trees grow next to each other, the forest is already choking itself, leading to worse tree condition. The second generation forest had a 576.5 m<sup>2</sup> crown projection while the first generation possessed a 361.2 m<sup>2</sup>, this was due to the fact that first generation young growth forests have smaller trees. Based on the data, without management, young growth forests will go into decline upon second generation. For future research, finding this information for old growth and conifer growth forests would further express which forest type has the greatest environmental livability.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV EM PS

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

257

Fair Category

LS

Project Number

3099

**Title:** The Effects of Natural Organic Compounds on the Inhibition of Bacillus Subtilis Biofilm Growth

**Student Name(s):** B. Koenigsberg

**Abstract:**

It is estimated that up to 80% percent of microbial infections such as otitis and strep throat are caused by bacteria in biofilms, as opposed to planktonic bacteria. Research suggests that manipulating the enzymes produced by the biofilm-forming bacteria inhibits biofilm growth. Such manipulation of the bacteria themselves requires complex technology and procedures. However, research proposes that biofilm formation may be inhibited by naturally occurring compounds in certain medicinal plants. Therefore, a simpler solution may lie in “plant-based” inhibition of biofilms. To determine whether plant-based solutions inhibit biofilm formation, we tested the inhibitory capabilities of the known compounds of the medicinal plant *Rubus Ulmifolius*, namely Tannic and Ellagic Acid, in gradient concentrations ( $\mu\text{g/mL}$ ) for inhibition of biofilm growth. We accomplished this by infusing a liquid growth medium with *Bacillus Subtilis*, a non pathogenic bacterium, and the compound (Tannic or Ellagic Acid), into which a glass slide was inserted to allow for biofilm growth. After a 48-hour culture, the slides were Gram-stained to indicate the presence of a biofilm; concentrated areas of color indicate a biofilm. We then measured the surface area and qualitatively observed the slide. Compared to untreated biofilm growth, a smaller surface area indicates the compound’s inhibitory capabilities. Results show that both compounds diminished biofilm growth compared to the control. When observed under the microscope, treated slides that contained biofilms also had more dispersed structures compared to the control, and smaller areas of concentrated growth. This indicates that there lies a possible plant-based solution for inhibition of biofilms.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

MI CB ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project Number

3100

Title: Natural antimicrobials: Alternatives to antibiotics in the control of ear infections

Student Name(s): A. Narayanan

## Abstract:

Purpose of the experiment:

Ear infection, caused by *Streptococcus pneumoniae* is a common illness in children, particularly in preschoolers. Once this bacterium enters the ear canal, it attaches to the ear cells by forming a film (biofilm) and results in infection. Although antibiotics are used to treat ear infections, emergence of drug resistant *S. pneumoniae* is reported. In such cases, we need safe alternatives that can be used to control antibiotic resistant *S. pneumoniae*. Hence, my study investigated the efficacy of essential minerals, namely selenium (Se) and manganese (Mn) to control *S. pneumoniae*. Selenium and manganese are two natural minerals that we consume daily through food or multi-vitamin supplements.

Procedure:

To test my hypothesis that Se and Mn can effectively kill *S. pneumoniae*, I incubated bacterial culture with different concentrations of Se and Mn for 12 hours. At different times during the incubation, I sampled the control (no mineral, bacteria only) and treated cultures to quantify the surviving bacteria. Additionally, I evaluated the ability of Se and Mn to prevent biofilm formation by *S. pneumoniae*.

Results:

Addition of low amounts of the minerals, 0.02% Se and 0.3% Mn, reduced the biofilm formation by 50%. Furthermore, at higher concentrations, 0.2% Se and 0.4% Mn completely killed *S. pneumoniae*.

Conclusion:

From these results, I conclude that Se and Mn are effective in inhibiting *S. pneumoniae*. Hence, I propose that Se and Mn could be used as a natural constituent of ear drops to prevent and control ear infections in children.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MI ME CB

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

198

Fair Category

LS

Project  
Number

3101

**Title:** Evaluation of *Caenorhabditis elegans* as a Bioindicator of Soil Toxicity via Chemotaxis Assay of Anthranilic Acid

**Student Name(s):** C. Anderson

**Abstract:**

It is proposed to use the glycosylated anthranilic acid inside gut granules of *Caenorhabditis elegans* as an excellent bioindicator candidate of toxic soil. Upon the death of *C. elegans*, the gut granules release anthranilic acid which fluoresces blue under ultraviolet light. *C. elegans* have also demonstrated a strong ability to detect and react to chemicals in the environment. Therefore, upon exposure to anthranilic acid, a chemical strongly associated with death, the *C. elegans* may exhibit negative chemotaxis response. Traditional methods of evaluating soil toxicity involve cost prohibitive and lab fixed instrumentation, which requires the user to have extensive training and expertise to produce minimal results, thus calling for cheaper and more practical applications. To validate this proposal, a chemotaxis assay is performed with a synchronized culture of *C. elegans*, which is placed in the center of a sterile Nematode Growth Agar Plate without an *E. coli* lawn. The plate is quartered, with two sections containing the anthranilic acid and the other two containing the control. Chemotaxis response is determined by the number of worms in each region after an hour has passed. Therefore, it can be concluded that *C. elegans* serve a bioindicator role for qualitative soil contamination.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV MI CB

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

LS

Project Number

3102

Title: Soil Nutrient Composition v.s. Ash Dieback

Student Name(s): S. Mullin

## Abstract:

This experiment is conducted with the goal of gaining more insight into the correlation between the concentration of nutrients in a given area's soil, versus the health of a tree that has grown on it. Furthermore, this experiment aims to gain some further understanding of ash decline and the destruction it's responsible for in America's ash tree population. To explore this relationship, this will involve observing samples of 10 healthy ash trees and 10 unhealthy, and on a monthly basis taking and analyzing the soil that they are rooted in for nutrients such as calcium and nitrogen, meanwhile comparing my findings overtime to the vigor of the tree.

Observing the quality of the leaves, leaf canopies, and the condition of the bark and branches will be the primary indicators for determining the tree's condition. As discovered in past data on the nutrient composition of the soil surrounding trees, the trees that lacked the most in nutrients became infirm or ill from obvious malnourishment. In this experiment, similar results are expected, but the objective is to also discover the most common factors that take advantage of the trees once their vulnerability manifests, which could range anywhere from fungal or viral infections, to infestation of the tree by invasive species such as the emerald ash borers. With this knowledge, the goal is to further understand the nature of the ash tree's most grievous threat, and in doing so, be able to better protect them in the future.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project Number

3103

Title: Implicating the Tolerance of Glyphosate on Artemisia Vulgaris

Student Name(s): T. Johnston

## Abstract:

The eradication of invasive species is a recognized importance in the environmental science issues in the state of Connecticut. Significant amounts of invasive species create detrimental harm to the ecosystem of a foreign environment. Mass amounts of invasive plants form massive stands and have the tendency to out compete with native plants in Connecticut. One of these invasive species in the state of Connecticut is Artemisia Vulgaris (Mugwort). Artemisia Vulgaris on average is 1-2 meters in height and 5-20 cm in width. Mugwort is currently not a native species and is very common in the Connecticut region. Mugwort can decrease the potential property value on land. The stands it creates to the primary consumers is affected such as the cotton tail rabbit that the authorities of Wildlife Conservation Society are overseeing. With the eradication of Mugwort would bring in more environmental sustainability in the ecosystem. This will bring societal benefits. The most efficient benefactor to eradicating Mugwort and most other plant based invasive is Glyphosate (Roundup). Glyphosate is currently an expensive herbicide and has harsh effects to the invasive and the environment around the affected area. Spraying Glyphosate of the leaves and stem of the plants structure is the most commonly used way of eradication. The process uses excessive amounts of Glyphosate to reach desired results. This experiment is to test the best efficiency for the use of Glyphosate on Artemisia Vulgaris to benefit further studies and strategies for the eradication process of invasive plant species in the Connecticut area.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EV EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

230

Fair Category

LS

Project  
Number

3104

**Title:** How the Frontal Cortex Connects to the Rest of the Brain  
A Study Using Public Databases

**Student Name(s):** J. Gross

**Abstract:**

Brain connectivity refers to a series of links and connections that exist throughout the brain. Different regions communicate with one another rapidly through complex pathways and circuits. Researchers at the Allen Institute for Brain Science have mapped the mouse brain in 3D using connectivity data. This data is now publicly available online. I am looking to see if the Brain Atlas can be used measure how the frontal cortex connects to the rest of the brain. Methodology for this project will entail extracting raw data from the Brain Atlas. This data, based off of injection location and resulting connectivity, will be analyzed in order to find how connectivity depends on injection location in the secondary motor cortex . Then, the brain connectivity will be characterized based on output to different regions.I have analyzed secondary motor connectivity to seven different regions, and found a significant trend in three out of those six; the primary visual area, the retrosplenial area, and the anterior cingulate area. Overall, these results indicate that topographical organization is present in some regions related to the secondary motor cortex. Each of these regions share a high  $R^2$  value and low p-value. This indicates that depending on injection location, projection density follows a trend. The three regions which exhibit low  $R^2$  values are either part of the motor cortex or in a very differently functioning part of the brain.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME AS CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

261

Fair Category

LS

Project  
Number

3105

**Title:** The Effects of Carbon Dioxide Levels in Comparison to Temperature on the Geographic Expansion of the White-Footed Mouse and the Spread of Lyme Disease

**Student Name(s):** K. Lauter

## Abstract:

Lyme borreliosis, commonly known as Lyme disease, is a vector-borne illness caused by the *Borrelia burgdorferi* bacterium. The disease is transmitted to humans through the bite of an infected tick. The tick becomes infected through the bite of a small mammal. Due to the northward expansion of the geographic range of the white-footed mouse, the primary mammalian host species for the *B. burgdorferi* bacterium, a number of Lyme disease cases are emerging in Canada. Carbon dioxide and temperature are two factors contributing to this migration.

The following study consists of four slope linear t-tests. The first test correlates atmospheric carbon dioxide levels and white-footed mouse migration into Canada. To explore the implications of this, the second test correlates white-footed mouse migration into Canada and Lyme disease cases emerging into Canada, to explore if a larger population of white-footed mouse species in the area is contributing to the increasing number of cases. The third test correlates *Ixodes scapularis* species migration into Canada and white-footed mouse migration into Canada. Finally, the fourth test correlates temperature and white-footed mouse migration into Canada, to compare the impact of carbon dioxide levels on migration to that of temperature.

In conclusion, there is stronger correlation between white-footed mouse migration into Canada and increasing temperature than increasing atmospheric carbon dioxide levels. There is also strong correlation between white-footed mouse migration into Canada and the number of Lyme disease cases emerging in Canada, as well as white-footed mouse migration into Canada and *Ixodes scapularis* species migration into Canada.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CB AS MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

LS

Project  
Number

3106

Title: Reactivity and Stability Analysis of Metal Organic Frameworks (MOFs)

Student Name(s): Y. Kim

## Abstract:

Renewable energy is an important field of research amidst the 21st century energy crisis. Many of the researches have been looking for new energy sources, but not as much research in nanotechnology have been done for efficient storage of energy produced from these eco-friendly sources. This research considers how to increase the capacitance though inserting nanoscale Metal Organic Frameworks (MOFs) as dielectrics and to use them for sustainable development. MOFs, composed of inorganic metal joints and organic carbon linkers, are porous and can store charges for alternative energy sources or capture gases such as carbon dioxide.

The research focuses on increasing capacity of batteries by using MOF particles as dielectrics, differing the structure of capacitors, and combining various inorganic metal joints and organic carbon linkers that can store more energy with better efficiency. Computational chemistry such as Avogadro and Chemcraft have been employed to find the stability and capacity of the MOF particles. Matlab will be used to optimize the movement of potential charges within capacitors in order to measure the maximum capacitance possible between capacitors due to change in geometrical structure. Physics principles and modeling will be used to retain the maximum value of capacitance and to detect the change in capacitance as a result of different structures or dielectrics.

This research will allow future scientists and engineers to develop more efficient ways to store energy. Applications of MOF particles to increase capacitance include lithium-ion batteries in electrochemistry and supercapacitors which save energy through electrochemical charge storage.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project  
Number

3107

**Title:** The Effect of Changes in the Stock Market on Polling of Incumbent Presidential Candidates Using Time Series Analysis

**Student Name(s):** J. Stimpson

**Abstract:**

This study seeks to address the “Socioeconomic Theory,” a hypothesis that holds: A.) stock market performance influences voting behavior in presidential elections; and, B.) voters reward the incumbent administration for positive increases, whereas voters penalize it for negative trends. Previous studies investigating these conjectures have found an association between yearly stock market trends and performance of incumbent administrations. This study therefore seeks to see if the association still persists from a more granular perspective. This study does so by comparing the daily closing price of the Dow Jones with the daily adjusted polling average of the incumbent presidential candidate in the 250 days before election day. The scope of the study was limited to the elections of 2004, 2008, and 2012, the most recent years where regular, daily polling information was available. A Granger Causality model, a form of linear regression that seeks to correlate two time-series by regressing past values of one on future values of another, was employed for all three years. The model, however, found no association, even when each year was broken down into shorter time intervals. While these results appear to reject a possible link, the unreliability of political polls raises the possibility that noise obscured a potential signal. Moreover, this study did not stratify the data by potentially exogenous variables, such as media exposure, level of education, and geography. Further research using different methodology or more fully taking into account exogeneity is necessary in order to reach a more robust conclusion.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BE MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

Yes  No

# CSEF Official Abstract and Certification

Word Count

216

Fair Category

LS

Project  
Number

3108

Title: Heat from Global Warming Affecting Bioluminescence in *Pyrocystis fusiformis*

Student Name(s): J. Milidantri

## Abstract:

*Pyrocystis fusiformis* are unicellular algae whose natural habitat is the ocean. They consume carbon dioxide in our environment through photosynthesis. These algae are bioluminescent, and they produce light when stimulated. To produce this bioluminescence, the oxidative enzyme luciferase must help the substrate luciferin create the light. Luciferase aids in oxidizing and speeding up a chemical reaction, which excites luciferin and it releases its energy as colorful light. The algae were given twelve hours to photosynthesize in fluorescent lighting, and then they were left in twelve hours of darkness, over a period of six days. Three temperature-controlled tanks of water held three test tubes each, filled with 22 mL of *P. fusiformis* in a liquid growth solution that they were purchased in. The variable being tested was how elevated temperatures may affect the strength of the light emitted. The test temperatures were 24 degrees Celsius and about 27 degrees Celsius. The control was 21 degrees Celsius, the optimal temperature for these algae. It was hypothesized and proven that, as temperature was increased, the bioluminescence of the algae would decrease. This is because the enzymes would denature, and the reactions to create bioluminescence would slow. In the test groups, the bioluminescence, measured with a light meter, decreased slightly, and the lifespan of the test group algae decreased.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV EM PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

277

Fair Category

LS

Project  
Number

3109

**Title:** Platelet Membrane Coating Bio-Interfacing of Pravastatin to Increase Removal of Arterial Plaque

**Student Name(s):** H. Stober

**Abstract:**

Atherosclerosis jeopardizes blood flow by blocking and narrowing arteries. Collection of arterial plaque can result in strokes, heart attacks, and cardiovascular disease. Current strategies for prevention of atherosclerosis include statin therapy, which acts to inhibit cholesterol production. Recently, statins have also shown promise as a post-corrective remedy; they may dissolve pre-existing plaque buildup within an artery. It is speculated that the drug's effectiveness is limited by its inability to biointegrate, or adhere to the walls within the clogged artery. This research seeks to increase statin's post-corrective efficiency by coating pravastatin (Pv) with a platelet-membrane coating, that will act as a bio-interface between the drug and arterial wall, leading to increased "adherence" and triggered dissolution of plaque. To begin, 25mg-Pv was coated with 25mg-PLGA (a drug-biointerface linkage layer) using a double-emulsion process. PLGA/Pv cores were then coated with C57BL/6 mouse platelets, to construct the final deliverable therapeutic. SEM/FTIR analyses confirm the successful 2-step coating of Pv; DLS results highlight the Pv/PLGA/Platelet nanoparticle size of ~130nm. To measure the therapy's effectiveness in removing arterial cholesterol, Pv/PLGA/Platelets were administered to fabricated Poly-E-Caprolactone arteries that were purposefully loaded with cholesterol. To mimic blood flow conditions, cholesterol-loaded arteries were submerged in water, Pv, and Pv/PLGA/Platelet solutions, under constant shaking, at 38oC for 30min. FTIR and UV/Vis analyses of the treated arteries highlight measureable removal of cholesterol by both the Pv and Pv/PLGA/Platelet therapies, highlighting Pv's usefulness as a post therapy treatment, and Pv/PLGA/Platelet's ability to adhere, dissolve, and deliver the treatment under arterial flow conditions.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

LS

Project  
Number

3110

**Title:** Effects of Feces Deposition in Natural Refuges on Common Bedbug, *Cimex Lectularius* L., Aggregation

**Student Name(s):** S. Saxe

**Abstract:**

Nearly 20% of Americans have had experience with a bedbug infestation. Their dependence on extermination is expensive and often ineffective as bedbugs with thick cuticles have grown resistant to many harsh chemicals, such as pyrethroids. Bedbug traps and nets are passive and rely on chance that bugs crawl through. As an alternative, could a bedbug's own feces or shed exoskeletons act as attractive beacons to herd bugs to a trap? To test, 20 adult bedbugs from the Harlan-line were placed into a choice chamber. Placed equidistant from two ends they were given 24 hours to roam. Pallets that were blank or coated with bedbug fecal matter were placed on opposite ends of the chamber. The independent variable is the presence or absence of fecal matter on the pallet. The control is the pallet without any added material. The dependent variable is the pallet the bedbug chooses to reside on. Overall, 117 trials were completed. Out of the trials, 85, or 72.65%, of bugs aggregated at the refuge with fecal matter and 32, or 27.35%, of bugs aggregated at the blank. A paired t-Test, with a two-tailed distribution probability statistical analysis was performed with a p-value of 0.0196016, thus demonstrating statistical significance. If bedbugs are attracted to this natural beacon, then the use of insecticides to exterminate bugs could be replaced with this cheap, natural alternative. This would benefit the environment, prevent the developing pyrethroid resistance, and alleviate legal disputes between landlords and tenants over the cost of extermination.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AS EM BE

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

209

Fair Category

LS

Project  
Number

3111

**Title:** Effects of Temperature Change and pH Change in Accordance to Climate Change Projections on Daphnia Magna Population Size

**Student Name(s):** J. Ledbetter

**Abstract:**

Water Fleas, Daphnia, are small freshwater planktonic crustaceans that belong to the phyllopora and serve as a food source for species of planktivorous fish, phytoplankton, and predatory invertebrates. Daphnia Magna are consumers of herbivorous zooplankton, recycled nutrients, bacterial community, and parasites. In order for freshwater ecosystems to survive and thrive, Daphnia are a crucial component. This project will test the effects of pH change and temperature change on Daphnia population size in accordance to climate change projections. Daphnia can reproduce in two different ways: sexually and asexually. Daphnia have a life cycle based on "cyclical parthenogenesis" and therefore alternate between parthenogenetic (asexual), and sexual reproduction. When Daphnia produce asexually they produce a large brood of eggs. This is a more effective way for them to reproduce. In unfit environments/ when environmental conditions deteriorate, females begin producing haploid sexual eggs which are then fertilized by male Daphnia. These broods are significantly smaller and sexual reproduction is consequently less effective. When the Daphnia are bred in unfit environments (lower pH and increased temperature), population sizes will begin to decrease. This project will explore at what point environmental conditions deteriorate enough for population size to begin to decrease in comparison to a constant at 23 degrees Celsius and a pH of 7.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EA EV EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

241

Fair Category

LS

Project  
Number

3112

Title: Determining the Most Distracting of the Five Traditional Senses from Feelings of Pain

Student Name(s): A. Snyder

## Abstract:

The goal of this experiment was to find the stimulation of which sense-- sight, sound, touch, smell, taste-- is most distracting from pain (increases pain threshold). To accomplish this, 8 female and 7 male test subjects between the ages of 14-19 were selected to perform a control test and a test for each sense. Pain was induced by having each subject submerge one hand in a bucket of water cooled to 5°C (the cold pain threshold). The selected sense was stimulated while the others were blocked, and the subject was timed to determine how long they could keep their hand in the water. After each test, subjects were asked to rate their distraction and pain levels on a scale of 1-10. It was found that females most frequently kept their hands in the longest during the tests for sight and touch, between 40-60 seconds. Males most frequently kept their hands in the longest for sight, sound, and taste, between 40-60 seconds. Both males and females most frequently felt the least amount of pain while testing taste. Females most frequently experienced the most distraction while stimulating taste, while males most frequently experienced the most distraction while stimulating sight. Based on this experiment stimulating taste produced the most positive results for females, and stimulating sight and taste produced the most positive results for males. However, because of limitations of the study, including uncontrollable variables and few test subjects, the results are inconclusive.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME BE CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

259

Fair Category

LS

Project  
Number

3113

**Title:** Anticorrosive Coatings of AZ31 Magnesium Alloy to Reduce Degradation Rate for Metallic Medical Implants

**Student Name(s):** A. Kosanam

**Abstract:**

Coronary stents are used to treat heart disease by keeping arteries open and prevent their closure due to plaque. Stents created on a stainless steel or cobalt alloy platform are not fully biocompatible and can result in restenosis and thrombosis. They also do not dissolve into the human body after healing and regeneration time has passed, and prevents the organ from returning to normal function. AZ31 magnesium alloys are promising materials for these issues, but barrier coatings are necessary since magnesium dissolves rapidly in the body. This study decreases the degradation rate of AZ31 magnesium alloy by altering hydroxyapatite-coating compositions. Flat magnesium substrates were coated (1.5 to 8 um/min) from prepared solutions, ranging from 0.75 to 3.5 Ca/P ratios and irradiated by a conventional microwave oven. The degradation rate of the coated substrates was tested in simulated body fluid where it was determined that a 1:1 calcium to phosphorus mole ratio had the slowest degradation rate of 0.0026 (mg/cm<sup>2</sup>)/hr for a seven day period. The effect of polishing the substrate prior to the deposition produced a higher degradation rate of 0.0416 (mg/cm<sup>2</sup>)/hr. Coatings on rod-shaped substrates were also successful with this technique. The chemical compositions, morphology, and porosity of the deposited substrates prior to and following their immersion in SBF were examined using scanning electron microscopy accompanied by energy-dispersive x-ray spectroscopy. It was elucidated that annealing could further decrease the degradation rate of AZ31 by increasing crystal size and decreasing porosity in the barrier coating protecting the magnesium alloy.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN CH ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project  
Number

3114

**Title:** A Novel Study on the Mechanism of the HAMLET Complex to Induce Apoptosis of Tumor Cells

**Student Name(s):** P. Mohanraj

## Abstract:

Alpha-lactalbumin and oleic acid complex to form HAMLET, which produces cytotoxic effects on cancer cells, albeit past research being inconclusive. The mechanism of creating both HAMLET's specificity to cancer cells and its tumoricidal effects remain unknown. In this project, to answer these research questions, it was hypothesized that polarity differences in cancer cell membranes versus healthy cell membranes confer HAMLET's specificity, and that HAMLET causes membrane perturbations allowing for initiation of apoptosis pathways. Exposing lactalbumin and oleic acid to cancerous or healthy *S. cerevisiae* cells demonstrated that HAMLET confers specificity to cancer cells. Unilamellar vesicles were synthesized containing general membrane phospholipids including phosphatidylglycerol, phosphatidylcholine, and phosphatidylethanolamine, and HAMLET strongly attracted to these negatively charged membrane lipids when near the vesicles. Since cancer cells typically have more negatively charged lipids in their cell membrane, it was proposed that HAMLET is specific to cancer cells through this polarity characteristic. Finally, lung carcinoma cells tagged for Ras proteins, when exposed to HAMLET, produced blebbing in the direction of the complex, and Ras proteins were attracted to these blebbing areas. The HAMLET complex was shown to inhibit these continuously active proteins, which are required for cell proliferation and survival. Thus, the inhibition of Ras proteins resulted in apoptosis pathways becoming active and killing the cell. It was concluded that HAMLET's specificity occurs through membrane polarity, inducing membrane deformation triggering signal transduction pathways for apoptosis. This overarching mechanism can be modeled with various proteolipid complexes to determine other tumoricidal agents more innocuous for human use.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB BI ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

88

Fair Category

LS

Project  
Number

3115

Title: The effect of videos games on school performance

Student Name(s): L. Lawson

## Abstract:

This experiment is testing to see if video games really have a positive link to academic performance. According to many researchers, children who played video games scored higher on math, science, and reading tests. Even though it's not been completely proven, I wanted to see if I would get the same result. I will use human subjects, from a gaming club, to test them on their math, science, and reading skills. I will administer one mini-test before they play and after they play to see a difference.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE AS ME

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

82

Fair Category

LS

Project Number

3116

**Title:** Studying Picture Quality: Evaluation of Pixels in Pictures Taken on the iPhone 7+ Camera, iPhone 6+ Camera and Snapchat Camera.

**Student Name(s):** J. Chisholm

**Abstract:**

In this project, we are studying picture quality, so the pixels were measured from pictures taken on the iPhone 7+ camera, iPhone 6+ camera, and Snapchat generated camera. In the experiment, pictures have been taken on the iPhone 7+ camera, iPhone 6+ camera, and the Snapchat generated camera. The pictures that were taken, were then put into a photoshop software and zoomed by 2000%. The zoomed in pictures were taken, and the pixels in the pictures were measured by height and width.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

226

Fair Category

LS

Project Number

3117

**Title:** Targeted Anticancer Properties of Honey Bee Melittin via Cell Surface Lipid Disruption

**Student Name(s):** D. Minichetti

**Abstract:**

Chemotherapy continues to play an important role in treating various cancers, however, during course of treatment, it is often difficult to differentiate between cancer and healthy tissue. For normal cells, the aminophospholipid phosphatidylserine(DOPS) and phosphatidylethanolamine (DOPE) are predominant in the inner membrane leaflet, however for cancer cells, DOPS and DOPE are found within the outer layer instead. Recently, researchers have discovered that melittin, contained within honey bee (*Apis mellifera*) venom, possesses anti-cancer properties. Melittin has demonstrated an ability to perforate the cancer cell membrane, based on what many have conjectured is selective in targeting PS and PE lipids on the surface of the cancer cell. This research investigates this proposed mechanism for cancer cell selectivity by melittin. To model cancer and normal cells, giant unilamellar vesicles (GUVs) were created via an interdigitated ITO-PET chamber described by Hongmei, et al., using application of 3V - 2 Hz sinusoidal ac voltage. To model cancer cells, fluorescent GUVs were constructed with up to 30% PE & PS lipids on the outer membrane, while simulated normal cells contained only 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC). Purified melittin from *Apis mellifera* was introduced to model cancer and normal cells. Light microscopic analysis highlighted melittin's increased selectivity, and ability to disrupt cell membranes for those containing PE & PS lipids, thus providing first-experimental evidence for the peptide's anti-cancer mechanism.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME EN CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

LS

Project  
Number

3118

Title: Limiting our Exposure to Radio Frequency Radiation

Student Name(s): S. Pithadia

## Abstract:

Cell phones and wifi routers, both of which are in close proximity to humans for sustained lengths of time, are examples of technologies that emit radio frequency radiation. New research is suggesting that with the long-term exposure that people withstand nowadays, RF radiation has the biological plausibility to elicit carcinogenic effects in brain tissue. My research sought to devise a platform to attenuate RF radiation whilst permitting wifi to pass, thus curtailing the capacity of RF radiation to usher reactions to pathways of tumorigenicity. This objective was achieved via three phases, the first of which tested various materials- namely aluminum foil, cotton, copper, cardboard, plastic, and tape. The second phase combined the aforementioned materials to fashion prototype covers for the wifi router, and the last phase resulted in the creation of a cell phone case that most effectively accomplished the purpose of this venture. Throughout the entirety of the experimentation process, an electromagnetic frequency detector was operated to measure the RF radiation that was discharged from the wifi router in terms of its power density. Based on those readings, results indicate that copper most successfully managed to attenuate the radiation. This intelligence aided in the formation of various prototypes, of which the most effective was assembled using copper, aluminum foil and cardboard. A culmination of the figures from the first and second phases contributed to the design of the final product: an iPhone case that effectively attenuates RF radiation whilst permitting wifi to operate.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN EE EV

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

256

Fair Category

LS

Project  
Number

3119

Title: PAD4 Inhibition: A Novel Treatment for Rheumatoid Arthritis

Student Name(s): A. Agarwal

## Abstract:

Rheumatoid Arthritis (RA) is a disabling autoimmune disorder which affects over 1.3 million Americans and as much as 1% of the global population. As one of the most disabling forms of arthritis, RA is characterized by painful systemic inflammation and synovium destruction. While therapy and timely treatment may reduce the effects of RA, no cure exists. Current approaches introduce serious toxicities such as the growth of tumors, cancer, etc. Peptidylarginine Deiminase 4/Protein Arginine Deiminase 4 (PAD4) catalyzes citrullination, the deimination of arginine side chains, a process required for the proper regulation of many human molecular mechanisms. However, in RA, this citrullination triggers an autoimmune response which leads to synovium destruction and bone damage. This project aims to treat RA through the inhibition of PAD4. In order to identify inhibitors of PAD4, mathematical and molecular modeling techniques were used. Roughly ten million available drug-like compounds were screened and their potencies were calculated. Docking scores, which approximate the receptor:drug binding energy, were computed for the set and the top 100 compounds were selected. Docking calculations include polar and non-polar interaction terms. The empirical function was used to evaluate the ligand's ability to bind to PAD4's active site, and the 20 most structurally diverse inhibitors were identified. The binding energies of the top PAD4 ligands ranged from -34 to -148 (more negative is better). Through conformational shape analyses and the calculation of docking scores, drug-like compounds with unique shapes and the highest affinities for PAD4 were successfully identified as potential anti-RA drugs.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME CS EN

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project Number

3120

Title: Determining the Ideal Management Strategy for Controlling Varroa Mite Levels

Student Name(s): T. Livesay

## Abstract:

Recently, a decline in bee population has been seen worldwide. Many studies were conducted to understand this trend. A mite was implicated called Varroa destructor, which vectors many viruses in developing bee pupae causing increased bee mortality. Much research has studied V. destructor. The objective of this study was to find the ideal management strategies for beekeepers to use to keep mite levels below the economic threshold thereby improving overall bee health. This was done through analyzing data from previous studies and national surveys of control methods effectiveness. Data was looked at for multiple strategies. The independent variable was the management strategy, including chemicals, drone brood removal, powdered sugar dusting and screen, brood interruption, and VSH queens. Dependent variables were varroa mite levels, colony loss, and Deformed Wing Virus (DWV). It was hypothesized the ideal management strategy would be avoiding chemicals and instead use powdered sugar, VSH queens, and drone brood removal to decrease mite load, limit diseases, and decrease colony loss. The data for this study was from the Northeast US region for the Apis mellifera bee. The data was statistically analyzed to determine significance of different methods actually had on the Varroa mite loads. After analysis, data showed the hypothesis was supported based on mite loads, but not colony success. Chemical treatments limited colony losses better, but maintained higher mite loads. Also, the most effective methods at keeping the mite loads beneath the economic threshold were oxalic acid, brood removal, and powdered sugar dusting with screen bottoms.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM EV AS

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project  
Number

3121

**Title:** Enzymatic Reactions at Nanoparticle surfaces: Studying the dependence of Substrate accessibility on the efficiency of enzymatic ligation

**Student Name(s):** J. Cheung

**Abstract:**

Dr. Rouge's group has developed nucleic acid nanocapsules (NANs) that have the potential to target and transport drugs to specific cells in the body, and without compromising other cells. Additionally, Dr. Rouge's lab has developed monophosphorylated linkers, which are essential components of NANs. The main role of the linker is to ligate DNA molecules to the surface of the NANs. The monophosphorylated linker consisting of triethylene glycol could efficiently ligate to DNA molecules in solution; however, when the linker was immobilized on the surface of a NAN, its efficiency to ligate decreased. The aim of my project is to test different lengths of monophosphorylated linkers to identify the length most suitable for attaching DNA molecules to NANs. My hypothesis is that the increased length of the monophosphorylated linker attached to a NAN will increase its efficiency to ligate to DNA molecules by making the monophosphate more accessible to the active site of the ligase. For testing, I will synthesize extended linkers, surface crosslinked micelles, and add DNA molecules and T4 ligase. After collecting data by using gel electrophoresis and by analyzing the NANs' zeta potential, I will determine which length is most effective by identifying which length linker resulted in the greatest amount of DNA molecules ligated. As of yet, we have been unable to synthesize the extended phosphorylated azide crosslinker. Currently, we are in the process of altering the procedure and we believe that the problem is due to the instability of the phosphoryl chloride that was used.

**Technical Disciplines Selected by the Student  
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CH BI CB

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

146

Fair Category

LS

Project Number

3122

Title: The Effect of Acid Rain on the Regeneration of Nematostella vectensis

Student Name(s): K. Thomas

## Abstract:

The Starlet Anemone (*Nematostella vectensis*) is a water organism that lives in shallow salt water (salt marshes) along the coast and other places like the Gulf of Mexico, Gulf of Maine, North sea etc. Pollutants dissolving into the water cause the water to become more acidic and can have a negative effect on the organism's daily functions. One function of the Starlet Anemone that is affected by pollutants is its capability to regenerate. In the procedure the animals will first be in three different groups of pH 6, 7, and 8. Each group will have 4 - 5 animals depending on the number of animals received. While, the animals are in the different pH they will be fed brine shrimp for three days before cutting. After they are cut, they will be measured and documented through microscopy until the dissected part of the animal is fully regenerated.

Technical Disciplines Selected by the Student  
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EV AS

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

209

Fair Category

LS

Project  
Number

3123

Title: BACTERIAL ANALYSIS OF KEFIR PRODUCTS

Student Name(s): Y. Aguilar

## Abstract:

Kefir products are produced from small grains formed by symbiotic communities of live bacteria and yeasts. The end product is usually a milky or watery fermented drink known for its unique taste and properties. Recently there has been an increase in the use of kefir because of its health-promoting bacteria. This research aimed to identify and quantify the bacterial communities of the organic product Kefir in order to determine whether they have a higher bacterial count as well as unique bacteria when compared to other similar probiotic products. Literature has proposed that Kefir products contain several major species of beneficial bacteria and yeasts not commonly found in yogurt. To conduct the experiment nutrient agar was used as a growth medium for the microbial cultures, and the agar plates were set up to cultivate and isolate specific colonies of bacteria. The data collected showed a significant difference in the number of colonies per sample (one-way ANOVA,  $p < 5$ ). Milk kefir contained the greatest number of bacteria and at the same time, Milk kefir also contained the most diverse colonies analyzed through bacterial morphology. This may indicate Kefir milk may contain a greater number of bacteria and unique species that provide more nutritional value than other commercial probiotic yogurts.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MI CH

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

265

Fair Category

LS

Project Number

3125

**Title:** PDE-4 Inhibitor- Assisted Antibiotic Suppression of Borrelia Biofilm Growth for Treatment of Chronic Lyme

**Student Name(s):** S. Chow

## Abstract:

Patients with Lyme disease rely heavily on antibiotics for treatment against chronic symptoms associated with *Borrelia burgdorferi* (Bb) infection. If not detected at an early stage, Bb adheres to internal surfaces, producing an extracellular biofilm, which prevents antibiotics from reaching the bacteria. Coincidentally, recent research has suggested that phosphodiesterase-4 (PDE4) prevents the formation of biofilm on medical equipment. In vivo, PDE4 degrades intracellular levels of cAMP, which indirectly increases the production of pro-inflammatory mediators. While PDE4 has been implicated in the treatment of a number of inflammatory diseases (psoriasis), this research will investigate whether its ability to mediate pro-inflammatory response will be effective in the treatment of Lyme. *B.turcica*-IST7(Bt), a nonhazardous yet morphologically similar organism to *B.burgdorferi*, was cultured in 2-3% Agarose/BSK-H/6% rabbit serum for 1 week, and subjected to separate solutions of PDE4 candidates Rolipram (1.29mM), Cilomilast (2.9mM), and Roflumilast (72mM). ImageJ analysis of PDE4-treated Bt biofilm SEM images highlight up to 31.7% reduction in biofilm growth and consistency, when compared to untreated *B. turcica* biofilms. To demonstrate synergistic benefit of a combined PDE4/antibiotic treatment of chronic Lyme, Bt biofilms were treated with PDE4 inhibitors, combined with 0.05mg/ml Tetracycline and/or Doxycycline. Inhibition of biofilm growth was measured via an innovative light scattering technique, using 400nm culture reflectance. While antibiotic regimens only marginally reduced biofilm growth, a single-dose, combined Rolipram/Doxycycline treatment reduced biofilm growth by 96%. Daily-dose treatment with Rolipram/Tetracycline/Doxycycline inhibited growth by 94%. These results concur with previous SEM analyses, where Rolipram provided the most significant biofilm inhibition.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME EN

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4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

246

Fair Category

LS

Project Number

3126

**Title:** An investigation into the use of fruit peel filters to reduce the level of heavy metal contamination in water.

**Student Name(s):** J. Siveyer

**Abstract:**

Heavy metals are dense elements that are cannot be digested, so they tend to bioaccumulate. In low quantities, they are necessary for life, but larger quantities can lead to serious medical complications, including organ failure and death. They can contaminate the environment through mining, farming, and industrial waste. An accessible way to remove the threat of heavy metal poisoning needs to exist. One gram of banana, apple, orange, and tomato peels were each put into mesh cheese-cloth bags then submerged into 200mL of 4ppm copper solutions for the course of two hours. Measurements of the copper levels were taken after 5, 15, 30, 60, 90, and 120 minutes. Controls were also made with no fruit peels and others were made with fruit peels but no copper in the solution. The data indicates that there was a significant drop in copper content within the first 5 minutes of testing. The drop was approximately 28%, 42%, 22%, and 49% for the banana, orange, tomato, and apple peels respectively, once the effect of the discoloration from the peels was taken into account. Without the mesh bags containing the peels, the copper content dropped by 69%, 54%, 38%, and 33% for the banana, orange, tomato, and apple peels respectively, which was a much more significant drop than with the mesh bags. The data suggests that all of the peels are effective at absorbing copper in a short time, but the effectiveness is limited when trying to contain the peels.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM EN PS

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

255

Fair Category

LS

Project  
Number

3127

**Title:** A customizable, 9DB1 Deoxyribozyme based system for the controlled production of proteins via artificial logic on the molecular scale

**Student Name(s):** C. Marino

**Abstract:**

In the last decade, numerous nucleic acid catalysts have been discovered using processes such as in-vitro selection. The applications of these enzymes are widespread, however finding, applying and tweaking a specific enzyme to fit one's needs is time consuming. The purpose of this research was to develop a system which can be easily applied and not only mirrors, but improves, the versatility of deoxyribozymes. The system is based on the RNA-Ligating 9DB1-deoxyribozyme, due to its stability and functionality in conditions similar to that of the cytoplasm. The purpose of this system is to perform an if-statement where the inputs are triggered by up to two specific sequences of RNA in solution and the output leads to the synthesis of any chosen protein. The operation of the system was demonstrated by comparing two experimental groups: a tube containing two substrates that code for a FLAG-tag peptide, and a tube containing these same substrates in the presence of a 9DB1-deoxyribozyme whose binding arms are complementary to the substrates. DNases were then added to the solution to separate the product and the resulting proteins were detected by ELISA. The results show that the proteins on the output can only be synthesized if the ligation occurs - a step that can be toggled with the addition of a stem loop to one or both of the binding arms. Due the adaptable nature of this system, it can be applied to numerous scenarios, ranging from detection kits, to systems capable of selectively killing cancerous cells.

**Technical Disciplines Selected by the Student  
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EN BI ME

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4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

164

Fair Category

LS

Project  
Number

3128

Title: Effect of Culturing Conditions on Lipid Quality in Marine Microalgae

Student Name(s): C. Sherman-Watson

## Abstract:

Microalgae such as *Nannochloropsis gaditana* are known to produce a potential high quality molecules of interest to the nutraceutical industry. They convert carbon dioxide into storage lipids in the form of triacylglycerols and eicosapentaenoic acid (EPA), an omega-3 polyunsaturated acid. EPA poses potential for making nutraceuticals, beneficial to people suffering from chronic diseases. *N. gaditana* was cultured in an F/2 nutrient medium. In the late exponential/ early stationary stage, lipids were extracted and quantitatively measured. These lipids were then fed to copepods. Another group of copepods was fed isochrysis, which is a microalgae with lower photosynthetic efficiency. The copepods were then analyzed, to determine if the EPA and other lipids converted from the carbon dioxide by *N. gaditana* does affect their growth and health. Preliminary results do show that nutrition being fed to the algae does play a role in quality of lipid production. These lipids can in turn provide more raw product of a higher quality to the nutraceutical industry.

Technical Disciplines Selected by the Student  
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MI ME ET

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4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

LS

Project  
Number

3129

**Title:** Utilizing a Freshwater Bioreactor as a Carbon Dioxide Sequestration Technique and a Multitrophic Microbial Fuel Cell System

**Student Name(s):** D. Schaefer

**Abstract:**

The acceleration of global warming has proven to be a response from the rapid increase in atmospheric greenhouse gases, the most prevalent of these is carbon dioxide. Current sequestration techniques are often very costly and use toxic chemicals to separate and purify CO<sub>2</sub>. A proposed solution is to design and develop a dual purpose multitrophic biological carbon dioxide sequestration technique which can effectively fix atmospheric carbon dioxide and be exploited to generate energy in a microbial fuel cell. A freshwater algae bioreactor situated near a source of CO<sub>2</sub> can be used as an effective carbon fixing tool in which the photoautotrophic species of *Phaeodactylum tricornutum* and *Chlorella* species can fix between 1.6 - 2.0g of CO<sub>2</sub> through oxygenic photosynthesis, for every gram of algal biomass (Sayre, 2010). The harvested algal mass was used as the energy source in a microbial fuel cell in which *Escherichia coli* metabolized the biomass and generated on average 76.1 mV at 2.7 mA, which yields 0.205 mW of power out of approximately 44 mL of the bacteria-algae solution. Based on a linear energy projection, a full scale fuel cell containing 1m<sup>3</sup> of the bacteria-algae solution would produce 1.7 kV at 61.4 A, which would yield 106 kW of power. It is proposed that microalgae species farmed for use as a carbon dioxide sequestration technique can also be developed into biofuels, utilized as nutritional additives, and used as agricultural fertilizers; this all expands the efficacy of investing in microalgae farming.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EV EM ET

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project  
Number

3130

**Title:** The Role of Acidity in Phosphorus Fixation of Brassica rapa through Induced Systemic Resistance by Inoculation of Azospirillum brasilense

**Student Name(s):** M. Zuckerman

## Abstract:

The use of fertilizer as a means to mediate abiotic stress and increase nutrient uptake has been used widely in the past 100 years (Farooq 2009). Phosphorus fixation is key components in plant development, playing an essential role in photosynthesis, respiration, energy storage and transfer, cell division, and cell enlargement (Dimpka et al 2009). Plant Growth Promoting Rhizobacteria (PGPR) solubilize phosphorus into compounds that the plant can use, which increases its uptake and increases the plant's biomass. The effect that low pH has on the phosphorus fixation of a rhizobacteria inoculated plant was investigated in this experiment. There were four experimental units, with two factors, therefore, having four treatments. Two of the plants had a soil pH of 7, and the other two 6. Varying levels of aluminium sulfate were used in order to change the pH of the soil and was monitored on a biweekly basis. One of each soils was inoculated with rhizobacteria, and the other two were not. After 5 days of growth, the Modified Morgan Extraction Method was used to determine the level of phosphorus in the soil, therefore determining how much phosphorus was fixed for the plant over the blooming cycle. While limited in scope, the level of phosphorus fixation in the plants with the inoculated PGPR does appear to be increased both in the neutral and acidic soils. If the hypothesis is correct, PGPR may serve as an effective biofertilizer to help plants combat acidic stressors as opposed to harmful artificial fertilizer.

**Technical Disciplines Selected by the Student  
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EM PS MI

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project  
Number

3131

Title: Viability of Cloudborne Bacterial Transport

Student Name(s): J. Vailionis

## Abstract:

The existence of bacteria in the upper atmosphere has been observed, yet much remains unknown about their physiology and precise function. Ice Nucleating Active (INA) bacteria make up a large portion of the bacterial content in clouds. INA bacteria cause water to freeze at higher temperatures, enhancing cloud formation by creating ice nuclei in the atmosphere. Some have theorized that this property could allow INA bacteria to travel with clouds until they precipitate back to the surface, where they can repopulate. This experiment aims to find how long INA bacteria can remain viable for reproduction while airborne in their frozen state and to speculate on the dynamics of bacterial population given existing data on atmospheric air movement. By finding the duration over which a relevant portion of INA bacteria populations can remain viable in a cloud we can highlight target pathways through which bacterial populations can be transferred. Many INA bacteria are known plant pathogens and this type of data could allow for more efficient use of pesticides and understanding into how these diseases spread globally. The experiment is being conducted by freezing *Pseudomonas fluorescens* in small water capsules (1 mL) at  $-5^{\circ}\text{C}$  for varying durations. The number of viable cells in each capsule are counted after and compared to the viable bacteria concentrations from the original culture. Currently, we have observed a 68% reduction in concentration of viable cells after 96 hours. More extensive data for longer durations will be completed during the next week.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MI EV EA

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2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

254

Fair Category

LS

Project Number

3132

Title: Improving Cardiac Motion Correction in Cardiac SPECT

Student Name(s): K. Zhao

## Abstract:

Single-Photon Emission Computed Tomography (SPECT) scans are imaging techniques used to monitor metabolic functions within the body, including that of the heart and liver. SPECT scans detect a positron-emitting radionuclide, or tracer, which is introduced into the body prior to the scan. A higher concentration of tracer results in a high resolution image, but puts the patient's health at risk, limiting the amount of tracer that can be used. Furthermore, accurate measurement of the heart is difficult due to movement within the heart. The SPECT scanner is unable to accurately quantify the parameters of the heart due to the the movement of the myocardium wall. This causes limited SPECT resolution, as more respiratory or cardiac motion within the heart will result in false quantification. To further develop heart quantification methods in SPECT, the research will attempt to improve heart quantification through resolution recovery and motion correction processes. SPECT listmode data was divided into 8 gated images based on heart motion. Non-rigid image registration was performed to deform all gated SPECT images to the reference gate, the most stable frame. Then, the deformed images were averaged to create a motion-free image. The image contrast was visually evaluated in terms of the ratio between myocardium and blood pool. Cardiac motion corrected images had superior image resolution compared to images without motion correction. A human study showed a 30% improvement in resolution, while a dog study showed 9% improvement. Further studies could expand on the reduction of time required to produce equal results.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME EN AT

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

98

Fair Category

LS

Project  
Number

3133

Title: How Light vs. Dark Areas Affect CO2 Levels of Meat

Student Name(s): S. Ford

## Abstract:

Things break down over time, and a main component of this breakdown is CO2 (Carbon Dioxide). CO2 breaks things down at different rates, depending on the environment around it. This experiment is used to showcase that difference based on environment. A lighted area and a darkened area were tested to see which one made a piece of meat release more gas, and after testing there was a significant difference, due to temperatures and other related factors. This experiment had a different outcome than expected, but still showed great evidence to support the claim of being affected by environment.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

238

Fair Category

LS

Project Number

3134

Title: The Effect of Different Types of Music on Students Academic Concentration

Student Name(s): L. Sirch

## Abstract:

Many students today listen to music while doing homework, but does it help or harm their ability to concentrate? The purpose of this experiment is to add to knowledge on this topic using a small local subject sample. The hypothesis was that classical music would increase students' concentration, popular music would decrease students' concentration and no music would have no effect. Sixty high school students were given three different math and English assessments on three consecutive days. Assessments were taken while listening to no music, classical music, and popular music. Each assessment was different, but similar in content and difficulty. The math assessment had twenty elementary level equations; the English assessment had a passage to read and four multiple choice questions. Duration in seconds and number of wrong answers were recorded and averaged for each. Averages for the math assessments: No music averaged 162.5 seconds with 2.17 answers wrong. Classical music averaged 153.9 seconds with 1.81 answers wrong. Popular music averaged 156.5 seconds with 2.17 answers wrong. Averages for the English assessments: No music averaged 145.86 seconds with 1.41 answers wrong. Classical music averaged 150.0 seconds with 1.12 answers wrong. Popular music averaged 130.6 seconds with 1.53 answers wrong. Results show that students listening to classical music made fewer mistakes than those listening to popular or no music. This experiment met its objective of providing data on whether listening to music helps or harms students' ability to concentrate.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project Number

3135

Title: Correlations Between Specific Gut Flora and Different Body Mass Type Changes

Student Name(s): J. Feuerstein

## Abstract:

Obesity is a major health concern, afflicting 35.7% of Americans, that is associated with serious illnesses. In researching obesity, a very important distinction to make is between fat mass (FM) and lean mass (LM). Many studies have shown that factors which impact the microbiome often times also impact total body mass (TM), suggesting a possible link between the microbiome and the types of mass gains. The purpose of this research is to determine if a correlation exists between different bacterial populations in the gut and changes in LM compared to FM. It is hypothesized that a correlation exists between these variables. Data from significant bacterial species in the microbiome as well as changes in both LM and FM in mice with these bacterial compositions were collected, and analyzed to determine if a correlation exists between the variables, and if so, which bacteria it existed for. The results found prove the hypothesis, for a majority of the bacterial species displayed correlation with or against the dependent variables. Because flora in the gut are correlated with different types of mass gain differently, this study suggests several bacteria that can be indicators of obesity risk. Several bacteria showing correlation with FM increases should be considered when searching for risk factors of obesity in the microbiome. Additionally, the results determining that several bacteria are correlated with healthier types of mass gain may become important in figuring out which bacterial species to target if further research can determine if correlations found are causations.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

233

Fair Category

LS

Project  
Number

3137

**Title:** The Use of a Hydroxybenzene Group Variant, Grapefruit Seed Extract, as an Alternative Natural Pesticide for Contemporary Chemicals in Modern Agriculture

**Student Name(s):** K. Rosenfeld, K. Rosenfeld

## Abstract:

The use of a hydroxybenzene group variant, grapefruit seed extract (GSE), is a viable natural alternative to contemporary chemicals in modern agriculture. These pesticides currently used in industrial agriculture lead to toxic exposure in humans. The soil pH undergoes change, the root systems of plants weaken, nearby watersheds are impacted, and trace amounts of pesticides bioaccumulate through the food web and result in a potential magnification impact. Soybeans were grown in uniform thermal and photoperiod conditions and were provided 250mL of water daily. To ensure validity the leaves were removed from the plant, desiccated, massed, and rehydrated for uniform moisture content during the experimentation. Leaves were then placed in five separate feeding stations. Leaves with 0% GSE (control), 25%, 50%, 75%, and 100% GSE respectively. Crickets were placed in a 55 gallon aquarium with free selection to the feeding stations to ensure an unbiased feed station selection and the locations were randomly shifted throughout the experiment. Once the experimentation period ended, the crickets had consumed all of the leaves from the control. All other feeding stations were left untouched. The crickets, with no remaining leaves in the control, 0% GSE, continued to avoid all other feeding stations. Some crickets starved, and others resorted to cannibalize the dead crickets rather than eat leaves from the other feeding stations. This data indicates that GSE is a viable alternative to natural pesticides in modern industrial agriculture.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM PS CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project Number

3138

**Title:** The Relationship Between Phonological Processing, Intelligence Quotient, and Reading Cognition: A Behavioral and Neuroimaging Analysis

**Student Name(s):** J. He

**Abstract:**

Reading serves as a fundamental aspect of education, but is very complex. Reading disabled individuals are left at a disadvantage in life, so this study investigated the relationship between IQ; phonological awareness (PA), the ability to manipulate phonemes; and reading cognition (RC), an individual's reading ability, to better understand and enhance reading development. It was hypothesized that IQ is positively correlated with a child's PA and RC, and that children with above average and average IQs exhibit less activity in the temporal lobe during phonological decoding while children with below average IQs exhibit the opposite trend. To investigate, forty-two participants aged 4-7 from New Haven were given standardized assessments to determine their PA, IQ, and RC. Correlation analysis indicated higher positive correlations between IQ and PA as well as between IQ and RC as children gained reading proficiency. Also, a child with a below average IQ and PA exhibits less bilateral temporal lobe activation when decoding pseudowords rather than real words. This suggests the absence of an automated phonological decoding ability, a vital factor for a positive reading outcome. In addition, a child with below average IQ and PA depends heavily on the right temporal gyrus for reading real and pseudowords, an indicator of a future reading disability. The data illustrates that IQ can potentially predict future reading outcome at the onset of reading instruction, and that children with low IQs are at risk for developing a reading disability. For these children, a PA intervention can potentially enhance reading development.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BE ME

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

218

Fair Category

LS

Project  
Number

3139

**Title:** Does the microbiota in the *Drosophila melanogaster* gut affect the severity of Type 2 Diabetes symptoms?

**Student Name(s):** G. Roche

**Abstract:**

Type 2 diabetes is the most common type of diabetes. It causes blood glucose levels to be higher because the glucose is not being brought into cells from the blood. This happens because the body cannot use insulin properly.

Recently, a *D. melanogaster* model of Type 2 diabetes has been developed based on feeding flies a high carbohydrate diet. There also is evidence that the gut microbiota play a large role in the development and severity of this disease, either by altering food metabolism or signalling pathways. The purpose of my experiment is to determine if the probiotic yeast, *S. boulardii*, can prevent or prolong *D. melanogaster* from developing diabetes when they are raised on the same diet as flies without the probiotic. The hypothesis is that the flies fed with the probiotics will not develop diabetes, will have a delayed development of diabetes, or will develop a less severe form than the flies who were not fed probiotics. One thing that has been observed with the development of the flies is that the control food flies have developed larvae and the diabetic has not yet. This will be measured with a variety of assays, including measuring total glucose, stored glucose (in the form of glycogen), trehalase, egg laying, adult and larval fly sizes, and life cycle length.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME CB BI

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

LS

Project  
Number

3140

Title: Developing a Robust Phylogeny of Xyridaceae and Closely Related Families

Student Name(s): W. Granath

## Abstract:

The study of Phylogeny depicts the evolutionary history of organisms and the relationships among individuals or groups. Phylogenetic trees can be used to assess biodiversity, evolution, ecology, and genomes. The family of Xyridaceae contains 5 genera and hundreds of species. They are flowering plants characterized by grass-like appearance, and can be used as bioindicators due to inhabiting coastal plains and wetlands. They sustain an important role to wildlife, providing pollen and seeds. The problem analyzed in this study examines whether the Xyridaceae family and other genetic families are more closely related to each other than to other species/families. This assesses the monophyletic nature of the Xyridaceae family. I, along with Dr. Lisa Campbell, hypothesized that the genera of Xyridaceae are monophyletic, and the family is monophyletic. As this research is ongoing, we aim to assess as many data sets as possible over several disciplines. A seed atlas was created using a Scanning Electron Microscope and Orion Software to image the seeds of Xyridaceae across multiple genera. These are being statistically analyzed and compared for their length, shape, apex shape, type of striae, and type of cross line. The other disciplines include molecular sequencing, cytology / anatomy, and morphometrics / macromorphology. While the implications of this research are mainly academic, it does give us access to a store of knowledge on gene-to-trait expression and its value. The hypothesis is currently expected to be supported.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

LS

Project  
Number

3142

**Title:** Adherence Rates of Escherichia coli to Mono-filament, Multi-filament, and Barbed Sutures

**Student Name(s):** A. Schommer

**Abstract:**

This project aims to determine if one type of suture has a lower rate of bacterial adherence. This can help hospitals determine which type of suture is better for a specific wound. The hypothesis for this project predicted that barbed sutures would have the same bacterial adherence rate as multifilament sutures, due to the small indentations and curves where bacteria would be able to grow.

This procedure began with tubes containing lengths of sutures and growth medium being inoculated with the bacteria Escherichia coli. The tubes were then incubated for ninety-six hours at thirty-seven degrees Celsius. The sutures were then taken out of the tubes, and placed into sterile water, where the tubes were shaken by vortex. The water was placed into a spectrophotometer, where the clarity was measured, giving the rate of adherence. The water with the culture shaken off of the suture was mixed with a growth medium and placed on agar plates, which were allowed to incubate for twenty-four hours, and the plates were analyzed. The results showed a negligible difference between the bacterial adherence rates of the types of sutures. The sutures all adhered to a minimal amount of the bacteria. In fact, some of the water measured for clarity was read as clear, which meant virtually no bacterial adherence. This project determined that in the test of bacterial adherence, there is no difference between different types of sutures, which can help surgeons when choosing sutures.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME MI CB

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4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

233

Fair Category

LS

Project Number

3143

**Title:** Investigation of the Effectiveness of Bowel Preparations and Physician Rating for Achieving Maximum Visibility in Colonoscopy Procedures to Increase the Detection Rate of Colorectal Cancer

**Student Name(s):** S. Barnett

**Abstract:**

Colorectal cancer (CRC) is a leading cause of death even though up to 90% of all cases and deaths are preventable by colonoscopy detection.

1600 data entries, including date of study, physician number, patient date of birth, patient gender, preparation used by patient, and outcome on the Aronchick Scale, were recorded at the time of the procedure at the Endoscopy Center of Fairfield. The proportions of success for each prep are:  $\hat{p}$  prepopik = .79,  $\hat{p}$  miralax = .72,  $\hat{p}$  suprep = .92, and  $\hat{p}$  movi = .95. After running a 2 Proportion Z Test, it can be reported that movi and suprep are equally as successful. A chi-squared test demonstrated that the outcomes recorded by each physician would not happen naturally 0.05% of the time, proving the subjectivity of the Aronchick Scale.

Currently, Miralax is the most widely used prep at the Endoscopy Center of Fairfield, but is the least successful. Recommendations for physicians to increase the instances of prescribing Suprep and Movi in place of Prepopik and Miralax, and to adopt the Boston Bowel Preparation Scale (BBPS), will be reported to the Endoscopy Center. Doing so would increase the overall success ratings of the procedures, increasing the Endoscopy Center's adenomatous polyp detection rate, and thus prevention of CRC. The BBPS quantitative scale preserves segmental and physician cleansing differences, allowing for more accurate comparisons of bowel preparations to validate Movi and Suprep as superior preps.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME

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4. Is this project a continuation?  Yes  No

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- Yes  No



# CSEF Official Abstract and Certification

Word Count

241

Fair Category

LS

Project Number

3144

Title: Gender Identity Dysphoria

Student Name(s): A. Bibeau

## Abstract:

**Introduction:** Gender Identity Dysphoria (GID) is defined by strong, persistent feelings of identification with the opposite gender and discomfort with one's own assigned sex. If people increased their knowledge of GID, would they have a better response to those individuals who are experiencing GID, and help alleviate their situation of feeling different?

**Problem:** If awareness can stop an individual's biased perception on GID, then the people affected will feel an increase of support from society.

**Independent Variable:** Knowledge / Social Awareness

**Dependent Variable:** Level of support

**Method:** A quantitative experimental research study on GID was conducted in a technical high school. Six out of twelve trades were selected. The control group received a pre-survey only.

The intervention group received a pre-survey, educational presentation and a post-survey.

Parental consent was needed for the students to participate. The surveys contained no identifying information and the questions were a mixture of yes and no, as well as open ended questions.

**Outcome:** The way to remove the stigma surrounding gender identity is about "choosing the right words." Replacing "disorder" with "dysphoria" removes the stigma that the patient is disordered.

**Limitations:** The major limitation of the research study is that the participants needed to get parental consent in order to partake in the study. Out of the ninety-five consent forms distributed only eight were returned.

**Implications:** Increased awareness and support will decrease the stigmas associated with GID.

**Keywords:** GID, stigmas, signs and symptoms

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE ME

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

187

Fair Category

LS

Project  
Number

3145

**Title:** The Inclusion of *Ulva lactuca* Masses to the Domain of *Isopora palifera* Fragments May Culminate in the Reestablishment of Moderately Suspended Symbiotic Zooxanthellae; Being Previously Induced by Atmospheric Adjustment.

**Student Name(s):** J. Lenes

**Abstract:**

Throughout the oceans of the world, coral has been experiencing mass amounts of bleaching; the result of an increase in sea temperature/chemicals, leading to the breaking of the symbiotic relationship between corals and Zooxanthellae. Research from Diaz-Pulido Guillermo (2009), involving climate change models and bleached coral observations, indicate that *Isopora palifera* (acropora) fragments, among many other types of coral, have been impacted throughout this large-scale degradation. The purpose of this research is to determine if mediation of coral bleaching can be provided, resulting in a lower susceptibility to thermal/chemical stress, and therefore preventing Zooxanthellae from leaving the coral skeleton. Small amounts of “Coppertone Sport” and “Neutrogena Fresh Cooling” sunscreen were utilized with seawater and *Ulva lactuca*, in attempts to determine the extent to which *Ulva lactuca* absorbs the toxic chemical Oxybenzone in coral regions. Oxybenzone was later observed with a spectrophotometer, allowing for support that the concentration of the toxic chemical was absorbed by *Ulva lactuca*. Future applications include the observation as to if the addition of sunscreens without Oxybenzone also implicate the breakdown of the symbiotic bonds with the coral taxa regions.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BI PS

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

223

Fair Category

LS

Project Number

3146

Title: Rhythmic Processing Abilities in Children Ages Five to Fifteen

Student Name(s): N. Maerean

## Abstract:

Evidence has shown that rhythm processing abilities are linked to speech and language abilities. For example, species that are able to synchronize to a beat are those capable of vocal learning. In addition, people who have language impairments, including dyslexia or specific language impairment (SLI), also show difficulties in perceiving and synchronizing to a musical beat. This linkage is explained by the structural similarities between rhythm and speech. However, there is limited research related to rhythm processing abilities in children, particularly how these abilities develop and change with age. The purpose of this study is to analyze the ability of children, across a range of ages and years of musical experience, to entrain to a musical beat. The Beat Alignment Test (BAT) was used to measure rhythmic abilities in 45 children with a range of musical experience. Inter-tap intervals (ITIs) were extracted for each participant across 12 pieces of music, and the variability of the ITIs was computed, as well as the correlation of the ITIs with the target inter-beat intervals in the musical pieces. Results indicated that children's ability to tap consistently to a beat improves with both age and years of musical experience. Research in this field can benefit the development of predictive testing for identifying language disabilities, as well as targeted rhythm-based therapies for addressing language impairments.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE ME

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2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

LS

Project  
Number

3147

Title: Cloning of the IRES Gene for Targeted Viral Gene Therapy

Student Name(s): C. Banks

## Abstract:

Gene therapy is the transplantation of a desired gene into a cell or cells in order to add, replace, or delete missing, defective, or harmful genes for the purpose of manipulating genetic disorders. One pathway for implementing gene therapy is using a virus, specifically an adeno-associated virus (AAV), in order to deliver genetic material directly to cells. The goal of this experiment is to produce genetic material for the virus through cloning. For the experiment, bacterial transformations were used to clone the IRES (internal ribosomal entry site) gene, a RNA element that allows for translation initiation. This cloning used EMCV (Encephalomyocarditis virus) IRES and Poliovirus IRES in the context of HIPK3 (homeodomain-interacting protein kinase 3), ZKSCAN1 (regulator of Kruppel-associated box subfamily of the zinc finger proteins), and circGFP (circular green fluorescent protein) constructs. The GFP indicator was used to test transformation rates in chemically competent cells. The results showed successful cloning of the IRES gene in the backgrounds of cells containing circGFP and IRES-GFP in comparison to HIPK3 split GFP. Further testing can be done to determine the accuracy of the cloning by sequencing and its application in AAV. The final goal of this therapy is to have the highest transduction rate or the highest rate of successful delivery of genes into the target chromosome(s) in the nuclei. The specific disease can then be affected through cell replication or the synthesis of proteins.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CB EN BI

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project  
Number

3148

Title: An Athlete's Guide to Picking a Marker to Write on Their Skin with

Student Name(s): B. Mendoza

## Abstract:

Swimmers at meets often write down the information of their events on their bodies in order to remember them. This writing should last the entire meet, but should wash off easily. This experiment is aimed to determine what marker's chemical makeup is durable enough to stay on in water and wash out after. This was tested by writing on pieces of pig skin with four different markers, all with varying chemical makeups. The skins were soaked in water with the average pH of a swimming pool, and then washed with soap. How well the markers stayed on the skins were measured on a scale from 0 to 5. Zero being completely clean, identical to the bare control skin and five indicates the marker stayed equally as pigmented as the control skin with the same marker, that wasn't washed. After being soaked in the water, the Sharpie was rated an average of 5, the Expo marker an average of 3, the Crayola Washable Marker an average of 3.3, and the Semi-Permanent marker an average of 4.8. Once the skins were washed with soap, Sharpie was rated an average of 4.8, the Expo marker an average of 0.1, the Crayola Washable marker an average of 3.3, and the Semi-Permanent marker an average of 1. The Take Your Mark Semi Permanent Marker was the most durable and washed off the easiest, due to its binder that allows for pigments to adhere to a substance, but still allow pigments to be lifted.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

208

Fair Category

LS

Project Number

3149

Title: Permanent Inactivation of the HIV Provirus via CRISPR Gene-Editing

Student Name(s): A. Agarwal

## Abstract:

Current HIV therapies fail to target the latent viral reservoir, the location of persistent, dormant HIV which often restarts producing virus. However, prior viral reservoir eradication attempts have been largely unsuccessful. This project aims to interrupt the replication machinery of HIV by making multiple cuts within HIV's highly conserved Long Terminal Repeats (LTRs) via the CRISPR (clustered regularly interspaced palindromic repeats) gene-editing system. Since they contain promoters, enhancers, and transcription machinery that are necessary to the viral replication cycle, LTRs are the "control centers" of gene expression. First, available HIV sequences were computationally analyzed to design and synthesize gRNAs specific to the LTRs. Now, the synthesized gRNAs are being molecularly cloned into a lentiviral vector. Next, surface-modified lentiviral particles that specifically target human T cells will be generated and transduced into a cell line carrying latent HIV with a fluorescent protein as reporter. A reduction in fluorescence after induction with activating agents will indicate damage to the integrated HIV and thus inactivation of the viral genome. In conclusion, CRISPR gene-editing of the HIV genome represents a potential cure/therapeutic for inactivating the latent viral reservoir. The data presented demonstrates successful production of HIV genome-specific gRNAs and ongoing testing will determine their HIV-targeting efficacy.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB ME BI

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4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

LS

Project Number

3150

Title: Silk Fibroin Microspheres Containing Lactase for Treatment of Lactose Intolerance

Student Name(s): K. Vartenigian

## Abstract:

Commercially available lactase tablets used to treat lactose intolerance are often completely or partially ineffective. These pills utilize the lactase of *Aspergillus oryzae*, which works by hydrolyzing lactose in the stomach before it can reach the colon and cause digestive distress. The purpose of this study is to engineer a treatment to supplement current lactase pills, reducing the amount lactose left unhydrolyzed. By using silk fibroin microspheres, I attempt to encapsulate the lactase of *Kluyveromyces lactis*, protecting the enzyme from denaturation in the stomach then releasing it in the small intestine where it functions best. Microspheres containing lactase were prepared by creating a silk fibroin solution from *Bombyx mori* silkworm cocoons, combining the silk solution with various concentrations of lactase solution, and mixing it with polyvinyl alcohol solution. This mixture was dried into films, suspended in water, then centrifuged. The resulting microspheres were soaked in solution with a pH of 2.5 then in a solution of pH 6.5 containing lactose to simulate passage through the gastrointestinal tract. Lactose remaining was quantified using colorimetric/fluorimetric assay. Results showed that microsphere samples reduced the concentration of lactose in the pH 6.5 solution, and that microspheres with a higher concentration of lactase yielded more lactose hydrolysis. Though this research is preliminary, results are promising. The reduction of lactose in samples containing microspheres indicates that lactase microspheres are effective to some extent. Future research will focus on increasing effectiveness by optimizing microsphere size, amount, and creation method.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project  
Number

3151

Title: A Study Of Circadian Genetics & Abiotic Stress Towards Sustainable Agriculture

Student Name(s): M. Geradi

## Abstract:

Food security and agriculturally unfavorable climates are prevalent sustainability concerns. Irrigation, a vital agricultural process, results in salinization of arable land. Saline soil diminishes crop growth and yield. Circadian genes regulate plant response to abiotic stress and can be used to solve these challenges. Furthermore, plant growth promoting rhizobacteria (PGPR) can be used in increasing yield under such adverse conditions.

This project aims to study circadian genetics and the effect of beneficial *Bacillus* strains (PGPRs) to develop methods to alleviate saline and osmotic stress. Towards this goal, wildtype *Arabidopsis thaliana* and 3 circadian mutant lines, GI-2, FKF1 and CCA1 OX, have been studied. Plant development and germination were studied in 8 hour v.s. 16 hour chambers and under a range of salt and mannitol concentrations (0-200mM). Stress mitigation and growth promotion by 3 *Bacillus* species were studied by spotting suspended cells onto agar plates with plants. Partition plates were used to study effect of microbial volatile compounds. Plant growth was evaluated by examining biomass, leaf surface area and chlorophyll content. Root growth promotion was tested by growing plants with bacteria on vertical plates and measuring root length.

2 of the 3 *Bacillus* species promoted growth and stress tolerance in both wildtype and GI-2 lines. The 3rd strain doubled biomass and increased chlorophyll in GI-2 mutant, but not in wildtype. Furthermore, 2 species improved lateral root development and increased root length.

These results indicate that the 3 *Bacillus* species tested can act as biofertilizers and increase crop production in the future.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS CH MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project Number

3152

**Title:** Temperature-Independent, Portable, and Rapid Home Detection of Lyme Disease Using a Silk-Derived Lateral Flow Salivary Test

**Student Name(s):** O. Hallisey

**Abstract:**

In the absence of early diagnosis and medical intervention Lyme Disease progresses rapidly, leading to the development of debilitating systemic symptoms and increased risk of “Post-Treatment Lyme Disease Syndrome” (“Chronic Lyme”). Previous research devised a rapid and inexpensive Ebola detection platform that is temperature-independent. Current research develops a rapid salivary test for the presence of Human Lyme Disease IgG antibodies. Utilizing the stabilizing properties of silk fibroin, the ELISA reaction is temperature-independent, confirmed by ELISA colorimetric detection of Lyme after prolonged, non-refrigerated storage of the kit's reagents. The Lyme ELISA assay was conducted in a 96-wellplate format (A 450nm) at 0-14 days from initial mixing and dilutions. Silk film Lyme ELISA reagents were embedded in load spots on a three channel, paper-based, microfluidic detection card. These colorimetric reagents, positioned to create timed, visible detection of Lyme IgG antibodies, are sufficiently sensitive to test saliva, rather than serum as used in existing protocols. After applying saliva to the center detection zone, 30µl drops of water dissolve the silk-embedded reagents, initiating a timed-flow towards a center detection zone, where a positive (colored) result confirmed the presence of Lyme IgG antibodies in 30 minutes, at a cost of \$5. This rapid, temperature-independent diagnostic flow test permits home testing and self diagnosis, eliminates blood tests, cuts cost, and allows for more frequent testing. Resultant earlier diagnosis and medical treatment permit a meaningful improvement in recovery times and the prevention of “Chronic Lyme”.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME EN AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

LST

Project Number

3501

Title: Depression Is Not A Choice, End the Stigma

Student Name(s): B. Cassidy, F. Stimson

## Abstract:

**Purpose:** This study explores the relationship between knowledge and awareness to increase levels of empathy in order to reduce the stigmas surrounding depression.

**Method:** An experimental quantitative study was conducted at a technical high school. 10th and 12th grade students were selected to compare the education and levels of empathy for depression. The study included two control groups and two intervention groups for each grade. An educational component was provided to the intervention groups to compare the pre and post knowledge of depression to see if less stigmatization is present.

**Results:** The data that the researchers collected was compared between the control and intervention group, the pre and post survey, and between the two grades. After the data was collected and made into graphs it showed that the researchers survey did in fact prove the researcher's hypothesis.

**Limitations:** The major limitation in this study was getting the students to bring back their permission slips with a parent signature. Out of the 97 students that were given permission slips, only 39 of them were turned in.

**Implications:** The study increased awareness and knowledge about depression and in the process lowered the stigmas associated with it. Incorporating the illness of depression to a greater extent into the health curriculum in schools would greatly increase knowledge of it. It's time that the movie industries try to stomp out the stigmas of depression by portraying it appropriately.

**Keywords:** Depression ~ Stigma ~ Awareness ~ Adolescence

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

LST

Project  
Number

3502

Title: A More Efficient Garden

Student Name(s): Z. Schrempp, P. Wilson, J. Amabile

## Abstract:

The purpose of investigating the topic of dry gardens was to find a more efficient way of watering gardens. Our hypothesis that we studied was getting water to our garden and have extra water stored in rain barrels to keep our garden hydrated for a dry period of time.

The procedures we used to find this and test it are as follows. First we took into consideration previous attempts, such as rain barrels, and hoses with pin holes that release rainwater. We decided that we would have two rain barrels at the bottom of the gutter. One of the rain barrels will be attached to a hose with pin holes that weaves through the garden, the other will also be attached to a separate hose. However the second rain barrel will have a valve that keeps the water stored in the barrel. When the valve is open it will let the water out into the hose and then to the garden.

Our data showed that our garden was hydrated much better than our control garden. Our control garden had dryer soil and was more like a powder. Our test garden had hydrated soil and was more dense than the control. Our garden had soil with a lighter shade of brown. Our test garden had a darker shade and a higher rate of hydration.

Our conclusion was that our design has a more efficient way of watering a garden, which may produce healthier plants in the long run.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

LST

Project Number

3503

Title: Stomping out the Stigma of Panic Disorder

Student Name(s): M. Marriott, N. Henderson

## Abstract:

The researchers conducted an experimental quantitative research study on panic disorder in a small New England technical high school to determine if students would be more empathetic towards individuals with panic disorder if they had more knowledge about the mental illness. The researchers randomly selected two grade levels and six technical career trades to survey, where half of them were designated as the control group, and the remaining half as the intervention group, who received a presentation on panic disorder. Although the researchers faced the challenge of students not returning the permission slip necessary to participate, parents refusing to allow their student to partake in the study, and the option for students in one of the grade levels selected to take a psychology course, the researchers came to the conclusion that participants were, in fact, more understanding and empathetic towards those who suffer from panic disorder following being educated. Even though the future of the stigmas surrounding panic disorder and other disorders similar to it is uncertain, the researchers plan to promote positive attitudes toward panic disorder within the high school and the technical career trades. The researchers hope that just as it was proven in the study with panic disorder within a technical high school; if the community had more knowledge of mental illness overall, they would be less likely to stigmatize, and thus a better perception of mental illness as a whole would result.

Keywords: Panic disorder, stigmas, mental illness, signs and symptoms, treatment

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

218

Fair Category

LST

Project  
Number

3504

Title: How Everyday Factors Can Impede on Reaction Time

Student Name(s): A. Werenski, J. Dion, Z. Hassan

## Abstract:

In the experiment we were trying to determine how different actions (texting and talking) affected reaction times in humans in order to assess the risk of these actions while being a pedestrian. We used a website called "Human Benchmark", and did three tests while focusing completely, while typing "My reaction time is slow" on a mobile device, and while singing the national anthem. From the results collected, it is obvious that talking and texting do impair the reaction time of individuals, with texting being the most harmful of them all. Ziad's average reaction time increased from the trial where nothing was used by 134 milliseconds (ms) because of texting, Aidan's average reaction time increased by 304.7 ms, and John's average reaction time increased by 153.7 ms. In fact, texting increased reaction times by 33% up to 100%, while talking increased reaction times by an average of 10%. We believe this is an important topic to be researched and tested because almost every year there are 330,000 crashes related to distracted driving. It takes approximately to 3/10 of a second to react to a jump scare, and in this case it takes approximately 5/10 of a second to react while texting, with this we can display the true dangers of distracted driving and the difference between life and death.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT BE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

226

Fair Category

LST

Project  
Number

3505

Title: The effects of sea level rise on the survivability of *Melampus bidentatus*

Student Name(s): G. Malloy, T. Matteau

## Abstract:

The study and experiments conducted were to get an understanding of the effects global warming has on Salt Marshes and how the destruction of these important ecosystems can affect others. Salt Marshes act as natural filters, serving as nitrogen sinks, filtering runoff water and diminishing nitrogen input to estuaries, because salt marshes trap nutrients, sediment, and build organic matter to form peat, they are able to grow and keep pace with the rising ocean. To do so, a plethora of M.B were collected from both high and low/mid marshes, and were put into test tubes for varying periods of time to represent effects from destruction and drowning in salt marshes. Each was placed into a separate test tube filled with salt water, covered with cotton so the snail couldn't escape, and taken out for measure after the times trials/periods we up. What was found was the low marsh snails survived longer for extended periods submerged, which was expected. The experiment was to show the effects of the destruction of salt marshes. This is mainly due to higher tides and rougher waves, causing more snails and other inhabitants of the area to be brought into the water. Eventually everything brought into the water will die after extended periods of time, even though they can only go a few hours, a day or two at maximum.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

LST

Project Number

3506

Title: Intermittent Explosive Disorder and Stigmas

Student Name(s): A. Verrette, K. Reyes

## Abstract:

**Purpose:** To determine if the stigmas related to IED would dissipate after students were educated about IED.

**Method:** A quantitative experimental research study was conducted by giving a pre-survey to both the control and intervention groups. The 10th and 12th grade career technical trade groups were randomly selected. An educational component was provided to the intervention groups followed with a post-survey.

**Results:** The researcher's hypothesis was proven because the intervention group demonstrated having gained knowledge after viewing the educational component. Thus, changing their mindset on IED.

**Limitations:** The main limitation was that out of 103 students that were given permission slips, only 39 of them returned it signed. In addition, not all of them took the pre or post surveys because of being absent or having conflicts with the times the pre/post surveys were given.

**Implications:** With knowledge about IED the surrounding stigmas were minimized. In order for students to gain a realistic view of what mental illnesses are, education should be provided so the stigmas surrounding mental illness can be diminished. It is clear that since health classes are mandated by the state for high school students, the teaching of mental illness needs to be added to the curriculum.

**Conclusion:** The study showed that the majority of the students that participated in the intervention group obtained more awareness due to the education component. The hypothesis was proven correct, however, additional studies should be conducted to get a more reliable data and accurate results.

**Keywords:** IED, Stigmas, Mental Disorder/Illness

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

196

Fair Category

LST

Project Number

3507

**Title:** The Investigation of the Effectiveness of Triclocarban as an Antibacterial Agent

**Student Name(s):** A. Wilson, M. Madan, A. Bhura,

**Abstract:**

On September 2, 2016, the FDA banned 19 antiseptic chemicals commonly found in antibacterial soaps. The premise of the ban was that there was no significant evidence supporting the effectiveness and safety of the chemicals. Of the 19 chemicals, triclosan and triclocarban were the most commonly used. Since the FDA announced the rulemaking in 2013, most companies have already phased out triclosan. However, products with triclocarban have been mostly unaltered. Hence, we chose to examine triclocarban and the products that contain it. The project will function to test triclocarban's effectiveness as a pure substance and as an active ingredient in a product. Triclocarban will be tested on a bacteria that is commonly found on the hand: *Pseudomonas fluorescens*. Distilled water with a concentration of 0.3% triclocarban would be used to simulate triclocarban being the only ingredient. Antibacterial soap containing triclocarban and non-antibacterial soap will be tested on the same three bacteria. The effectiveness will be determined by measuring the growth of the bacteria in each chemical environment. This will be done using the growth curve and sterile disk methods. The goal of this experiment is to confirm or disprove the claims made by the FDA.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

MI ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LST

Project  
Number

3508

**Title:** Investigation of the Tenascin-X Protein and its Role in Ehlers-Danlos Syndrome

**Student Name(s):** B. Dziekan, A. Missios

**Abstract:**

Ehlers-Danlos Syndrome is an inherited condition that affects connective tissues in the body. There are not many tests for diagnosing someone with EDS and there are not good treatment options. Most treatments help with the pain and other symptoms caused by EDS. There are 6 major groups of EDS including the hypermobility, classical, vascular, kyphoscoliosis, arthrochalasia, and dermatosparaxis types. Another type that has been recently discovered the tenascin-X deficient type. Tenascin-X deficient EDS is caused by alterations in the TNXB gene. This gene is the instructions for making the protein tenascin-X. The deficiency of tenascin-X causes changes to the connective tissues resulting in the clinical features seen in EDS.

The purpose of this experiment is to study the function of the tenascin-X protein and its role in EDS. In this project, the tenascin-X gene was cloned and tagged with a His tag, which can be used to purify it and identify proteins that interact with it. Cow connective tissue will be used to find tenascin-X protein binding partners. So far, we have designed PCR primers to introduce specific restriction sites, amplified TNXB, and used restriction enzymes to prepare the insert and expression plasmid (pET28a(+)) for ligation. After we clone the gene into the expression plasmid, it will be purified using the His tag and Ni-NTA column chromatography. Binding proteins will be isolated from cow tissue by native Ni-NTA column chromatography and identified using SDS-PAGE and MALDI-TOF mass spectrometry.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB ME MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LST

Project Number

3509

**Title:** Effect of Popular Acidic Drinks on Human Tooth Enamel and Use of Common Chemical Additives to Reduce Enamel Erosion

**Student Name(s):** C. Chang, H. Zhang

## Abstract:

Oral health has always been an important topic in the field of medicine. Concerns about the erosion of tooth enamel lead to research of possible methods to prevent enamel loss. This research focuses on the effects of several common acidic beverages on teeth, and possible ways to lessen such effects by adding human-safe buffers to those beverages. Teeth from raccoon skulls (simulating human teeth) have their masses measured. One control and two experimental groups are used; the control group focuses on the effects of four different beverages (cola, orange juice, coffee, and water) to raccoon teeth, and the two experimental groups use the same four beverages with  $\text{NaHCO}_3$  and  $\text{HPO}_4^{2-}$  added to them, respectively, to mitigate acid damage to tooth enamel. The teeth are taken out every week for their mass to be recorded, and the beverages and buffers are replaced with new ones. After three weeks, the data is analyzed to determine the percentage of mass lost. As hypothesized, the results show that there is a measurable decrease of mass for teeth placed in orange juice, cola and coffee, but no change of mass for teeth in water. In the experimental groups,  $\text{NaHCO}_3$  has a significant effect on the mass loss caused by orange juice and cola, but not coffee, while  $\text{HPO}_4^{2-}$  is not effective as hypothesized. The mass change of the teeth in the  $\text{HPO}_4^{2-}$  group is uncertain. Some teeth have gained weight over the course of the experiment, and others have dropped significantly.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ME BI CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LST

Project Number

3510

Title: Biorock: Calcium Carbonate Deposition and Oyster Growth in the Fishers Island Sound

Student Name(s): C. Snyder, T. Allen

## Abstract:

The Biorock system is essentially an electrolytic cell. Electricity running through the steel dome causes ionized  $\text{CaCO}_3$  to deposit onto it. The system is often used in tropical waters for coral reef restoration. We sought to test Biorock in cold waters, which decrease efficiency, as well as the effect of the electricity on oyster growth in length, width, and mass. We used solar panels to ideally electrify two domes with 12 volts and 10 amps, leaving a third disconnected as the control. We then suspended bags of 40 oysters inside, 5 feet, 10 feet, and 15 feet away from one of the electrified domes. The bag furthest away was the control, as the electricity dissipates within 10 feet. The oysters 5 feet from the dome grew 7.7 cm lengthwise, 1.9 cm in width, and 1.09 g in mass, as compared to 3.63 cm, .95 cm, and 0.7 g respectively in the control. This shows that the electricity of the dome is beneficial to the growth of the oysters. No significant deposition took place during our study, but the system operated for 2 months before our project was approved. To begin with, there was an average difference of 1.32 cm between the bar diameters of the control dome and electrified domes, meaning that significant  $\text{CaCO}_3$  deposition occurred before our study was approved. We conclude that Biorock can and will be effectively implemented in Northern waters to “grow” wave breaks and habitat in the form of  $\text{CaCO}_3$  structures and oyster reefs.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BI CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

242

Fair Category

LST

Project Number

3511

Title: The Effect of Enzyme Treatment on Soil Bacterial Growth

Student Name(s): S. Grott, H. Bill, E. Haller

## Abstract:

Antibiotic resistance is a growing concern in the medical field. This occurs when bacteria changes in a way that prevents drugs from curing the infections they are intended to fix. In response to this issue, a program called the Small World Initiative has recruited students to perform self-lead research in hopes of discovering new techniques to increase the supply of effective antibiotics. Our experiment will help accomplish this goal by determining if enzyme activity has an effect on antibiotic producing activity.

The enzymes we chose to use are cellulase, pectinase, and amylase. Along with examining the effect of enzyme activity on soil microbe growth, we also chose to look at the effect of different temperature environments and organic versus non-organic soil samples. In our observations, we saw that pectinase and amylase have shown to have an effect on microbes that produce something, as these are the only plates that had haloing in the overlay assay. The results also showed that the producing microbes preferred the colder climate rather than the warm and there was only a small difference in the amount of microbes produced by non-organic soil samples and organic samples. A future direction for this research would be to only examine one variable at a time. By examining one variable we would be able to determine if, in fact, the enzymes had a major effect on the microbes without the help of temperature or organic vs. non-organic.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MI ME BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

LST

Project  
Number

3513

**Title:** Analysis of Environmental Stress: The effect of temperature and pH on the Restriction Enzyme Analysis of Spirulina

**Student Name(s):** C. Burdick, M. Restieri, G. Wolfram

## Abstract:

The purpose of this project was to examine the effect of environmental changes, temperature increase and lowering of pH, on the restriction enzyme digest of Spirulina, a common marine cyanobacteria. It was hypothesized that increased temperature and decreased pH would increase mutations in Spirulina's code resulting in varying fragment lengths after restriction enzyme digestion and analysis. Five flasks, each containing a 10 ml sample of Spirulina combined with 300 ml of saltwater growth medium were set up as follows: Flask 1 served as the control. Flasks 2 and 3 were subjected to reduced pH. Flasks 4 and 5 were subjected to increased temperatures. After two weeks, 2ml samples from each flask were collected and the DNA extracted. After isolation, a restriction enzyme digest was completed using a combination of the restriction enzymes HindIII, EcoRI, and PstI. Samples were stained and run through agarose gels at 100V for 30 minutes alongside a DNA standard. Gels were analyzed for differences in fragment length and compared to the control. Initial results indicate that the restriction digest of the Spirulina was not influenced by reduced pH or increased temperature as the small changes could have been produced by human error. Future studies should include increased culture times, a larger sample, or a sequencing comparison of the DNA from each flask. Regardless, continued research on potential mutations due to climate change is critical.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB EV BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

207

Fair Category

LST

Project  
Number

3514

Title: The Effect of livestock Supplements on Soil Microbes

Student Name(s): A. Czech, G. Martin

## Abstract:

Our experiment is part of the Small World Initiative. Many doctors have been over prescribing antibiotics, leading to an antibiotic resistance. Antibiotic resistance is when a bacteria has mutated and is now resistant to the prescribed antibiotics. Antibiotics are important because they are needed to treat bacterial infections. It is very difficult to isolate a new antibiotic that is produced from soil microbes because it is so time consuming and not cost effective. The Small World Initiative's goal is to use students to discover and identify new antibiotics that are produced from soil microbes, that can lend a hand to the antibiotic resistant crisis.

The purpose of our experiment is to find a new antibiotic that has not been discovered by scientists yet. We choose to use soil from a horse farm that had horses treated with antibiotics, because we wanted to see if already existing antibiotics would work with soil microbes to produce a new unknown antibiotic. Our control is the soil from the nature preserve because this soil theoretically is in its virgin form. A future direction for this research would be to conduct more trials and to closely monitor the horse farm soil samples to see if there is any effect on the soil microbes.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MI ME BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

242

Fair Category

LST

Project  
Number

3515

Title: Environmental Stresses on the Rate of Evolution of Escherichia coli

Student Name(s): P. Gupta, Z. Hao, A. Boyko

## Abstract:

Within the lifetime of a human, a single bacterial lineage can generate an array of new species. In this microbial evolution environment, Escherichia coli is prepared as to allow evolution by artificial selection through a selection pressure: antibiotics. This selection pressure stimulates evolution by promoting the survival of resistant, mutant strains of E. coli. In addition to ampicillin antibiotics, each bacterial culture also hosts a unique stress factor of the following: pH, nutritional, osmotic, and alcoholic. Each of these factors induces the general mutagenesis response in E. coli, a response which increases the frequency of random mutations in DNA replication and thus expands the genetic variation and adaptive ability of offspring. In other words, bacteria under these stresses can evolve faster due to more accumulated mutations. The question examined is how effective each stress factor is in speeding up this process of evolution; this study terms this as evolutionary effectiveness. Effectiveness is measured by the rate at which a mutant strain that can thrive in deadly ampicillin levels emerges from the culture. Evolutionary effectiveness also illustrates how effective a stress factor induces the mutagenesis response and creates a more diverse set of offspring genotypes. The study seeks to find differences in the evolutionary effectiveness of different stresses, hinting that each stress activates the mutagenesis response to a different degree. If such a pattern exists, a correlation between these environmental stresses and the rate of E. coli evolution towards antibiotics can be found.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CB MI BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

174

Fair Category

LST

Project Number

3516

Title: The Effects of Salinity on Spartina Alternaflora

Student Name(s): E. Santiago III, A. Riddick

## Abstract:

Abstract:

Recent literature has focused on the decline in marsh grass and the connections to human activity. Spartina alternaflora is a common marsh grass that is the target for restoration efforts, and complications of culturing these seedlings in the lab has usually centered on salinity. Salinity reduces substrate water potential, thereby restricting water and nutrient uptake by plants; salinity may also cause ionic imbalance and toxicity. Replicated trials of Spartina sp. seeds grown in a salinity gradient (5 ppt – 30 ppt) with germination times and growth rates tracked. Data showed that the lowest salinities (5 ppt) produced significantly higher growth in comparison to other treatments ( $p < 0.05$ ). The implication for this are in the fact that culturing techniques for this species need to be far more intensive than originally thought due to the fact that it is a marine species as an adult. Further studies should confirm the rate at which this increase in salinity should happen to achieve maximum yield in adult plants for ecorestoration efforts of cultivation programs, especially those in schools.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BI EM PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LST

Project  
Number

3517

**Title:** Testing *Drosophila melanogaster* Flies as a Model to Study Alcohol Addiction

**Student Name(s):** K. Stackpole, T. Nordgren

## Abstract:

The purpose of this experiment is to use *Drosophila melanogaster* to study underlying alcohol addictions. Since animals can be good models to find underlying causes of human diseases, we can use the results we get to study human addiction more in depth. In this project we fed flies acamprosate, which is a medication used to reduce the desire to drink alcohol. We are testing if the flies that have been fed ethanol will prefer alcohol less after being dosed with acamprosate. The hypothesis of this experiment is that if the flies are fed acamprosate, they will not prefer alcohol as much as the control. Assays performed are the olfactory trap assay, the capillary food assay, and dosing the flies with ethanol. Flies will have been raised on food with or without 100  $\mu$ M acamprosate. The capillary food assay involves liquid food solution in one tube and another with added ethanol. This will tell us which food the flies consume more of. With the olfactory trap test there will be flies put into a choice chamber where they are given the choice of alcohol or water. Since acamprosate is used to decrease the craving of alcohol, doing this can tell us how our fly model reacts. Lastly, dosing the flies with ethanol consists of putting different amounts of ethanol into each vial of fly food. The 4 treatment groups are acamprosate, acamprosate with ethanol, ethanol and a control group. The flies will be tested over 24 hours and in two trials.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ME AS AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LST

Project Number

3518

**Title:** A Statistical Analysis of the Inflation of Atmospheric CO<sub>2</sub> Levels and the Correlation Between Sea Ice Thickness (SIT) and Aptenodytes Forsteri Breeding Patterns

**Student Name(s):** E. Gaspar, T. Macchia

**Abstract:**

A Statistical Analysis of the Inflation of Atmospheric CO<sub>2</sub> Levels and the Correlation Between Sea Ice Thickness (SIT) and Aptenodytes Forsteri Breeding Patterns. The thinning of Antarctic sea ice in the last 25 years as a result of increasing temperatures due to CO<sub>2</sub> depleting the ozone layer were examined variables that affected the number of breeding pairs of Emperor penguins. Aptenodytes Forsteri breed on sea ice, and if it is not equivalent or greater than the average thickness of approximately 1 meter (Serreze, 2010), then they are unable to successfully breed. The data utilized included the concentration of the atmospheric CO<sub>2</sub>, measured in ppm (parts per million) according to its partial pressure and sea ice thickness, measured with a satellite to look at the relative heat of each area (Kurtz, 2012). Through a linear regression statistical test, a negative correlation between CO<sub>2</sub> and both other variables was observed. As for breeding pairs and sea ice thickness, there was a positive linear correlation found. Our results suggest that as atmospheric CO<sub>2</sub> increases, sea ice thins, resulting in a decrease in the number of breeding pairs due to the ice cracking. With damage done to this ecosystem, the food chain will suffer, causing a humongous conflict, all due to the CO<sub>2</sub> concentration increasing and the sea ice thinning, causing a decrease in the number of breeding pairs. To save these penguins from facing extinction, transporting them to the Arctic could be investigated, as the sea ice is gradually thickening in that environment.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AS EV MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

146

Fair Category

LST

Project Number

3519

Title: Effects of Salt Water Concentrations in Brine Shrimp

Student Name(s): S. Abouneameh, G. Ali

## Abstract:

We undertook the present study to examine the effects of varying concentrations of salt in water on the growth rate and lifespan of brine shrimp. This experiment is in response to a recent trend of rising salt water concentrations in the Great Salt Lakes, a primary habitat for brine shrimp. We created three salt concentrations based on the trends in the great lakes; a 10% “optimal” solution, a 20% “high” concentration solution, and a 5% “low” concentration solution. We hatched the brine shrimp eggs in the “optimal” 10% solution, then suspended them in the test solutions [with results currently pending]. Brine shrimp play an integral part in the ecosystem of the Great Salt Lakes, filter feeding on invasive types of algae, such as *Dunaliella*. Increased salt concentrations in the Great Salt Lakes after the construction of the Railroad Causeway may prove fatal to this important species.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV AS

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

LST

Project Number

3520

Title: Nannochloropsis Algae Biofuel Process without the need for electricity

Student Name(s): J. Werenski, Y. Mehta, T. Evans

## Abstract:

We started our project by building a set up to allow the sun as well as a light bulb (to emphasize the idea of solar power) on a timer to provide light energy for the algae to grow off of. Using simple yeast bought from a supermarket we prepared a mixture of yeast, warm water, and sugar in a two-liter bottle, allowing the yeast to settle in. We then used plastic tubing to connect the yeast to a bubble counter which was then connected to the algae. We allowed the yeast to grow for two months. The algae grew immensely over the time period and after those two months, we removed the algae from the bottle, placing it into a smaller container. With the smaller container, we used a bicycle wheel as a makeshift centrifuge to separate the algae from the water. Doing this multiple times, we separated the water from the algae to the best of our ability so that we could apply a heated pressed to remove the crude oil from the algae. Using a pressure cooker, we converted the algae into a basic crude oil. The hopes of this is that we can create algae biofuel using cheap products that don't require constant attention. Though we do not have the necessary technology to convert crude oil into usable gasoline or diesel, these are the first steps to creating a quick and powerless technique to creating biofuel.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MI ET PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

217

Fair Category

LST

Project  
Number

3521

Title: The Effects of Fertilizers on Soil Bacteria

Student Name(s): A. Toof, J. Coleman

## Abstract:

Each year over two million people become infected with bacteria that are resistant to antibiotics and around twenty-three thousand of these people die as a result of not having working antibiotics. That is why it's important to discover new antibiotics to continue treating bacterial infections even as they develop resistance to some medications. The Small World Initiative aims to solve this issue by getting more people involved in searching for antibiotics. We are contributing to this nationwide effort by creating our own experiment to help find antibiotics in the soil.

In our experiment, we tested two different soils from different locations. One sample was treated with fertilizers, the other was not. The unfertilized sample was from Voluntown, CT and the fertilized sample was from Norwich, CT. We took the two samples and performed a series of assays to determine if any of the microbes that we isolated from our soil samples were producing something. After performing the Antibiotic Overlay Assay we observed a halo from a microbe isolated from the soil sample that was treated with fertilizer. Further tests will be performed to further identify the unknown microbe.

A future direction that can be performed based off of this research is to examine the effects of different types of fertilizer on the growth of soil microbes.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PS EA BI

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

LST

Project Number

3522

Title: The Effect of Climate Change Variables on Inheritance Patterns of Butterfly Wings

Student Name(s): A. Smith, S. Nair

## Abstract:

This project focuses on how different environmental variables affect the wing pattern inheritance of a Painted Lady Butterfly. In today's society, the climate is constantly changing. Due to the rapid change in weather, there is less pollen available. Pollen contains protein, which is essential in the diet of a Painted Lady. Protein will be tested by decreasing the amount of protein given to the butterflies in comparison to the control group. Both groups will start off with 12 grams of protein powder mixed with 60 grams of banana mush per week. After one week, the control group will continue to receive the same amounts while the other group will receive 8 grams per 60 grams of banana mush. In week three, the supply will decrease by another 4 grams. This is due to the fact that protein levels in pollen have decreases by 1/3 per 20 years. Another important environmental concern is acid rain. Pollution has changed the pH of the rainwater. This has affected many organisms negatively. We will supply them with 50 ml of nitric acid with water per day. This will be compared to the control group of butterflies receiving 50 ml of purified water per day. The pH of the solution will be four because this average pH of acid rain that butterflies are native to. Since the butterflies need a warm environment to live in, they will kept in an environmental chamber. Our data will be presented in the form of qualitative observations.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CB EV AS

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

209

Fair Category

LST

Project  
Number

3523

**Title:** The Effect of Different Solid Medias on the Amount of Antibiotic-Producing Bacteria Isolated From Soil Samples

**Student Name(s):** N. Padgett, E. Russell

**Abstract:**

Microbes are becoming resistant to antibiotics used to treat infection faster than new antibiotics are being discovered. Yale University formulated the Small World Initiative in 2012, a cooperation between more than 180 schools to discover new antibiotics to expand the pool of effective antibiotics. To contribute to this mission, we are trying to find the most effective solid media for cultivating promising microbes from the soil as well as trying to discover a new antibiotic. We collected three soil samples from diverse environments; one from the woods, one from under the roots of a tree in a field, and one from a duck pond. Each of our samples yielded one antibiotic -producing bacteria, giving us a wide variety of microbes to test. Our solid medias, Soil Extract agar, LB, 30% TSA, and Nutrient Rich agar, were tested with the microbes gathered to determine which was the best for growing antibiotic-producing bacteria. Out of the four, this was proven to be 30% TSA. This research could be used in any future experiments to better find which solid media to use if we are trying to find antibiotic-producing bacteria. Another future direction could be to use different types of media to stress the microbes into producing a new antibiotic.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

MI ME BI

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

Fair Category

LST

Project  
Number

3524

**Title:** The Effect of Predation and Availability of Resources on the Habitat Selection of *Oniscus asellus*

**Student Name(s):** J. Benedetti, A. Gilbride

## Abstract:

The motivation for this experiment came from our mentor's previous experiment, analyzing the physiological aspect of the isopod behavior, when there is a predator present. When it was concluded that the predator did not affect the isopods on a biological level, it was decided that the isopods could be researched from a behavioral aspect, to determine if the isopod changes behavior, even when no physiological change is given off.

First, white plaster must be placed in a container. The divider must be placed halfway between the container. Ten isopods should then be placed in the container. The spider should be placed in the mesocosm by the mentor, and let roam free on one side. The spider is then removed shortly after running around. The predator cued side has a plenty of food, and the nonpredator side has between 0-100% total food

The projected results of the experiment are expected to be that the Isopods will favor a habitat without a predator is when the habitat has 60% of the amount of food. This is due to the giving up density graph which represents the starving saturation points. The giving up density graph is a logistical curve which has two primary intervals.

There are implications of determining where to find Isopods in the environment, based off number of predators and amount of food in the ecosystem.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AS BE EV

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

245

Fair Category

LST

Project  
Number

3525

**Title:** Methylmercury concentrations in Fish Tissue: A comparative analysis of Long Island Sound v. the Atlantic Ocean

**Student Name(s):** A. Delgado, R. Mulshine

**Abstract:**

The purpose of this experiment was to measure mercury concentrations in fish caught in the Long Island Sound and compare them to mercury averages for the same species of fish caught in the Atlantic Ocean. It was hypothesized that mercury concentrations of fish in the Long Island Sound would be higher than the baseline mercury-level averages of fish in the Atlantic Ocean, east of Long Island. Ten grams of striped bass and blackfish (tautog) were tested. Experimentation started in a 125 mL boiling flask attached to a standard condenser. The fish sample was digested in a potassium permanganate solution. The digest was then filtered out into another flask and was neutralized with dilute ammonia in the presence of a .01% EDTA solution. This solution was then transferred to a 25 mL calibrated flask and filled to the mark with deionized water. 1-2 mL of the solution was then pipetted into a 10 mL calibrated flask. The solution in that flask was then mixed with 5 mL of Sodium Dodecyl Sulfate and 1 mL of hydrogen sulfate. Finally, a dithizone solution was added, and the final mixture was filled to the mark with deionized water in a cuvette and measured at 490 nm in a spectrophotometer and compared to a standard mercury calibration graph. Initial results supported the hypothesis in that the mercury concentrations were higher, however, the results were not statistically significant. Future research may include sampling more species or other bodies of water.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BI EV EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

LST

Project  
Number

3526

Title: Changing Attitudes Toward Panic Disorder

Student Name(s): A. Roch, Q. Mendez-Neff

## Abstract:

**Introduction:** Panic disorder is a disabling condition that affects 3 to 6 million people in the United States at any given time.

**Problem:** If people were knowledgeable about panic disorders, would they be less stigmatic?

**Hypothesis:** If people understood the signs and symptoms of panic disorder, then there would be less negativity towards people affected by this disorder.

**Independent Variable:** Understanding/Education

**Dependent Variable:** Attitudes surrounding panic disorder

**Method:** A quantitative experimental research study conducted in a small suburban New England community at a technical high school. This study tested the relationship between the education of panic disorder and the attitudes towards this mental illness. The control group received only a pre-survey, while the intervention group received a pre-survey, education component and post-survey. These surveys were made up of ten questions consisting of multiple choice, open-ended, and Likert scale.

**Outcome:** Many of the high school students lacked knowledge and understanding of the mental illness and stigmas surrounding it. However, after the educational component in the intervention group, their knowledge and attitude toward this mental illness increased dramatically.

**Limitations:** The main limitations to the experiment is that it was a small study size due to students failing to return signed consent forms on time, students being absent on day of presentation, and different cycles for each grade level.

**Conclusion:** Include education on mental illness into the health curriculum. Have mental illness awareness week within high schools.

**Keywords:** Panic disorder, stigmas, behaviors of panic disorder, sign and symptoms

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

254

Fair Category

LST

Project Number

3527

Title: The Effect of Foot Arch Height on Foot Strike Type While Running

Student Name(s): J. Sugarmann, S. Mahler

## Abstract:

Most runners run with a rear-foot strike. In this study, we looked for a correlation between foot arch height and foot strike while running both at a slower and increased pace. The independent variable was the height of one's foot arch, and the dependent variable was the distance from the heel of the foot to the average area of maximum force the foot exerts while running divided by the entire length of the foot. This percent quantifies foot-strike and can be compared with any size foot. Male distance runners participated from a local High School Cross Country team. There was no control group. Each participant's foot arches were measured using the Arch Height Index Measurement System. Dominant foot and shoe type were also recorded. Participants ran at a predetermined slower pace for 5 minutes, 10:00 per mile. After a 90-second break, they ran at an increased pace for 3 minutes, based off their fastest 5km run this past Cross Country season. During the final minute of each run, the treadmill recorded the force each foot exerted as it landed. Data thus far shows that foot arch height does not have an effect on the average location of maximum force exerted by the foot. This goes against our hypothesis. However, there is a statistically significant trend to exert more force at a higher vertical location on the foot as speed increases. Results could help prevent running-related injuries and help athletes learn their ideal foot-strike, as foot strike can be forced.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

212

Fair Category

LST

Project Number

3529

Title: The Effect of Soil Moisture Content on the Isolation of Motile Bacteria

Student Name(s): K. Williams, J. McConnell, D. Rediger

## Abstract:

Antibiotic resistance is a very serious problem that is affecting the possible treatments used against bacterial infections. The reason is because bacteria are constantly changing and reproducing, which essentially makes the antibiotics used against them useless. The Small World Initiative's mission is to use students to lead the research in isolating microbes from the soil that produce antibiotics, with the hope that new antibiotics will be discovered. Our contribution to the SWI's mission is to study the effect of moisture content in soil on microbial motility. We hypothesize that soil with a higher moisture content will contain more motile bacteria. To evaluate our hypothesis, we collected soil samples from an environment that was dry and a sample from a place that is consistently wet. Techniques that we performed during our research to answer our hypothesis are; patch plating, antibiotic overlay assays and Gram staining. Our research to date has shown that the soil sample that contains more moisture is the sample that has produced more antibiotic-producing microbes. A future direction for this research would be to collect more soil samples from each environment to be tested. Another aspect that can be researched would be to see how insects living in soil affect the growth of soil microbes instead of the moisture.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MI ME BI

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

144

Fair Category

LST

Project  
Number

3530

**Title:** Analysis of the Effects of Selenastrum capricornutum on the pH of Freshwater Marine Environments

**Student Name(s):** A. Palvinski, M. Klein Wassink

**Abstract:**

The goal of this experiment was to test the benefits of introducing Selenastrum c. algae into a mock freshwater marine environment that has been affected by acidification and CO<sub>2</sub> dissolution. Specifically, Selenastrum c. raised the pH of its environment through bioremediation, the removal of unwanted waste from water (in this case dissolved CO<sub>2</sub>), and grew and prospered in a low pH environment at the same time. In addition, information was gathered on how varying levels of acidity effect Selenastrum c. and its ability to perform bioremediation through photosynthesis. While there is a wealth of research around how algae can perform bioremediation, this is very much concentrated on salt water algae. While the oceans are much larger, freshwater lakes and rivers provide humans with drinking water. Therefore it is important to consider freshwater bioremediation, so drinking water can be protected from acidification and CO<sub>2</sub> dissolution.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS MI CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

LST

Project Number

3531

**Title:** The Effect of the Consumption of Organic vs. Non-Organic Lactuca Sativa on the Growth and Health of Cynthia Caterpillars

**Student Name(s):** R. Paine, S. Awan

**Abstract:**

This project is a study of how painted lady caterpillars are affected when fed organic versus non organic romaine lettuce.

To ensure that the results acquired from caterpillars tested are accurate, second generation caterpillars are used. This is to make absolutely certain that everything the caterpillars have eaten are from the food group being tested (organic or inorganic). The first caterpillars that were bought went through their life cycle untested. The eggs that were produced were separated into many containers and fed the appropriate food. Each group had five caterpillars and they were all separate so they wouldn't get mixed up and make the results unreliable. The length, color, energy, amount of food eaten, and amount pooped were then recorded for the next two weeks.

The results are expected to show that the caterpillars fed organic food may not be the biggest, but they will be overall healthier. For example, they will have more energy and have better color. If the caterpillars are fed non-organic foods, they will be bigger, but not as healthy. Non organic food can be incredibly harmful to most organisms including painted lady caterpillars. The pesticides and herbicides used to encourage growth in everyday food can often cause long term health problems such as infertility, birth defects, and cancer. "Pesticide Residues from Non-Organic Foods Building Up in Our Bodies." Pesticide Residues from Non-Organic Foods Building Up in Our Bodies. N.p., May 2004. Web. 01 Mar. 2017.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PS AS EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

232

Fair Category

LST

Project  
Number

3532

**Title:** The Construction and Tagging of a LCHAD Deficiency Model System using *C. elegans*

**Student Name(s):** C. Michaud, K. Tempesta

**Abstract:**

Long-chain 3-hydroxyacyl-coA dehydrogenase (LCHAD) deficiency is a rare condition that prevents the body from converting certain fats to energy, particularly during periods without food (fasting). In patients with LCHAD, long chain fats can not be converted to medium chain fats, which then cannot be converted to the short chain fats that make energy for the cell. This means that LCHAD effects the energy in a person's body.

The purpose of our research is to create a *C. elegans* model for LCHAD. We chose this project because LCHAD is a rare disease that is chronic and degenerative. Since it is rare, not many people are doing research on it. Someone in our class has this disease and brought it to our attention. It would be practical to have another model for LCHAD deficiency to test any developing treatments and further study the effects of LCHAD. *C. elegans* can be grown more quickly than other LCHAD model organisms and its fat metabolism system is very similar to humans. The goal of this project is to successfully recreate the LCHAD-causing mutation in *C. elegans* using CRISPR/Cas9 as a gene editing tool. We are also tagging the gene with a fluorescent protein to monitor its expression level and location in response to different treatments. We followed published procedures on the use of CRISPR/Cas9 in *C. elegans*, which is still underway.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CB MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

134

Fair Category

LST

Project  
Number

3534

Title: Does Bacteria Grow on Makeup?

Student Name(s): K. Corporan, S. Ulloa

## Abstract:

The purpose of this project is to test and see if liquid foundation grows bacteria. It was determined that if the longest used foundation has had more opportunity to be exposed to the air then it will have the most growth on the petri dishes. It was apparent over the course of 5 days of observation that all of the liquid foundations grew bacteria on them. The used foundations grew more colonies that were larger and more gross. The 3 year dishes had the biggest and most gross colony growth on them. Our hypothesis was supported because, the used foundation that was 3 years old grew the biggest colonies. Next time we should get the same brand of foundation at different years just incase one brand causes more bacteria to grow than another brand.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

210

Fair Category

LST

Project  
Number

3535

Title: Stomping the Stigma of Schizophrenia

Student Name(s): K. Estelan, A. Kamuda

## Abstract:

This psychological study was performed in order to examine the question “ If someone understood schizophrenia, would they feel more or less comfortable around people with this condition?” The researchers conducted thi study in a high school setting where the participants were juniors and seniors. The participants were given a consent form which informed their parent/guardian that they were selected to take part in a research study, that they must have signed in order for the selected participants to participate. The students who managed to get the forms signed and handed in, took a pre-survey to assess their base knowledge of schizophrenia and the stigmas associated with this mental illness. Some of the participants from both eleventh and twelfth grade were randomly chosen to take a post-survey after seeing an education powerpoint presented by the researchers. The study did have a few limitations however, such as participants not handing in the consent forms, not taking the surveys seriously, and the seniors’ responses could have been skewed due to the fact that they may take the psychology course offered at this technical high school. Regardless of these setbacks, the study showed an increase in understanding and knowledge of schizophrenia as well as awareness and compassion for this mental illness.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

227

Fair Category

LST

Project Number

3536

Title: How much do we need to dilute the solution for it to still perm eyelashes?

Student Name(s): K. Ludovicy, C. Telesco

## Abstract:

People are going blind because of the strong chemicals that are involved in permanently curling eyelashes. Eyelash perming is a new trend that's catching on across the country. For only a couple of hundred dollars and less than an hour, you can have the most desired eyelashes in the beauty industry. We tested the optimal way to perform an eyelash perm that would reduce the risk of blindness to the client. We predicted that by diluting the chemicals and also increasing the processing time on the eyelash, we could still provide a great amount of curl but while reducing the risk of blindness. To avoid harming any people during the trials, we used fallen eyelashes from one person. Rather than using a row of lashes, we used a single eyelash for each perming rod. Our experiment showed that when we diluted the solutions they all looked like they got the same amount of curl as the 100% solution. The interesting thing was that the curl was actually less as the time increased. We believe that the reduced curl was because the lashes were damaged by the chemicals sitting on it for a long period of time. We are hopeful that we can save many people from going blind or getting terribly irritated eyes due to the chemicals used in these commercially available products currently used in eyelash perming.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH EV ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

211

Fair Category

LST

Project Number

3538

Title: Post Traumatic Stress Disorder of Veterans and the Associated Stigmas

Student Name(s): Z. Meuse, O. Reynolds

## Abstract:

Abstract

**Introduction** Few people have an accurate working knowledge of Post-Traumatic Stress Disorder (PTSD) and the stigmas associated with it. PTSD is a psychiatric disorder that can occur following the experience or witnessing of a life-threatening event.

**Problem** This research study was done in order to examine the question, will people with a good understanding of PTSD act more empathetic toward survivors?

**Hypothesis** If students had a better understanding of PTSD, then they will be more empathetic towards survivors.

**Method** A quantitative experimental research study conducted at a technical high school that serves 33 sending towns. A letter was distributed to the randomly selected grade levels to inform them of the study and requiring parental/guardianship permission to participate in study. Survey questions were yes/no, and multiple choice.

**Outcome** PTSD has a direct impact on empathy toward survivors of the disorder. Stigmas surrounding PTSD are numerous and common. More must be done to help stop the stigmas associated with PTSD in combat veterans. To increase validity the study needs to be replicated on a larger scale and at different schools.

**Limitations** The main limitation to the study is that parental consent was required for students to participate. Out of the eighty permission slips distributed only sixteen returned them.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

152

Fair Category

LST

Project Number

3539

Title: Passive Solar Heating

Student Name(s): Z. Burke, F. Hernandez

## Abstract:

Our project is similar to what they call a solar heater. We wanted an inexpensive way to heat a room in your home.

We had a 42 1/2" by 32 1/2" wood frame made for the glass block window and a 42" by 21" frame made for the regular glass window. After installing the windows in, we added thin brick onto the frames and tested the windows with one heating lamp each, followed by a thermometer behind each frame. We collected the data by writing down the start temperature and then leaving the lamps on for exactly one hour. We took three trials, the heat lamp representing the summer and winter sun.

The glass block window would go up 2-7 degrees from its start temperature while the regular window would only go up 1-3 degrees. In conclusion, as we predicted it would, the glass block window stored more heat than the regular window.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

LST

Project  
Number

3540

Title: Impact of color of light on the growth rate of *Gracilaria tikvahiae*

Student Name(s): D. Sherwood, J. Alvarez

## Abstract:

An experiment was conducted to determine which wavelength of light would increase the growth rate of a stock culture of *Gracilaria tikvahiae*. Samples of the red algae, *Gracilaria tikvahiae* were obtained from the hatchery at the Bridgeport Regional Aquaculture School. The wavelengths that were tested were; Red, Blue, White. Based on prior research it was predicted that the red wavelength of light would increase the growth rate of the algae more than red and blue wavelengths. Three, five gram samples of stock *Gracilaria tikvahiae* was placed in a separate one liter beaker in 800 mL of nutrient solution. Each beaker was placed into an LED test chamber with a different wavelength of light (white-60  $\mu\text{mol}/\text{meter}^2/\text{sec}$ , red-30  $\mu\text{mol}/\text{meter}^2/\text{sec}$  and blue- 60  $\mu\text{mol}/\text{meter}^2/\text{sec}$ ) as determined by an Apogee light meter. Every seven days, for six weeks, the mass of the algae from each beaker was found and recorded and the algae was returned to a clean beaker with a new nutrient solution. After six weeks, the data supported the prediction. *Gracilaria tikvahiae* exposed to the red wavelength of light increased by 2.4 grams while the algae in the white LED test chamber increased by 2.1 grams and the blue by only .9 grams. In order to improve confidence in the data additional trials should be conducted over a longer period of time. In addition, other wavelengths of light should be tested to determine their effectiveness at increasing the growth rate of *Gracilaria tikvahiae*.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PS EM AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

232

Fair Category

LST

Project  
Number

3541

**Title:** The Effect 12-12 Light/Dark and 24 Light Cycles Have on the Growth of Ocimum basilicum using Different Systems

**Student Name(s):** X. Melendez, B. Fielding

**Abstract:**

Ocimum basilicum (sweet basil) being the number one used and consumed spice in the world needs to be produced at high rates and healthy conditions due to its use. Recent studies have shown that this fast growth rate or increase growth rate needs to be done under 24 hours of light for optimal growth and health of the plant (Skrubis, B). This study was done to evaluate whether 12-12 cycles could contain similarly optimal growth when used in a hydroponic system versus a conventional growing the Ocimum basilicum. This study was done with replicated trials in both conventional growing as well as hydroponic systems using 12-12 light/dark cycles and 24 light cycles. Data from the study suggests that was achieved at 12-12 light/dark cycles using conventional systems ( $p > 0.05$ ). Further studies will be needed to confirm that optimal growth was occurring at this setting because conventional and hydroponic growth showed very similar trends. Further studies are needed to confirm these trends due to the fact that 24 hour hydroponic producing the least growth also visually grew the fastest so the temporal component needs to be evaluated. The implications for this are the fact that faster growth and healthier growth could be achieved hydroponically as the data suggests, than it may be more cost effective for a restaurant or a home grower to get faster growth rates out of the basil.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

234

Fair Category

LST

Project  
Number

3542

**Title:** Human fingerprints and Gecko Setae: A fusion of configurations to create a super-grip, non-slip surface

**Student Name(s):** T. Scannell, A. Mukherjee

## Abstract:

The objective of this project was to design and create a super-grip, non-slip surface by combining the patterns associated with different types of human fingerprints and the anatomical adaptations found on gecko feet. It was hypothesized that patterning and combining gecko setae with human fingerprints would produce a pattern, when etched into a silicone polymer, that would enhance both traction and adhesion in the material and increase the coefficient of friction. Corel Draw was used to create patterns that were later etched into the silicone polymer with an Epilog Laser Cutter. Control patterns were created using a montage of dots, dashes, and lines. Next, human fingerprints representing multiple patterns were etched into silicon as well as scanning-electron micrographs of gecko feet. Each pattern was etched in isolation and then in various combinations in an effort to create the perfect hybrid. Created patterns were tested by dragging the prints across a given surface with a pulley and weight system and using  $F = \mu F_{\text{Normal}}$  to identify the pattern with the highest coefficient of friction. Initial data collected indicated that the combination of human fingerprints with gecko setae did not significantly increase the Van Der Waal forces associated with gecko adaptations and did not produce a high coefficient of friction. Future studies may include the addition of synthetic setae hairs to the fingerprint/ gecko material to create more friction and a more adhesive medium.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

PT

Project Number

4001

Title: Using Flocculation to Extract Chromium VI From Water

Student Name(s): W. Zhang, C. Yuan

## Abstract:

Chromium VI, a carcinogenic chemical, is found in 90% of water samples across the United States and is present in over 218 million Americans' tap water. This research project's aim was to determine if the flocculation process could successfully extract chromium VI from tap water while keeping the water consumable, and if so, which flocculant (aluminum sulfate or ferric chloride) would be the most effective. It was hypothesized that if ferric chloride or aluminum sulfate were used to treat tap water containing chromium VI, then the chromium VI level would decrease. To test this hypothesis, two beakers were treated with two grams of ferric chloride, two with aluminum sulfate, and two with no flocculants. After 30 minutes, the chromium VI level and potability were examined. The water treated with two grams of aluminum sulfate reduced the level of chromium VI, however, ferric chloride had the reverse intended effect, significantly increasing the level of chromium VI. Next, the tap water was treated with one gram, two grams, and three grams of aluminum sulfate to further test the effectiveness of aluminum sulfate. All beakers of aluminum sulfate decreased the level of chromium VI, and the beaker with two grams was most effective. Thus, the hypothesis was supported when aluminum sulfate was used, but unsupported when ferric chloride was introduced. The data indicates that the flocculation process can be successfully used to extract chromium VI from water. In the future, this experiment can aid the process of purifying water.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CH EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

201

Fair Category

PT

Project  
Number

4002

Title: Future of Filtration

Student Name(s): M. McAndrew, V. Butler, H. Mahoney

## Abstract:

Future of Filtration investigates the potability of rainwater through tests and a homemade filtration device. Our goal was to find an effective, yet efficient, way to filter rainwater for drinking purposes. We collected buckets of rainwater from a patio, roof, and gutter. We concluded that rainwater collected from a gutter has more contaminants than rainwater that has fallen straight from the sky into a container. However, we collected more water from the gutter than from the buckets left in the open. After collecting the water, we used a water-testing kit supplied by Xylem, a water technology company. We tested four factors: turbidity, pH, dissolved oxygen, and temperature. Next, we constructed a filtration device composed of a plastic bottle, gravel, sand, and activated carbon. Once the water was filtered, we tested the same four factors again. To our surprise, the filtered water test results were worse than the unfiltered water. While the filtered rainwater was free of dirt, it had a cloudy appearance. We suspect that when the water came into contact with our filtering device, it may have picked up new contaminants. Although the water was not perfectly clear, the filter did remove the dirt particles from the original rainwater.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE EV EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

121

Fair Category

PT

Project  
Number

4003

Title: Apple Oxidation

Student Name(s): N. Yastremski, A. Giansiracusa

## Abstract:

For this experiment, we decided to test which liquid helps apples turn less brown. We thought that lemon juice would make the apples turn less brown. First, we cut and soaked each apple piece into the appropriate liquid. We then waited for two and a half hours, observing every half hour, to see which liquid worked the best. Our hypothesis was proved correct because we saw that the lemon juice soaked apple was the lightest in color. The vinegar apple was the darkest by the end of the experiment. We figured from the beginning that the vinegar apple would be the darkest because the liquid itself is dark. In conclusion, we enjoyed this experiment and we learned a lot from it.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

PT

Project Number

4004

Title: Water Turbine

Student Name(s): C. Hill, B. Lee

## Abstract:

The objective of this project was to design, create, and test a prototype water turbine with the idea to use the energy produced by currents to generate electricity. A second objective was to test different materials and design configurations that could be used for the turbine propellers to maximize efficiency.

To achieve these objectives, a prototype water turbine was designed and constructed using a small hobby motor and more than 15 types of 3D printed propellers. To test the prototype water turbine and various propeller configurations a tank of water with simulated currents was used. The original design did not produce any voltage as measured by the multi meter. The new design underwent many modifications with the most prominent being that the turbine would no longer be directly connected to the bottom of the tank. Instead, the prototype was changed to attach to a pendulum which allowed the turbine motor to swing, and a new propeller was also designed and used. After the new design was tested it created 0.1 volts. This shows that the design is viable and was indeed successful in proving the concept of creating renewable energy using currents with this newly discovered pendulum-type system. Therefore, the results taken from this experiment reveals that this pendulum-type water turbine system has the potential to provide a way to capture energy in low current environments.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

117

Fair Category

PT

Project Number

4005

Title: Paper Towel Strength

Student Name(s): T. Curtiss, G. Kronenberger

## Abstract:

The purpose of the experiment was to determine which paper towel brand will hold the most mass, thus being the strongest. To verify this, a paper towel holding apparatus was created by using plywood and binder clips so the pieces of paper towel would be suspended in the air and taut. To conduct the experiment, six different brands of paper towels were wetted with 10 ml of water each. Quarters (mass) were added to the paper towels until it ripped. It was determined that Scotts is not very durable by holding an average mass of only 368.55 grams. Bounty outlasted all of the brands by holding a mass of 946.89 grams. This rejected the hypothesis of the experiment.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PT

Project Number

4006

Title: The Battle of the Rockets

Student Name(s): J. Srivastava, M. Persuad, A. Alsi

## Abstract:

Our project is about comparing the different types of rockets. There are 3 main types of rockets: air pressure powered rockets, hydro powered rockets, and of course, solid fuel powered rockets. We are seeing which would do better in many different categories. The five categories are: duration, Ascending speed, max altitude, environmental friendliness, and fuel efficiency. The rocket that does the best in each category gets 3 points. The second best in each category gets 2 points, and the worst of each category gets only one point. The type of rocket with the most points at the end wins. Duration is the time it takes for the rocket to go up and come back down. To measure this, we are going to use a stopwatch. Ascending speed is how fast a rocket launches to go to its maximum altitude. We find that by dividing distance by ascending time. Maximum altitude is the apogee of the rocket's trajectory, of the highest point the rocket goes. We are going to measure this using pictures, and comparing the pictures. Environmental Friendliness is how safe it is to launch the rocket for the environment. We did research to find out that part. Fuel Efficiency is how well it uses its fuel to fly up. That is Distance/Ascending speed. Those are the categories that we are comparing the rockets in. Our experiment involving building and launching rockets, and also doing a ton of research on rockets and how to build them. That is our experiment.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH ET AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PT

Project Number

4007

Title: The Plantaid

Student Name(s): E. Gorelick, P. Savelyev

## Abstract:

According to the Penn State College of Agricultural Sciences, temperature, humidity, soil temperature, and light deficiency or overabundance are some of the leading causes of plant death. Plants need specific factors to grow correctly.

Our objective in this research project was to correctly measure and send the variables of a plant's environment to the user via a computer. Once our sensors record this data, the Arduino sends it to a web server where it can be accessed by the user.

The Plantaid was made using an Arduino MKR1000 (a microprocessor with wifi capability), sensors for identifying the condition of the plant's environment, battery, and case for the system. The sensors consist of a soil moisture sensor, a soil temperature sensor, a light sensor, and an air temperature and humidity sensor. The entire unit resides in the soil beside the plant. The case containing the system was made with a CAD program.

The Plantaid was tested by connecting the Arduino to the sensors and adjusting code to give data inputs as a percent of the maximum possible input value. Initially, this didn't work, but after a few problems were fixed such as incorrect syntax, it worked as intended. Once the data collection was completed, the code for using the Arduino as a client for a wifi web server was written. This code sent the sensor inputs to the web server for the user to see.

In the future, Plantaid can be used to improve planting and gardening for everyone.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT CS EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

PT

Project  
Number

4008

Title: Energizing Electrolytes

Student Name(s): L. Ward, O. Halas

## Abstract:

The purpose of the experiment "Energizing Electrolytes" is very important and can affect anybody's daily life. The purpose of the experiment is simple- to test the electrolytes in orange juice and Gatorade. The more electrolytes in the drink, the more energy the person who drank it has. It affects how the cells in our bodies communicate and it also affects the electrical impulses sent throughout our body. All of these factors play into our final coordination and performance. The question guiding the experiment was "Are there more electrolytes in orange juice or Gatorade?" The hypothesis was that orange juice would have more electrolytes. This would be seen by the conductivity on the multimeter expressed by microamps. For the procedure, a nine volt battery, a multimeter and a plastic tube were connected through wires and alligator clips. This would help the conductivity of the drink travel to and be expressed by the multimeter. The independent variable was the drink being tested, and the dependent variable was the amount of electrolytes. The controls were the same multimeter, same amount of drink, same type of bowl, same amount of time, and same clips, wires and battery. In Trial 1 for orange juice, it was 24.1 microamps, and Trial 2 was 29.4 microamps. Trial 1 for Gatorade was 14.6 microamps, and 14.7 microamps was Trial 2. In conclusion, the hypothesis was proven correct. It showed that the orange juice contains more electrolytes than the Gatorade. The entire objective of the experiment was met.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

219

Fair Category

PT

Project Number

4009

Title: Take Cover

Student Name(s): J. DeSouza, W. Catalani

## Abstract:

Tsunamis and earthquakes are major natural disasters that injure and kill millions every year. This is a problem that our project is attempting to solve. In other words, we are trying to build a structure that is resistant to both tsunamis and earthquakes. There are three tests that we conducted on our model. The first test was putting our model on a table and shaking it both softly and roughly in order to simulate different magnitudes of earthquakes. The second test was slowly placing five textbooks on our model in order to simulate withstandability of force. The third test was placing our model in a bathtub vertically and horizontally and splashing each placement ten times in order to simulate a tsunami. Our model handled all three tests it was put through. The only test that worried us was the force simulation. We were worried that the model would collapse under all of the pressure. Our worries were wrong, however, because the model withstood the forces. Maybe we should have put more trusses inside of the model just to add extra structural support in case we wanted to add even more textbooks. Also, we wish we could have made the earthquake test more challenging. Overall, our model might be an example for an actual house that could possibly save lives.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

239

Fair Category

PT

Project Number

4010

Title: Using Nanotechnology to Clean Oil Spills

Student Name(s): A. Malik, K. Inclima

## Abstract:

Oil spills can be extremely hazardous to animals and people; in fact, the BP oil spill on April 10, 2010 killed countless wildlife and caused massive damage to the environment.

The objective of this research project is to see if nanotechnology can help resolve oil spills before they endanger or kill any humans or animals. To meet this objective, different methods and techniques were explored in an effort to magnetize the oil. Specifically, ferrofluid and a neodymium magnet were used to try to “pick up” the oil by making the oil magnetic and separating it from the non-magnetic water. Equal amounts of mineral oil were placed in three petri dishes. Ferrofluid was then added to two of the dishes, but not in the third dish. A neodymium magnet was enclosed in a plastic bag and run through the oil in each dish in an effort to give the oil a magnetic property. This allowed for the oil to stick to the neodymium magnet. When the magnet was lifted out of the water, there was much less oil remaining in the water.

The results showed that the more ferrofluid placed in the water, the less mineral oil remained in the water. The magnet picked up the oil with the ferrofluid in it due to the new magnetic property of the oil. This experiment proved that nanotechnology can be a powerful method to aid in the cleanup of oil spills.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT EN EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

229

Fair Category

PT

Project Number

4011

Title: To Sensor or Not to Sensor

Student Name(s): M. Ehmka, C. DiChello

## Abstract:

Our experiment tests an ultrasonic sensor versus an ir remote control, to see which controller allows the mBot to successfully complete a maze in the shortest amount of time. By doing this experiment, we want to learn more about what programmers and robotics engineers have to think about when they're building cars, or others objects that include ultrasonic sensors.

In this experiment, we created a maze out of 4mm corrugated plastic. The dimensions and path of the maze can be found in the blueprint below. For our robot, we used the Makeblock mBot Kit. We placed the robot in the maze, and tested the mBot's ultrasonic sensor's capabilities to the handheld ir remote control in completing the maze.

We developed our hypothesis based on research that ultrasonic sensors are used in everyday objects, such as backup cameras in cars and burglar alarms. Our hypothesis is if the speed of a robot is related to the use of an ultrasonic sensor, then a robot using an ultrasonic sensor for obstacle avoidance through a maze will be faster than a robot moved remotely.

After we conducted the experiment, we found that our hypothesis was unsupported by our data. The IR remote controller completed the maze faster, beating the ultrasonic sensor by 65.08 seconds. Based on our data, we have concluded that the IR remote control is faster than the ultrasonic sensor.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

202

Fair Category

PT

Project  
Number

4012

Title: Got Plastic?

Student Name(s): L. Eaccarino, A. Mullins

## Abstract:

Everybody knows that milk has many uses for food purposes. But, did you know that milk is also used to create casein plastic? The purpose of our experiment was to find out what amount of vinegar will cause milk to turn into plastic. We determined that for our hypothesis four tablespoons of vinegar would be the ideal amount of vinegar to make the best casein plastic. During our procedure, we first poured the vinegar into cups, each to its specific number, while we heated up the milk. Once we got it to 123 degrees Fahrenheit, we poured the milk into the vinegar. While #1, #2, and #4 seemed more like plastic, #8 was a liquid mess. #4 turned out more like a clay upon further investigation. In terms of sculpting, #1 was very brittle and hard to work with. #2 was better, and it turned out to be the best plastic, meaning that our hypothesis was incorrect. Also proving it was the best plastic, #2 dried in the right amount of time, which should only take 2 days. This project was a fun project, and if we were to do it in the future we'd probably change the milk and vinegar types.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

PT

Project Number

4013

**Title:** Light Intensity and Photosynthesis: How different colors of light and their intensities affect photosynthesis?

**Student Name(s):** S. Caesar, S. Chaudhry

## Abstract:

The purpose of this experiment was to discover two things, if:

1. Light intensity affects photosynthesis (constant distance)
2. Color of light affects photosynthesis (constant intensity)

Our hypothesis states that if we place spinach leaflets in a water/baking soda solution under a light with a white filter, then the leaflets will rise fastest because the intensity will be highest and more light will seek through to speed up the process.

Spinach leaflets were cut out and placed in a water/baking soda solution in a syringe. The solution was depressed until all leaflets sunk to the bottom. The leaflets were placed under different light filters (with a constant distance). The intensity and time for all pieces to rise up was recorded. To determine which color maximized photosynthesis, different color filters were used (under constant light intensity) and previous steps were repeated.

The white filtered light had the greatest intensity at 10,518 LUX and the leaflets rose faster under this filter compared to blue, green and red filters. When comparing the times for all of the leaflets to rise under a constant intensity (approximately 1,880 LUX) with different colored filters, we observed that the blue light made the leaflets rise fastest.

Based on our results, the white filter yielded the highest light intensity therefore made the leaflets rise the fastest. However, at a constant intensity, the blue light made the leaflets rise the fastest. Therefore, the second part of our hypothesis was incorrect because white filter isn't the best color for photosynthesis.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EA AT PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

94

Fair Category

PT

Project Number

4014

Title: Fats In Cooking Oils

Student Name(s): A. Alston, S. Galvan

## Abstract:

The purpose of this project is to measure the levels of saturated fat, in different types of cooking oil. Will the peanut oil have the highest amount of saturated fat, when the iodine test is performed? Peanut oil will have the highest proportion of saturated fat, and when the iodine test is performed, will require the longest time to lose it's color. The test will be taken with 5 different oils and iodine solution will be dropped into each oil to see which oil takes the longest to loose it's color from the iodine.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

149

Fair Category

PT

Project Number

4015

Title: The Effect of Temperature on Solar Cells

Student Name(s): T. Fahey, E. McNamara

## Abstract:

Solar panels are a great way of creating electricity, and are used around the world. This experiment tested the effect of temperature on the electrical output of solar cells. If solar cells are cooled, then heated up, then the colder the temperature, the more electricity it will generate. The solar cell was in a box with a glass top to keep the air inside. The box contained a thermometer and the solar panel. Attached to the panel was a digital multimeter that read DC voltage (VDC). The temperature in the box started off at 40°F; then the box was heated by a hair dryer. The box was placed under a light bulb, the first trial being 87 inches away, the second trial being 45 inches away from the light. The results attained supported the hypothesis. The cooler the solar cell was, the more electricity the solar cell produced.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

PT

Project  
Number

4016

Title: Snap: The Effects of Temperature on the Elasticity of Rubber Bands

Student Name(s): J. Urresta, M. Ginsberg

## Abstract:

The purpose of this experiment is to test if a rubber band is put under different temperatures, would it affect the elasticity and/or purpose of the band. The hypothesis that our group formed was that if the rubber band is heated, then it will become more elastic because most materials expand when they are heated. To start the experiment, cut the top off a two liter soda bottle. Near the top of the bottle, make two holes, one on each side of the bottle just large enough to fit a pencil. Stick a pencil through one of the holes, loop a rubber band around it, and put the end of the pencil through the other side. Tape about 20 quarters together (depending on band's size/strength), and stick a paperclip through the top of the tape. Connect the paperclip to the rubber band, letting the coins fall into the bottle. Fill the bottle with hot water up to the pencil, and wait a while, and then mark the bottle where the rubber band ends, and label the line "hot". Next, stir in ice cubes until the water turns cold (the ice will make water spill through pencil holes). Wait, then mark the bottom of the band with a line that says "cold". Compare the heights of the lines. The line labeled "hot" was actually closer to the top of the bottle, which meant it was less elastic. In conclusion, our hypothesis was incorrect and rubber bands are more elastic when cold.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

173

Fair Category

PT

Project  
Number

4017

Title: The Heat Is On!

Student Name(s): A. Aponte, M. Adnane

## Abstract:

Most people know that Styrofoam is bad for the environment, yet people still use it. Why is it still so widely used? The purpose of this experiment was to investigate three different types of insulators to see which was the best at keeping hot chocolate warm the longest. One plastic cup, one Styrofoam cup, and one porcelain mug were used; all were filled with the same amount of hot chocolate using a Keurig brewer. Each cup's starting and ending temperatures were written in degrees Celsius, the temperature was recorded for five minutes. After five minutes the temperature of the liquid in each cup was recorded. The three cups had a tremendous difference between them, which was extremely surprising. From this experiment it was concluded that Styrofoam was the best for keeping a hot drink warm the longest. Unfortunately, Styrofoam works very well as an insulator, but is terrible for the environment. Time and energy needs to be focused on finding a new substance that works just as well as Styrofoam, but is biodegradable.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

247

Fair Category

PT

Project Number

4018

Title: Strength Of Bridges

Student Name(s): K. Naworol, P. Castellano

## Abstract:

We based our experiment on the design of bridges. We wanted to know what type of bridge was the strongest: girder, suspension, or truss. We believed that the suspension bridge would do the best.

We built the three bridges using popsicle sticks, each about two feet in length. We then tested them by adding on 2.5 pounds every 30 seconds. We added the weight until the bridge collapsed. We also noted when there were significant cracks in the bridge.

Overall, we found that the girder bridge performed the best, withstanding 110 pounds. The bridge suffered two major cracks at 92.5 pounds. The suspension and truss bridges did not perform nearly as well. The suspension bridge was weak, and collapsed at 30 pounds. There were many cracks in testing of the suspension bridge, and they were very early on. The truss bridge broke during testing at 20 pounds, and also cracked a lot and very early.

Overall, the bridges did not perform as we expected them to. But we observed that the girder bridge did the best. It did not agree with our hypothesis that the suspension bridge would do best, but it made sense after testing. Girder bridges are made for short distances, and if we made the deck slabs larger, then our results could be different, because truss and suspension bridges are made for longer distances. We could have regulated the experiment better by choosing bridges that were either all meant for short or long distances.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE EN PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

PT

Project  
Number

4020

**Title:** Testing a new environmentally friendly method of generating electricity utilizing wave power

**Student Name(s):** A. Zoghol, A. Mohammad

**Abstract:**

Most of the energy needs in the modern world depend on nonrenewable energy resources, but these resources have a negative impact on our environment because of their toxic byproducts. Engineers and scientists have (and still are) come up with efficient ways to utilize renewable energy. Common types of renewable energy are wind and solar but they don't always generate electricity, which is why scientists and engineers have started using ocean energy. We designed a double plated magnetic generator with springs--connected at each of the four corners. In order to generate electricity, a coil will be connected to the top plate and a magnet to the bottom plate so that an electromagnetic inductor is formed. The bottom plate will be stationary and the top plate will move in response of the waves. Our control will be a miniature axial rounded tip sea turbine.

We tested the wave generators by using a fiberglass wallboard to move water in a tub back and forth to simulate waves. Then either of the wave generators were placed in the tub and the voltage produced was recorded at an interval of 20 seconds for 4 minutes with 4 trials for each generator. Our invention generated an average of 18.254 millivolts every 20 seconds compared to the sea turbine which generated an average of 5.01 millivolts every 20 seconds. Based on the results, our invention has proven to be almost four times more efficient as our control (miniature axial rounded tip sea turbine).

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

PT

Project Number

4021

Title: Harnessing Human Body Warmth to Generate Electricity

Student Name(s): K. Khwaja, S. Green

## Abstract:

Across the globe, millions of people have no access to electricity. Thus, a renewable, affordable, and efficient source of energy is needed. The objective of this project was to create a device capable of harnessing human body warmth to generate electricity.

To create the device ("The Energy Band"), peltier cells we used, which utilized the temperature differential between normal body temperature and normal air temperature. The body warmth was simulated with a heating pad set to the same temperature as a human wrist. In the construction of the prototype, a peltier cell was inserted into a sports wristband and connected to a DC-DC USB Converter to convert the electricity generated into a USB port. Silicon tubing was also placed around the wires to ensure safety from possible overheating. To test the device's efficiency, the voltage produced was measured with a digital multimeter. One side of the module was placed on the heating pad, and the other side was placed under a cup of iced water. Next, an attempt was made to charge an iPhone 5s using the USB converter. While the device proved capable of producing energy as measured by the multimeter, it could not generate enough to charge the iPhone.

The results indicate that further improvements to the device such as the use of a different converter or a different source of heat energy could reveal a device with promise to provide a new renewable source of energy.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

201

Fair Category

PT

Project  
Number

4022

Title: Do Antennas Love Geometry?

Student Name(s): S. Antonios, C. McCormack, C. Logan

## Abstract:

Have you ever had trouble listening to the radio because of a bad signal? Well, now there is a way to avoid it. The shape of the antenna can help better receive the signal. This experiment will help people to choose the best antenna that brings the best reception in low-signal areas. The goal of the experiment is to prove that the geometry of an FM radio antenna has an effect on the strength of the reception. In this experiment, one will shape 7 pieces of 120cm pure copper wire into different shapes such as a circle, a square, a line, a wavy line, a cube, a sphere, and a fuzzy shape. One will also record the arbitrary numerical value of the signal strength. The Radio manufacturer arbitrary units (RMAU) ranges from 0 to 5. The data states that line shape was 2.2, the circle shape was 2.4, the square shape was 1.4, the wavy line was 2.2, the cube was 4.6, the sphere was 4.8, and the fuzzy shape was 4.2. As a result, the sphere is the best shape that gives the highest reception. This experiment proves that the different shapes affect the reception of the FM radio.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

196

Fair Category

PT

Project  
Number

4023

Title: How does the temperature of a tennis ball affects the height of its bounce?

Student Name(s): G. Pinto, C. Schramm

## Abstract:

Christopher Schramm & Guilherme Pinto  
Science Fair Abstract

Testable Question: How does the temperature of a tennis ball affects the height of its bounce?

The purpose of this project is to find out how the temperature of a tennis ball affects its bounce. We chose this project so we could have new learning of how temperature changes the way the ball works and maybe learn a little bit about the metric system by using degrees celsius. Also we noticed that temperature can do a lot of things. It will help other people because we can tell some tennis players how the ball works depending on its temperature so they can learn if it is better to play on hot or cold temperature days. Or we could tell people how does temperature interacts with objects we see everyday. Our Hypothesis was: If the ball is hot then it will bounce higher because it will be expanded in the inside. We adjusted the temperature of the balls by using a freezer and a microwave. We tested the performance of the balls over several trials. We measured the height of the bounce in metric units. We found our hypothesis was supported.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH ET

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

175

Fair Category

PT

Project Number

4024

Title: Sturdiest of Them All

Student Name(s): K. Keddo, D. Jones

## Abstract:

Buildings are always collapsing and many brace positions have been created to make them sturdier, but which brace position will make a building the sturdiest it can be? This project tests which brace position will be able to uphold the most amount of mass; k-type, x-type, channel, or knee bracing system. The brace positions were tested by being put into a basic frame structure, then having 2.27 kg weights placed on them until they broke. This project was tested in a static manner, the weights were placed onto the buildings, not dropped. Our hypothesis was that the K-type brace would uphold the most amount of weight out of all the brace positions we tested. The experimental results supported our hypothesis by showing that the k-type brace position, due to the fact that it supports all of the structure rather than just parts of it, was able to uphold the most amount of mass. The project also showed us that that more triangles a building has, the stronger the building will be.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

PT

Project Number

4025

Title: The Clean Drain

Student Name(s): W. Livesay, A. Paliwal, J. Feuerstein

## Abstract:

According to a recent Long Island Sound Study, stormwater can carry fertilizers, pesticides, or leaking motor oil from driveways, streets, and lawns into local streams or storm sewer systems. Eventually these harmful chemicals get flushed into the Long Island Sound. Furthermore, when leaves and debris clog storm drains, the runoff produces flooding which often contains pollutants from sources such as pesticides, fertilizers, automotive fluids, and pet waste. This pollution can travel hundreds of miles downstream from their source.

The objective of this project was to design, create, and test a stormwater drain system capable of reducing runoff pollution and flooding.

To achieve these objectives, a prototype drain was designed, created, and tested. The drain itself was made with a variety of materials, including 3D printing filament and wood. A polypropylene filter filtered the water upon entrance to the drain, filtering out the large debris and waste. Load sensors were also wired to an Arduino board and attached to the inside corners of a load plate specifically designed for the system. As the drain system becomes filled, the load sensors are engaged and the weight on the filter is sent to the user via the Arduino board.

The prototype was successful because it successfully filtered water, separated debris from water, and sent data about the weight of the debris to the user via the Arduino board. The Clean Drain system has the potential to prevent runoff pollution large bodies of water and lessen flooding.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT EE EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

232

Fair Category

PT

Project Number

4026

Title: Can U(V) See the Light

Student Name(s): L. Millott, M. Morales

## Abstract:

Our topic is about determining which sun protection has the best ratio of UV protection versus UV protection duration. We pursued this topic because our families sunburn easily and we wanted to be able to recommend the best sunscreen to prevent sunburn. Our hypothesis was that the 50+ spf sunscreen lotion would score the best. We investigated our topic by coating UV reactive beads with various types of sunscreen lotions and recorded how long it took for the color of the UV beads to reach its peak and also how long it took for the UV protection to wear off. The peak times ranged between 1-3 minutes. The time for the UV protection to begin wearing off ranged between 2-5 minutes. We also tested mud as a natural alternative to sunscreen lotions. We were not able to record exactly how long mud took to wear off, but it was at least five minutes and would probably have lasted longer. Because the UV sensitive beads do not absorb the sunscreen or mud, we had to estimate how long it would last on human skin by using what we found online about how long 30 spf lasts. With our results we found that we were wrong with our hypothesis and mud did the best. SPF 50+ lotion came in second. Through this experiment we learned about how sunscreen works and also about UV rays.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

237

Fair Category

PT

Project Number

4027

Title: Mars Exploration

Student Name(s): K. Dimitrov, A. Tully, A. Lanzillotti

## Abstract:

Abstract

In our experiment we built a model Mars rover made from Lego EV3 and programmed it to drive over a variety of surfaces. We tested it on three different terrains replicate Mars most accurately: rocks, sand, and asphalt. We added color, ultrasonic, and touch sensors to enhance our rover and improve it's performance while driving. When the ultrasonic sensor detects an obstacle in front of our rover, it is programmed to stop and reroute in an alternative direction. When something touches the touch sensor, the rover also stops and reroutes. The color sensor detects the difference in value of color. We also added a forklift on the back of the rover to lift a crate to test how much weight our model can lift.

Our experiment also included testing different amounts of wheels and tracks. Four wheels did not perform well on dirt and rocks. However, when we added another set of wheels the performance improved. On the sand, the tracks prevailed.

The procedure that we followed is build the rover, test the rover, modify any components that need to be changed, and keep repeating this until it performed adequately on all terrains. Some of the questions we will answer are how fast is the rover with different sets of wheels, which type of wheels will be the most efficient, which sensor is the most efficient, and then we will present a record of the results .

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PT

Project  
Number

4028

Title: A Helping Hand

Student Name(s): G. Saviano, S. Tillman

## Abstract:

Our project is a robotic hand controlled by the wearer of a special glove. We chose this project to help those who work with bombs, harmful chemicals or anything else of that ilk. Our project would allow them to do their job without it being dangerous. We made our project in two parts, the glove and the hand. For the glove, we used a glove, breadboard, jumper wires, flex sensors, an arduino, an Xbee module, 10k resistors, and an Xbee shield. The flex sensors are attached to the finger parts of the glove, and they send signals on how much one's fingers are bending at a certain time. The signal goes through the wires and breadboard and gets processed by the arduino. Then the arduino sends the information over to the servo motors in the robotic hand through the wires. The hand, on the other hand (No pun intended) is simply put together like a puzzle. We 3D printed out a lot of parts for the hand and put them together. Then we threaded the string through the fingers and attached them with hot glue. Finally, we attached the string to the servos and then added our Arduino. We both learned a lot about how wiring and coding works doing this project, and that is as much an amazing result as building the hand itself. Even though we had many bumps in the road, in the end we managed to build the hand and get it to work.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P7

Project Number

5001

Title: Building Tesla Coils

Student Name(s): L. Santo

## Abstract:

The purpose of this project was to learn about Tesla Coils and electronics. With the guidance of a certified electrician, two Tesla Coils were successfully built and a third is in progress, still being adjusted. A purchased Tesla Coil available from the school was used as a control for comparison to the homemade Tesla Coils. One goal was to exceed the performance of the control Tesla Coil.

The basic components include a transformer, primary coil (capacitors, bleeder resistors), spark gap, secondary coil with the toroid/top load. A small prototype was built with little troubleshooting required. The process of building the full scale model required reducing the size of the capacitor array, adjusting the spark gap and primary coil and selecting a different transformer. The spark length, spark intensity, ability to light up a fluorescent light bulb, and the distance the light bulb could be moved away from the toroid and continue to be lit were measured and evaluated. These tests helped to determine what changes needed to be made to improve the performance of each Tesla Coil.

Before experiments were finalized, the length of the primary coil and the length of the spark gap were adjusted. The primary coil length was adjusted by moving a clip that fed the coil with the electricity. The spark gap was adjusted by moving the tungsten rods towards or away from each other. This experiment was exciting and it helped developed my interest in a career in electrical engineering and building more projects.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

219

Fair Category

P7

Project Number

5002

Title: Mass Maglev Manufacturing

Student Name(s): P. McHugh

## Abstract:

For my project I will be creating a maglev wind turbine. If you are not familiar with maglev, it stands for magnetic levitation. Maglev is when you put two magnets together and they stick, but if you put it so that two of the same sides (negative and negative or positive and positive) the magnets will repel. Thus the name maglev or magnetic levitation. Wind turbines are used to create energy from the wind that spins the fan of the turbine and I have an idea to improve this so we can generate more eco friendly power. Turbines using maglev is nothing new, but in my research I have noticed flaws with the design. I will be trying to unlock the full potential of the technology of maglev. This whole project is really an example and I am hoping to make the point that maglev is an underestimated technology. My project (or part two of the project) is to test the boundaries of maglev and is designed to make people grow aware of the potential of maglev. If a twelve year old child (such as myself) can design a maglev wind turbine with little to no flaws, then imagine what maglev could do in the hands of experienced people whose jobs are to make technology that shapes the future.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

177

Fair Category

P7

Project Number

5003

Title: Wind Energy I'm a big Fan

Student Name(s): A. Flaherty

## Abstract:

Imagine seeing wind turbines instead of smoke when you pass a factory! By having more efficient wind turbines, factories all around the world would have another option for energy instead of using fossil fuels. This would improve the economy. It would also reduce greenhouse gasses and acid rain. This experiment was performed to research one "go green" idea. Specifically, does the length of the blades on a wind turbine effect the amount of power it generates? The hypothesis was, if windmills have longer blades (increased surface area), then energy will be produced. This was tested by constructing a scale sized windmill using a 3 volt D.C. Motor, PVC pipes to make the base and pole of the turbine, and card board for the blades. Through the results, it was discovered that blade length is not the only factor impacting energy output. As the length of the blade increases, it becomes heavier and requires more wind to turn. Analysis of the data determined an optimal blade length where the surface area and weight combination produces the most energy.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P7

Project Number

5004

Title: Environmental Monitoring System For Dog Safety

Student Name(s): M. Tainter

## Abstract:

The purpose of this project was to build a device to keep dogs safe by monitoring environmental conditions (temperature/humidity) and notifying dog owners of a deteriorating environment. The procedure included research, learning, building, experimenting, testing and improving the device. Information was gathered about dog safety, related laws and existing/similar dog safety devices. No products that monitored environmental conditions were found. Simple circuits were created on a breadboard and controlled by the Arduino Uno to learn how to write/compile/upload Arduino sketches to collect data with sensors. Components included Arduino Uno, two temperature/humidity sensors, 3 LEDs, a buzzer, a 7-segment display, bluetooth and/or WiFi. Several prototypes were built and modified until the device functioned as designed.

Using the prototypes, multiple trials of experiments collected and compared temperature/humidity data in an enclosed area versus an open area with five different configurations (indoor, outdoor, stuffed pet with and without a carrier, different sized enclosures). A dog safety device, based on prototypes, was built by soldering components on a Printed Circuit Board.

Results show the enclosed area temperature exceeded the open area temperature by more than 20°F in less than 30 minutes. Temperatures inside the enclosed area exceed 85°F (identified by USDA Animal and Plant Health Inspection Service as dangerous for dogs) even when outside temperatures are very comfortable (<70°F). A device was successfully built to measure temperature/humidity. The final product sends data to a website using WiFi and notifies the owner through a smartphone app.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE CS AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

135

Fair Category

P7

Project Number

5005

Title: Gravity and Air Resistance

Student Name(s): N. Grabinski

## Abstract:

Parachutes were created to oppose the force of gravity and were designed for military use, but what material would be the most effective at slowing down the passenger? The materials used were paper, nylon, and fabric. The hypothesis was that the nylon parachute would continue to perform the best throughout the experiment. Parachutes were made from three materials and weights were added to serve as the “passenger”. The parachutes and passengers(weights) were then dropped from a consistent height. The results showed that paper had greater air time, but did not hold the weight of a “passenger”. As the weight got heavier, the paper parachute dropped much faster. Nylon and fabric parachutes had more consistent performances with the nylon taking about .5 second longer to fall for each trial. Overall, nylon had the best performance.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

209

Fair Category

P7

Project Number

5006

Title: What's Blocking Your Wi-Fi Signal?

Student Name(s): A. Rosenthal

## Abstract:

Wi-Fi signals are constantly changing inside the house. This experiment tested the effect of house building materials on Wi-Fi signal strength. It was hypothesized that the material with the least density would impact the signal strength the least. The steps consisted of building boxes of some common building materials which were placed around the router. Wi-Fi signal is measured in dBm, which is decibels per milliwatt, with a decibel being a unit that expresses sound wave intensity, and a milliwatt is a unit of power equal to one thousandth of a watt (dBm) (Decibel) (Milliwatt). On a MacPro, NetSpot pro was used to test the signal strength from 182.88cm away with each tested material. Each tested material was compared separately against the starting signal strength to determine the degradation of signal. The bamboo flooring, R-6.7 insulation and the drywall barely affected the signal strength, while the engineered wood and the OSB, or oriented strand board, affected the signal strength the most, however at less than 3 dBm, it was not significant (Oriented Strand Board). This experiment only focused on each material separately and not in combination(s), like what is found in house construction. Due to the results, the hypothesis was proven to be correct.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

178

Fair Category

P7

Project  
Number

5007

Title: Cleaning Coins

Student Name(s): P. Savo

## Abstract:

The objective of my project is to see what liquid (Coca-Cola, Lemon Juice, Vinegar, Salt Water) will clean coins (same dirtiness). I took the pH to see which liquid has the most acidity. First you put each liquid in a cup then you test the liquid for the highest acidity. After that you put the coins in its selected liquid then you take them out and scrub them after given time. Finally you record the data. Data was collected by seeing which coin is the cleanest and then making two pie charts. What I found while doing this is that the lemon juice cleaned better but in a longer time the Coca-Cola cleans better because it had time for the acid to react with the coin. In my project lemon juice worked best in 30 minutes but in 12 hours coca-cola worked better. The study did answer my research question which was, do the coins or do they remain tarnished? I think the project does need further research to figure out what really is better.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CH PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

216

Fair Category

P7

Project Number

5008

Title: Orb Characteristics and Containment

Student Name(s): E. Ramthun

## Abstract:

Studying packing patterns to find the most cost effective way to transport water-containing spheres could address vital needs in areas of water shortage and excessive plastic waste. This investigation began with an interest in trying to create edible water bottles like those made by the Skipping Rocks Lab (Ooho bottles), commonly known as reverse spherification orbs. Production of these orbs took excessive time and they weren't successful during weight and durability testing. Switching to polymer orbs produced improvements in bounce and weight test results. This work led to packing investigations of six different container shapes. The focus became packing the spheres into containers to transport them safely and efficiently using one liter tests and one layer tests. The inaccuracy of the orb placement in the one layer model led to multi-layer packing as a variable for phase three. Several random and dense patterns, such as lattice, for equal sized spheres, were then tested, as well as several patterns using unequal sizes of spheres. A Princeton University study lists efficiency ratings of 74% for hexagonal dense packing and 65% for random packing (Chamberland). All trials in this study had rates below these percentages, however, unequal sphere combinations and hexagonal tests produced higher percentages, therefore, more efficient packing. Numerous variables have been identified for further testing.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MA EN ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

138

Fair Category

P7

Project  
Number

5009

Title: Brownie Points

Student Name(s): H. Gold

## Abstract:

This study addresses the effect of different types of flour on certain qualities of brownies. Gluten acts as a binding agent and different flours have different gluten contents. It was hypothesized that the brownies made with white flour would overall turn out the best and the brownies made with gluten-free flour would fall apart. Brownies were baked with white flour, whole wheat flour, spelt flour, gluten-free flour and had people taste them and fill out a survey. 66% of participants said the brownies made with white flour were the best and 81.4% of responses said all of the brownies stayed together. The overall results showed that the gluten content in flour does not affect brownies as much as other aspects of flour. Future research could include researching the role of other aspects of flour in baking.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH ME PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

95

Fair Category

P7

Project Number

5010

Title: Reaction Times between Video Game Players and Non-Video Game Players

Student Name(s): A. Mehta

## Abstract:

My hypothesis of this project is to show video game players have a faster reaction time than non-video game players.

This will be done by volunteers filling out surveys based on how much hours a week they play video games, their gender, and their age. After this humanbenchmark.com is used to test each volunteer's reaction time. Humanbenchmark.com will test participants reaction time by a box turning green and having to click it as fast as possible. When all the data is collected a graph will be made to show the conclusion of the project.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MA AT CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

126

Fair Category

P7

Project Number

5011

Title: Bath Bombs

Student Name(s): E. Reilly

## Abstract:

I wanted to find out if more cornstarch would affect the dissolve time of a bath bomb. My hypothesis is, if I add more cornstarch then it will dissolve faster than a regular bath bomb would. To do this project I had to make bath bombs. I started by making regular bath bombs and then making bath bombs with extra cornstarch. After they came out of the oven I tested them. I tested them by dropping them into warm water. After testing, I found out that my hypothesis was incorrect and that the normal recipe dissolved faster than the extra cornstarch recipe. In conclusion my hypothesis was incorrect. I think that it's because cornstarch is a thickener. This was a fun project that I enjoyed doing.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

197

Fair Category

P7

Project  
Number

5012

Title: It is rocket science.

Student Name(s): J. Szeghy

## Abstract:

The purpose of my experiment was to demonstrate in a fun and creative way the inner-workings of a rocket. This is the procedure I used. First you need to assemble the rocket using common household items. You will need tin foil, a skewer, matches, pliers, scissors, a cutting surface, a barbecue lighter and finally safety glasses. Print out the template from this link <https://tkor.squarespace.com/matchbox-rockets-template> . Use this template to cut out tin foil and mark the skewer for best performance. Assemble the rocket consisting of a match head, tin foil template cut out, and the skewer. Then find a safe place to launch them. Proceed to fire all of your rockets by holding the lighter under the match head and record the data. The results of the launching consists of the windproof matches having its longest run of 14 ½ feet long, waterproof matches having its longest run of 20 feet long, the large kitchen matches having its longest run of 12 feet, and the small kitchen matches having its longest run of 6 feet. I proved my original hypothesis wrong by demonstrating that the largest match heads didn't always go the farthest.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE EN AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P7

Project Number

5013

Title: The Super Magnetic Glove.

Student Name(s): K. McGovern

## Abstract:

Hello my name is Kenny McGovern, i'm in 7th grade at St. Joseph's school. Let me tell you about my design, Have you ever been working on a project for school or for work, and you drop your metal piece. After you drop your metal piece on the ground you don't have any free space to pick it up. This Glove design can light up a new path to the construction world! With this glove design the little covering over any glove design so it's compatible with any glove of your size. After you drop your metal piece or object while you have a tool in your hand just wave the glove's back side to the metal object and then the metal object will stick to the back side, and is also adjustable to the front and sides. Not only is this glove used for construction but for medical use and possibly military. Most of the magnetic tools usually costs about 20 dollars or more but this experiment or design would only cost you about maybe 5 to 8 dollars or less. When you try this glove it's the easiest and efficient glove ever, if you don't want to use the magnetism the glove can take the magnets off without glueing it on or getting it taped on. After use this glove should be washed due to the magnets because if dirt gets on the magnet it will ruin the magnet's magnetic field. Next I would like to investigate Electromagnet's Magnetism.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

142

Fair Category

P7

Project Number

5015

Title: Parachutes

Student Name(s): R. Lawlor

## Abstract:

For my Science Fair Project I wanted to test what shape parachute has the most air resistance? To test this I used four different shape parachutes: circle, triangle, rectangle, and square. I believed that the circle parachute would work the best out of the four parachutes.. I used two garbage bags to cut the shapes for the parachutes. After that I went my dad's job as a firefighter to go on his 100ft ladder truck to test my hypothesis. We went up 75ft to make sure that the parachutes would stay in the air for a little while. Overall after testing my hypothesis, my results do not support my hypothesis because I thought the circle would have the most air resistance. Actually the triangle had the most air resistance and therefore work the best and the circle had the performed the worst.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

223

Fair Category

P7

Project Number

5016

Title: Insulation Wars

Student Name(s): M. MacDaniel

## Abstract:

My question is what insulation insulates the best. My purpose was to find out if we are spending too much money on insulation that is not doing what it is meant to do. My hypothesis was that the fiberglass would be best because of its tremendous popularity among American households. I developed a mechanism made out of wood and put each sample between the two wood blocks. I then heated one side with a hair dryer and let the heat flow through to the other block of wood. I did this for every sample. To find out what was the best insulation I used total temperature change. I found out that the fiberglass is the best insulation because it only changed by .3 degrees. My conclusion was that businesses have been making the right choices by choosing pink fiberglass as their insulation. The other insulation changed more and did not closely keep any temperature. I would like to next investigate if the insulation is in a different environment with a different ambient temperature will it change the outcome. I would also like to know if the temperature would change if I heated it for a longer or shorter amount of time. After that I would like to find out if there is another type of insulation that could beat the legendary fiberglass insulation.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

230

Fair Category

P7

Project Number

5017

**Title:** Bisphenol A Content in BPA Free Water Bottles, Canned Food Items, Children's Plastic Connectable Beads, and Pen Caps

**Student Name(s):** I. Komninakas

**Abstract:**

BPA(Bisphenol A) is a chemical found in polycarbonate plastics and in epoxy resins. It has been found to possibly cause effects in humans such as asthma, cardiovascular disease, liver-enzyme abnormalities, and the reproductive system. I tested the amount of BPA in commonly used plastic items including water bottles, canned food items, plastic toys, and pen caps. I predicted that the cans would have the most BPA because of the epoxy resin used to line the can and that the water bottles would have the least amount. During trials each item was exposed to boiling water and then tested for BPA using BPA testing kit. It revealed that the pen caps showed the most BPA (58.3 ppm), followed by the plastic toys(33.3 ppm), the cans (20 ppm), and finally the water bottles(15 ppm).The results were unexpected. I initially hypothesized that the epoxy resin lined can would show the most BPA but that was not the case. The water bottles were found to have the least amount of BPA. The effect of BPA exposure in our food remains a concern and should be further investigated.This experiment was done to reveal how we are exposed to BPA in the food we eat, the beverages we drink and items we use. Future studies should be done with a more sophisticated measurement device to better quantify the presence of BPA.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EV CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

116

Fair Category

P7

Project Number

5018

Title: A Smart Gutter

Student Name(s): C. Tucker

## Abstract:

Having energy is very important for our modern world, but many sources of energy are extremely harmful to our environment. However, water power is not one of them. For my project, I wanted to try to build a hydroelectric device that could use rainwater from a gutter to light a small light bulb. I made a small turbine that could fit into a gutter, and I attached it to a motor. I tried two motors of different sizes to try to produce enough energy, but neither produced the 1.35 volts needed to power the light bulb. Therefore, my hypothesis was incorrect because although I created energy, I did not make enough to light the light bulb.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

130

Fair Category

P7

Project  
Number

5019

Title: Eggceptional Geodes: An Eggsperiment

Student Name(s): B. Hyland

## Abstract:

How do various types of water affect the growth of crystals inside of an egg shell?

The purpose of this experiment was to see if there is a relationship between the type of water and the amount and formation of crystals inside of an egg shell. The research question was: Does tap water, distilled water, lake water or SmartWater allow greater crystal growth? My hypothesis was that tap water would allow the greatest growth of crystals due to the minerals in the water. After conducting the experiment, it was determined that distilled water allowed for the greatest amount of crystal production followed by tap water. The results do not support the hypothesis outlined prior to the experiment. If you want to grow crystals, distilled water is the way to go!

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EA EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

91

Fair Category

P7

Project Number

5020

Title: What's Your Boiling Point?

Student Name(s): I. Pero

## Abstract:

Does salt water boil faster than fresh water? To find out, I compared one liter of hot salt water, cold salt water, hot fresh water and cold fresh water. Each were heated and timed to see when they reached 100 degrees Celsius. I found out that hot salt water boiled the fastest out of all of the other types of water that were tested. Salt water took 10 minutes to boil and salt cold water took 17 minutes and 20 seconds, which came in last of the four types of water.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

181

Fair Category

P7

Project Number

5021

Title: Greasy Times and Triple Enzyems

Student Name(s): J. Ryder

## Abstract:

This science fair project that was completed was to compare the most effective way of breaking down the fat, oil and grease (FOG) from a local restaurants grease trap to help minimize the amount of grease that solidifies in the wastewater leaving the restaurant that causes blockages to pipes and city sewer systems. The experiment was done to compare three different forms of enzymes and the effect each of them had on breaking down the grease from the grease trap. Will of bacteria into a grease trap help in breaking down fat, oil and grease?

If the fat, oil and grease from the trap is thick, then the liquid enzymes should pass through easier, therefore breakdown the grease faster than the solid or powder enzymes. Observations were taken daily to see which of the enzymes broke down the fat oil and grease the fastest. The hypothesis that liquid enzymes will be the quickest enzyme to break down fat, oil and grease was incorrect. In this case the solid enzymes followed by powder proved to breakdown the FOG both quickly and completely.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

188

Fair Category

P7

Project Number

5022

Title: Strength of Electromagnet

Student Name(s): S. Hammond

## Abstract:

An electromagnet is a magnet that is created by an electric current passing through a magnetic material such as a screw surrounded by a coil of copper wire. The magnetic material connected to the electric current allows the magnet to attract objects. The more times the coil is wrapped around the magnetic material, the stronger the magnet should be.

My hypothesis is that the more times the coil is wrapped around the magnetic material, the stronger the electromagnet will be. I built four electromagnets by wrapping copper wire of four different lengths around four different bolts. I connected the two loose ends of the copper wire to a battery to produce the electromagnet. I measured the strength of the electromagnets by how many paper clips each magnet picked up. Each magnet was tested five times and average of the five trials was used to test the hypothesis.

The data supported my hypothesis. The electromagnet wrapped 200 times could pick up 21 more paper clips than the one wrapped 50 times, 10 more clips than the one wrapped 100 times, and 5 more than the one wrapped 150 times.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

P7

Project Number

5023

Title: Sneaker Feature

Student Name(s): S. Gasbarro

## Abstract:

The goal of my project was to find out what temperatures and weights had a greater effect on the depletion of the padding of a sneaker. The temperatures that I tested on were the average temperatures for winter and summer in New England, and room temperature. The weights that I used were 1 kg, 500 grams, and 0 grams. I used an incubator for the average summer temperature, which was used under supervision of and with the consent of my science teacher and the Inventor's Lab teacher at SIS. I tested each weight with each temperature, so I did a total of 9 tests, times two so that I could use the average result as my conclusion. The steps that I took to prepare for the experiment included separating the top of the sneaker from the padding, cutting the padding into small, testable squares, which both used and X-Acto knife. The knife was used under supervision and with consent of my father, and he and I were both equipped with safety glasses. The steps to test included placing the testing squares in cups to stabilize them, placing the weights on them, and putting them in the required environment for 12 hours. This was enough time to produce a reliable and reasonable result. The conclusion of my project was that a cold temperature had a greater effect on the padding, regardless of what amount of weight was put on it. Knowing this can help you choose your next pair of sneakers! :)

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

192

Fair Category

P7

Project Number

5024

Title: What Recyclable Material Makes the Best Insulator?

Student Name(s): J. Byrne

## Abstract:

This project asks, what recyclable materials makes the best insulator? I hypothesized that Styrofoam would work as the best insulator and that cardboard would be the next best. Styrofoam is a commonly used insulator, but is bad for the environment. I wanted to see if there was a more easily recyclable insulator that is as effective. I tested plastic bubble wrap, shredded cardboard, shredded paper, old clothing, and Styrofoam scraps, as well as a control with no insulation. I placed a glass bottle in the middle of a can and the different insulation between the bottles and cans. I poured boiling water into the bottles and monitored the temperature every five minutes for an hour. As expected the Styrofoam was the best insulator, but plastic bubble wrap closely followed it. I believe these two were the best insulators because they allowed the least amount of air between the bottle and can. In the future I would perform the experiments again with the cardboard and paper without shredding them to reduce the air. Other errors that could have affected the results was the varying room temperature and start temperatures of the boiling water.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

P7

Project Number

5025

Title: A Study on soil product following biodegradation of Styrofoam by Tenebrio

Student Name(s): C. Plank Pinho

## Abstract:

Abstract

The purpose of this experiment was to discover if using mealworms to biodegrade Styrofoam is a safe way to reduce pollution in the environment, and after the biodegradation, would the soil be good for growing crops. The independent variable is the mealworms. The dependent variables are: levels styrene before and after the project, and levels of pH, Nitrogen and Phosphorous before and after the project. The list of materials used include: 1 ten gallon steel can, 4 quarts of yard soil, 1 package of Styrofoam cups, 100 mealworms, 1 package of disposable gloves, and one glass container with lid.

Mealworms were placed in soil with only Styrofoam (styrene) to eat. Testing of pH, Nitrogen, Phosphorous, and styrene was completed on the control soil and the after mealworm and biodegradation soil. Testing of the control #1 soil showed no styrene, a pH of 6.82, Total Nitrogen of 1530, and the Phosphorus was 704. Testing of the #2 medium soil showed a pH of 6.56, Total Nitrogen of 2430, and a Phosphorus level of 995. The conclusion of this study is that there is no change in styrene level, a higher Total Nitrogen, and higher Phosphorus level following biodegradation by mealworms. The soil after biodegradation of Styrofoam by Tenebrio had no styrene and high nutrients so the soil would be safe for crops. We now have gotten the results which show that our hypothesis was correct.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

244

Fair Category

P7

Project Number

5026

Title: Snap Crackle Pop

Student Name(s): M. Birdsey

## Abstract:

Pop Rocks when mixed with soda have been known to create a large amount of carbon dioxide, even enough for people to believe they could explode the occasional stomach. Contrary to popular belief, when Pop Rocks and soda are combined they create carbon dioxide but not enough to cause harm.

The experiment was conducted to determine whether or not different flavors of soda produce different amounts of gas when Pop Rocks were added. My experiment attempted to discover if the flavor of soda, when combined with Pop Rocks, affected the amount of carbon dioxide released.

Using 5 different flavors of soda, Cotton Candy Pop Rocks, a balloon, a funnel and a micrometer, I measured the amount of CO<sub>2</sub> released when Pop Rocks and soda were combined. The soda, a carbonated liquid, contains a lot of CO<sub>2</sub>, therefore when the Pop Rocks, also containing CO<sub>2</sub>, and soda mixed, the volume of CO<sub>2</sub> increased. The flavors of soda directly impacted the amount of carbon dioxide released when combined with the Pop Rocks causing different balloon diameters during each of the five trials.

My results indicated that the soda flavor did affect the amount of CO<sub>2</sub> given off when combined with Pop Rocks. My findings concluded that, on average, orange soda and Pop Rocks when combined produced the most CO<sub>2</sub>, however, the results don't explain why this happened. Further investigation will be needed to explain why orange soda when mixed with Pop Rocks produced the most CO<sub>2</sub>.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH BI ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

163

Fair Category

P7

Project Number

5027

Title: Taking Flight

Student Name(s): B. Adams

## Abstract:

The purpose of my experiment is to determine how different densities of golf balls affect flight distances. My hypothesis was that the less dense golf ball will fly farther because less work is required to move it. I built a mechanism out of household items such as hinges, cardboard, and wood. I attached a 12 degree driver to the mechanism to hit the ball. The mechanism was a machine that would hit the ball without human intervention. I tested three different golf balls three times each and measured the distance they flew when hit. I measured the mass and volume of each golf ball by using a gram scale and beaker. I then divided mass by volume to calculate the density of each golf ball. In conclusion, my hypothesis was correct and the less dense golf ball did fly the farthest. This experiment is an example of inertia. A question that remains is how the Magnus effect would change the golf ball's flight.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

198

Fair Category

P7

Project Number

5028

Title: The Plentiful Popcorn Project

Student Name(s): R. Logue

## Abstract:

Popping popcorn the most effective way has always been a mystery. Three different experiments were conducted to test the variables that affect a bag of popcorn. The measure used throughout the experiments was the percentage of kernels popped. In the first experiment, varying amounts of kernels were put in each bag. This was done to see how a number of kernels affected to percentage popped. In the second experiment, the microwave power was reduced to 80% from 100%. Lowering the power was done in an effort to see the effect it would have on the total percentage popped. In the third experiment, oil and salt were added to see how these tasty additives impacted the popcorn and percentage popped. The outcome of the first experiment was the larger quantities of kernels had a greater percentage popped than the smaller quantities. The result from the second experiment was the larger amounts were not as affected as the smaller amounts of kernels to the power reduction. The outcome of the third experiment was the oil and salt did not affect the results of percentage popped. Ideas for further testing include microwaving larger amounts of popcorn and soaking it in different substances.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

160

Fair Category

P7

Project  
Number

5029

Title: How Safe is Your Water

Student Name(s): M. Zayas

## Abstract:

The topic for my science fair project is How Safe is Your Water. I chose this topic because one day I was drinking water at home and thought it tasted a little weird. My question was “which water was the safest or cleanest?”, and my hypothesis was that filtered water would be the best water. For my experiment, I used a pH drop tester, and a TDS tester to test all the water. For the pH testing, I put all the water into test tubes and then put 10 pH drops into each tube and shook well. For the TDS testing, I filled a cup with one of the waters, tested it with the TDS tester, dumped out the water, and repeated testing the other waters the same way. Filtered water was the cleanest but not the safest. I learned that tap water was safer than the filtered water I have at home, but filtered water is still the cleanest.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

227

Fair Category

P7

Project Number

5030

Title: LED Light Bulbs: A Bright Idea?

Student Name(s): C. Stanton

## Abstract:

The purpose of this study was to test if LED light bulbs perform as advertised and to see if the more expensive LED bulbs provide a better value. It was hypothesized that if different brands of LED light bulbs are tested for energy efficiency and longevity, then the more expensive LED light bulbs should meet their advertised claims better than the cheaper LED light bulbs. I did online research about LED and compact fluorescent (CFL) light bulbs at Consumer Reports online. I bought 5 different brands of LED light bulbs of varying costs, some inexpensive and some expensive. I powered each of the bulbs for a minimum of 57 hours, measured the electrical usage using a Kill-A-Watt™ device, recorded the data, and calculated the average kilowatts per year each bulb would use. I compared my results with the advertised claims on the packaging and found that not all LED light bulbs meet their advertised claims.

Specifically, the least expensive LED bulb, Great Value 9W sold by Walmart, outperformed the most expensive bulb, the Sylvania Ultra. The expensive bulbs are not necessarily the best deal. I also tested the bulbs for longevity by continuously running them for the equivalent of 480 days; however, due to time limitations I was not able to run them long enough to validate the advertised life expectancy claim of 20 years.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

124

Fair Category

P7

Project Number

5031

Title: The Unspillable Table Setting

Student Name(s): M. Bertolami

## Abstract:

The reason for this invention was to prevent children from spilling their glasses or bowls at the dinner table. The first prototype was made of floral foam that held the cup and bowl. It did not tip but it kept sliding around. The next idea was using magnets and a magnetic sheet to hold it in place. So the magnets stick to a steel cookie sheet and now they only slide when they are hit. To keep the magnets from falling off, epoxy was applied to the bottom of the cup, plate, bowl, then the magnets were stuck to the epoxy, keeping them in place. This experiment helped to make the conclusion that magnets are better than floral foam to keep a cup from spilling.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

155

Fair Category

P7

Project Number

5032

Title: Natural Power

Student Name(s): J. Atehortua

## Abstract:

Abstract.

The reason of me doing this experiment was so that I could learn more about how to create energy using renewable sources. I think people should care about my work because this is the solution to the global warming now that producing energy with renewable sources we contribute to the decrease of environmental pollution. I didn't discover anything new we just want to show that electric energy could be produced in a simple way. This info could be important if you see it like a possible solution to the problem of global warming. In the end the Hydroelectric model was more efficient. I created the model and took the result according to the averages I could conclude that the Hydro can produce more energy do to the fact that the speed increases over time and the wind stay the same. Next time I will look deeper into the mechanics and science in this project

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

121

Fair Category

P7

Project Number

5033

Title: The IRON-ic Truth About Cereal

Student Name(s): L. Peters

## Abstract:

The question that I investigated is “Can the iron in cereal be extracted with magnets?” I wanted to answer this question because iron is a very important mineral in the human body; it maintains a healthy bloodstream. My hypothesis of what will happen is that the magnet stick will pull out congealed blobs of iron as well as some slurry from the cereal. I used a saran wrapped magnet stick to take the iron out of a Cheerios slurry. The magnet stick pulled out small blobs of iron as well as some of the Cheerios slurry. The results of my experiment showed that my hypothesis was correct. Through my experiment, I learned that iron can be extracted from iron-fortified food.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ME PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

164

Fair Category

P7

Project  
Number

5034

Title: Ready, Set, Blast Off!

Student Name(s): A. Teixeira

## Abstract:

The effect of changing the amount of baking soda combined with vinegar on launch height of a CO<sub>2</sub> rocket was investigated. After building a model rocket out of a soda bottle, I developed a procedure where I planned to increase the average amount of baking soda used by a half teaspoon for each trial. I also researched the reaction that occurs when combining baking soda with vinegar. My resulting hypothesis is that the largest amount of baking soda used will produce the highest average launch height because if the amount of baking soda is increased, then the launch height will increase as well. After assembling the rocket and performing a total of three trials for each specified amount of baking soda, my hypothesis was correct. The highest amount of baking soda used (2 tsp.) resulted in the highest average launch height. The reaction happen because when baking soda is combined with vinegar, it creates carbon dioxide gas and causes the rocket to launch upwards.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH ET AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P7

Project Number

5035

Title: Making Tie Dye Milk

Student Name(s): M. LaMonica IV

## Abstract:

Does the amount of fat in milk affect the length of time that food coloring swirls when dish soap is added? Who knows? I predicted the colors would spread for a longer time in the milk with a higher fat content. I gathered the materials needed for the project and got down to work making "Tie Dye Milk".

First, I needed 3 shallow dishes, 3 types of milk (all the same temperature), dish soap, cotton swabs, and 4 different colors of food coloring. I got my stopwatch ready, added one type of milk to the dish, added food coloring, dipped cotton swab in dish soap and then into the center of the milk. When the swirling was done, I immediately stopped the stopwatch and recorded my results. I repeated this 3 times for each of the 3 types of milk. I was curious to see which type of milk swirled for the longest and shortest amount of time.

In conclusion, the colors swirled for a longer amount of time in the whole milk than in the 2% or skim milk; on average thirty seconds more than 2% and one minute longer than skim. My research showed that the chemicals in dish soap, called surfactants, greatly reduce the surface tension of liquids breaking down fat molecules. The separation of electric charges (polarity) in milk and dish soap, also contribute to the swirling action. When the colors eventually meet, they begin to form new colors creating the appearance of "Tie Dye Milk".

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

106

Fair Category

P7

Project Number

5036

Title: What kind of water is the purest

Student Name(s): R. Killeen

## Abstract:

My purpose for this project was to see which type of water was the best to drink. My scientific question was "What kind of water was the purest". My Hypothesis was filtered water because it reduces the risk of common impurities like copper and iron and keeps in the nutrients we need to be healthy. For the procedure I first got tablets ready and then put them in the vials filled with the different water and recorded the results. My results came out great; the waters were fine and drinkable. My conclusion was that bottled water had the least impurities proving my hypothesis to be wrong.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

P7

Project Number

5037

Title: Going The Distance

Student Name(s): V. Fioriello

## Abstract:

The purpose of my experiment was to test the performance of three differently priced golf balls and see if the more expensive ones traveled further. The golf balls I used in the experiment were Titleist Prov1 (Expensive), Callaway Diablo Tour (Mid Priced), and Maxfli Super Revolution (Cheap). My hypothesis is that the Prov1 golf ball being the most expensive and top selling golf ball would travel further and perform more consistently than any other golf ball.

The procedures I followed to find the results of my hypothesis: I went to the driving range and hit 10 of each of the differently priced golf balls. I recorded the distance after each shot and graphed the data for each ball type.

The results of my experiment were the prov1 did go the farthest out of the three types of golf balls. The Prov1 ball traveled 200 yards, but I found it to be very inconsistent. The Callaway did shock me because it was really consistent and the average distance stayed in the 130 to 150 yard range. The Maxfli performed terribly, travelling a maximum distance of only 130 yards.

My conclusion is that the Prov1 did travel the farthest. The Callaway's performance was the most consistent because the distance stayed in the same range. The Maxfli was inconsistent and only reached a max of 130 yards. If I were to do this again I would consider the shape of the dimples to see if it affects the distance.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

198

Fair Category

P7

Project Number

5038

Title: Slip Hazard Alarm Robot--H2OhNobot

Student Name(s): T. Zhang

## Abstract:

Many people are injured when they slip on the floor because of water. According to the 2014 Liberty Mutual annual Workplace Safety index, falls on the same level were the second most costly injury and same level falls accounted for 15.4 percent of the nation's total injury burden.

The objective of the project was to prevent people from injuring themselves because of slipping on the wet floor. The non-contact water sensor would be attached on the person's knee or waist. First, we researched about the sensors which can detect water on the floor.

Experiments were conducted to test the sensors. A thermal camera (FLIR ONE) was selected to detect the water because the water having a lower temperature than the environment due to the evaporation. The data was collected indoor and outdoor. The thermal image data was analyzed to find the temperature difference between dry floor and wet floor. The H2OhNobot (H2O Oh No Robot) was built and a smart phone (android) app was programmed to take thermal images, detect water area on the floor in the thermal image (colder area) and make a warning sound..

All in all, this device could save many people from getting injured.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE AT CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

181

Fair Category

P7

Project Number

5039

Title: A Battery That Makes Cents

Student Name(s): E. Ramirez

## Abstract:

In this experiment I am going to create electrical current similar to a battery but with a lower voltage. Alessandro Volta discovered the first electrical battery in 1800. He made a stack of alternating layers of zinc, paper soaked in salt water and silver.

I used the following materials: 4 pennies, 4 nickels, white vinegar, salt paper towel, glass bowl, plate, straw scissors, digital multi-meter, aluminium foil. Using a paper plate you put a small strip of aluminium foil all stacked together in the same order till you have four each.

I noticed when I was doing this experiment the salt-vinegar paper towel were creating the currents because the salt has ions and the vinegar has electrolytes, I also noticed that when you soak the salt-vinegar paper towel, if it's dripping or touching anything, the currents wont make sense and you would have to either dry it or do another one.

The salt-vinegar paper towel were the most important material in this experiment because the salt (ions) and the vinegar (electrolyte) made the electrical currents go up.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT EN EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

134

Fair Category

P7

Project Number

5040

Title: What Quantity of Dimples on a Golf Ball Best Contributes to Flight Distance?

Student Name(s): E. Lebo

## Abstract:

The purpose of this experiment was to determine what quantity of dimples on a golf ball best contributes to flight distance. It was hypothesized that when launching golf balls of varying dimple numbers (332, 352, and 432) the golf ball with 352 dimples would travel the farthest because it provides the best balance between drag and lift. A test was created to launch golf balls using a slingshot as an alternative to a golf club and tee due to the ground being frozen at the time of the experiment. A total of five flight trials were performed per ball, measuring the distance traveled and calculating an average flight distance for each. The results obtained from the experiment demonstrate that a ball with 352 dimples is most likely to travel the farthest in practical use.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

220

Fair Category

P7

Project Number

5041

Title: Wave Generated Beach Erosion

Student Name(s): A. Staggs

## Abstract:

The reason I picked this project is because beach erosion is a big problem in the world. Just last year, in California, a whole side of a cliff fell down into the water. My hypothesis is that the amount of waves or the height of the water will affect the amount of beach erosion happening. The procedure I used was to create a beach out of a paint roller pan and beach sand. A bottle moving up and down in the water was used to create waves. The location of the shoreline was determined after one minute of wave action, and then again after two minutes of wave action. Three trials were done. A headline was also created with aquarium gravel to compare and the wave action was repeated to determine if there was a difference in erosion of the beach using gravel or sand. From this experiment, I found that the more waves that are made, the more sand will get pulled into the water. This experiment helps us better understand beach erosion on a smaller scale. Knowing that different types of beach sediment erode differently can be helpful to scientists who actually study beach erosion in the environment. This information could be valuable in terms of saving lives from erosion, beach planning, and for anybody with beachfront property.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

P8

Project Number

5501

Title: Baking Vanilla Cupcakes with Different Ratios of Ingredients at Different Temperatures

Student Name(s): S. Balotescu

## Abstract:

I decided to investigate baking with different ratios of ingredients, at different temperatures because I have always been very interested in baking, and I wanted to learn how ingredients and temperatures affected cupcakes. My hypothesis was if one bakes cupcakes with different ratios of ingredients at different temperatures, then it will greatly affect the consistency, texture, volume and appearance. To complete this experiment I followed a recipe, one time following the regular recipe, one time for half the temperature and double the time, then I started taking away ingredients. First I took away all the baking soda, and then I used half the correct amount of flour. After that I started combining variables and I baked the cupcakes for half the temperature for double the time, and took away the baking soda, and then for half the temperature for double the time, with half the correct amount of flour. After every trial I recorded the appearance, texture, volume, and consistency, which were all changed drastically any time I changed the recipe. Many times the cupcake didn't even bake all the way through or rise. Throughout this project I concluded that when baking, the tested variables are needed at the right ratios and the correct temperature, because you need a certain heat to trigger the chemical reactions, or the baked good will be greatly affected and not cook properly.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

P8

Project Number

5502

Title: Rusty Steel: How Acids Affect the Rate of Corrosion

Student Name(s): I. Albert

## Abstract:

### Purpose:

This project is designed to determine how various types of acids impact the rate of corrosion of steel wool. My hypothesis is that different types of acid will affect the steel wool differently and therefore cause the steel wool to rust differently. Over time different amounts of rust will develop with continued exposure to acidic liquids.

### Procedure:

Fine grade steel was soaked in different liquids for thirty seconds. The liquids were chosen to cover a wide range of pH values. The excess acid was squeezed out and the steel wool was wrapped around a thermometer. The thermometer and steel wool was placed in a test tube with a stopper. The test tube was then insulated with a cloth towel and placed in a cup to remain upright. Temperature changes were recorded every minute for ten minutes and after 15 minutes. The experiment was repeated for each liquid three times.

### Observations/Data/Results:

The data demonstrated that acids of varying pH values impact the rusting of the steel wool differently. Liquids with lower pH values caused much higher temperature changes during the rusting process. These liquids also caused the steel wool to rust at a higher rate and the overall rust was more extensive.

### Conclusion:

Different types of acids as demonstrated by different pH values cause steel wool to rust to a different degree and at different rates.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

116

Fair Category

P8

Project Number

5503

Title: Examining the impact of window moisture on the strength of a wifi signal

Student Name(s): J. Lema

## Abstract:

The internet is undoubtedly crucial in the lives of people everyday, from checking our snapchat streaks to absorbing information from Google. Therefore, it is logical that people demand to have constant access to the internet. Wireless mobile telecommunications technology (otherwise known as 4G) has filled that role. However, it is not without faults, weather and other obstacles often end up interfering with the signal. Have you ever noticed that your internet connection fluctuates whenever you're inside a car or outside your home with vast amounts of condensed water on the windows? Well chances are, this Science Fair project is going to provide a new perspective on how condensed moisture on windows affects your wifi signal strength.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

127

Fair Category

P8

Project Number

5504

Title: Trash to Gas!

Student Name(s): V. Gomez

## Abstract:

Abstract

Today's society is using large amounts of nonrenewable resources to produce energy, resulting in a diminishing supply of these natural reserves. In order to preserve the nonrenewable resources, we must find an alternative way to produce energy just as efficiently. In my project, I tested which type of manure biomass would produce the most biogas. The experiment was conducted at home. Data was collected throughout the course of three weeks as the six plastic water bottles with differing contents slowly inflated the balloons attached to the top. As a result, I learned that a combination of alpaca manure, mashed bananas, and water produced a greater amount of biogas than the others. The project displays one of the many ways we can produce energy from renewable resources.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM BI EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

244

Fair Category

P8

Project Number

5505

Title: The Fastest Manicure

Student Name(s): H. Allik

## Abstract:

The purpose of this experiment was to find the fastest method to dry fingernail polish. My hypothesis is that if I use the light nail dryer to dry the fingernail polish, then it will dry the nail the fastest. I did my experiment by painting fingernail nail polish on one faux nail, and using each of the methods to see which one dried the nail fastest. I did three trials and checked the nail at thirty second intervals. I noticed two of the methods disfigured the polish and did not dry the nail well. The fastest method was using a blow dryer on the warm setting to dry the nail, and the slowest method was spraying the artificial nail with Orly Spritz Dry (even less than air dry). I was surprised about the results because the Orly Spritz Dry is specifically designed for drying nails, yet it did the worst in this experiment. The Touch Beauty Light Nail Dryer, another method specifically designed for nail drying was second fastest, but still did not do as well as the blow dryer, so my hypothesis was false. The third fastest was air drying, and the fourth fastest out of the five methods was ice water. I will show the data by tables and a bar graph for each trial. I hope this experiment I will help people who struggle with finding an effective, quick way to dry their nails, which is a common problem for many.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

223

Fair Category

P8

Project Number

5506

Title: Solar Cell Power

Student Name(s): G. Garvey

## Abstract:

Around the world, as we use up our natural resources such as oil, coal, natural gas and wood for energy, there is an ever present need for reusable energy. Solar power is an excellent alternative because it is a renewable energy source. My project tests if you can construct a simple solar cell that would register on a multimeter, which is a machine that is commonly used by many electricians to test the amount of electricity in a circuit. By oxidizing a piece of copper, and creating a semi-conductor, I was able to create a makeshift solar cell. By adding salt water it completed a circuit. I tested with a multimeter and alligator clips. The three times I tested it the number of microamperes that resulted were 46, 42, and 39. On a much larger scale, sunlight could provide enough energy to cut down on our reliance on oil and other commonly used fuels as energy sources. This is not something that would work effectively in all places, as the further away from the equator the less sunlight and energy you would get. Also, depending if you are in the Northern or Southern Hemisphere your solar panels should be titled a certain way for the most effective results. All in all though, solar energy is still a great form of renewable energy.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

248

Fair Category

P8

Project Number

5507

Title: Battle of the Bridges

Student Name(s): A. Coleman

## Abstract:

The purpose of my experiment was to find out which bridge was stronger a beam bridge or a suspension bridge. We the beam bridge held 38 on the first trial , the second trial we got 42 pennies , trial three it held 46 pennies. You could see the beam bridge was about to give out because of the weight of the pennies was right in the middle of the the beam bridge and that was the beams weak spot. After the testing was done we got an average and it was 42.

Next we tested the suspension bridge and the bridge held 10 times the amount of pennies the beam bridge held. We tested the suspension bridge ,for the first trail we got 573 pennies. We tested the bridge again and move it over to the other to see if we would get different results. Our results for the second trial was 420 pennies. It still held double the amount of what we expected. Then we tried moving it to the right side of the bridge to see if we would get a different results. Our results from trial three was 502 pennies. After measuring we got an average of 498.

In conclusion the trials of both yielded the result that the suspension bridge is much stronger and can carry a significantly larger load due to support from the cables. The cables provide additional strength and tension to the structure and therefore required higher loads to produce a failure.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P8

Project Number

5508

**Title:** Natural Plastic: Will Milk Plastic Substitutes Biodegrade Faster Than Commercial Plastics?

**Student Name(s):** M. Lee

**Abstract:**

About 15 billion tons of plastic is produced globally every year. More than 100 million tons of plastic debris ends up in the ocean, which threatens the health of marine life. Plastic piles up in landfills and releases toxins into the soil and water, which harms both people and wildlife. I wanted to come up with a solution to this problem, so last year I conducted an experiment to make “natural” plastic made of milk. The purpose of this experiment is to test the biodegradability of my milk plastic against the commercial plastics. I hope to show that instead of using harmful oil-based plastics, we can transition to more sustainable, natural plastic.

To test how different kinds of plastic wear down over time, I tracked the weight loss of two kinds of milk plastic and two kinds of commercial plastic when exposed to different environments. Samples of whole milk plastic, 2% milk plastic, floor mat plastic, and bottle plastic into ocean water (Hydrolytic Degradation), soil (Land Degradation), and sunlight (Photodegradation) which mimics where discarded plastic ends up. I hypothesized that the milk plastic substitutes would biodegrade at a much faster rate than the commercial plastics in each test. The experimental results support my hypothesis because the milk plastics lost anywhere from 8% to 91.5% of their total weight, whereas the commercial plastics had negligible degradation. Using biodegradable milk plastic that has the characteristics of commercial plastic will prevent us from depleting our resources and causing further ecological damage.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P8

Project Number

5509

Title: The Effect of Heat on Static Electricity

Student Name(s): Y. Humphries

## Abstract:

It is hypothesized that if statically charged balloons are heated to a starting temperature of 48.889 degrees Celsius the static electricity will begin to leave the balloons. The experimentation process began with materials like two 106cm strings that hung the balloons from the doorsill parallel to each other, after the balloons were weighed. They then were equally charged with static electricity from the felt, cotton, acrylic, polyester, and Styrofoam. They were then measured for the amount of charge in them before the application of heat and after the charge, with an equation, and each time after heat was added on.

The balloons repelled each other greatly after each charging before any heat was applied, as is recorded as so in every trial. After each temperature was applied to the balloons they repelled less from each other and space between them decreased. The hairdryer did not reach a high enough temperature to entirely discharge the balloons. In the trials, the balloons never became totally parallel from each other, like they were before static charge. The static was low after the highest temperature of 93.333 degrees Celsius. The balloons looked very different compared to amount of static electricity in them before the applied heat. The hypothesis was correct due to the visible and recorded lesser amount of Static electricity in balloons after the applied heat, therefore if heat is applied to the balloons at the starting temperature of 48.889 degrees Celsius the static electricity will begin to be discharged from the balloons.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

223

Fair Category

P8

Project  
Number

5510

Title: Inexpensive and Light Jackets for Expensive and Bulky Jackets

Student Name(s): A. Kongani

## Abstract:

The purpose of this project is to see if I can come up with an inexpensive and lightweight jacket to keep people as warm as or warmer than expensive, bulky jackets. I decided to use red sweatshirt fleece with different coatings on the sweatshirt fleece that I thought could insulate from heat loss. The substances that I used were silicone caulking and elastomastic rubber. I used sweatshirt fleece with nothing on it as my control group. I glued the fleece to the 3 water bottles. Next I coated one of the water bottles with silicone caulking and coated another water bottle with the elastomastic rubber. I then got a 5 liter white bucket and filled it up with ice and water with a constant temperature of 5 degrees Celsius. I filled the water bottles with water and put them in the bucket. The temperature of the water bottle was between 20°C. Then I measured how much the temperature dropped over 5 minutes. After all the trials, I recorded the data and came to the conclusion that the silicone caulking insulated the water bottles the best from heat loss. The elastomastic rubber did not differ much the control group. Therefore, if we use silicone in jackets it will keep us as warm as or warmer than a normal jacket of the same thickness.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

140

Fair Category

P8

Project Number

5512

Title: Which water bottle keeps the water coolest?

Student Name(s): K. Hunt

## Abstract:

The water bottle experiment will help everyone know what water bottle to use when they need their water cool for a long time. Which water bottle will keep water coolest? My hypothesis is if I test out a plastic water bottle, an aluminum water bottle and a Gatorade water bottle, then the aluminum water bottle will keep the water the coolest because online it says that is the best type to use. The procedure will be to fill each different water bottle and put in fridge for thirty minutes and then check the temp. and wait another thirty minutes and see which stayed the coolest. The result was that the aluminum kept the water most cool, then was the plastic bottle, and Gatorade. All in all my hypothesis was correct because the metal water bottle kept the water most cooled.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

122

Fair Category

P8

Project Number

5513

**Title:** A study on the most effective method for the extraction of essential oil from citrus.

**Student Name(s):** A. Williams

**Abstract:**

This project is about manipulating orange peels, in order to extract limonene (C<sub>10</sub>H<sub>16</sub>). Limonene is a colorless, liquid hydrocarbon with numerous uses. In this study, limonene is extracted from a citrus (oranges) using differing methods such as solvent extraction, distillation, cold pressing or expression, and conclude which method provides the greatest yield of oil. The standard limonene samples and the samples produced from my experiment, were run through the gas chromatography mass-spectrometer. This is a form of chromatography to separate compounds that can be vaporized without decomposition. This is extremely effective because of its ability to vaporize all other compounds besides the limonene, and find the mass of the limonene and other compounds combined with it, in the samples of limonene.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

241

Fair Category

P8

Project  
Number

5515

Title: Efficient Non-Toxic Dye Sensitized Solar Cell

Student Name(s): E. Haddad

## Abstract:

Dye sensitized-solar cells are safe, green, and efficient technology used to harvest the Sun's energy. This project tested the performance of dye-sensitized solar cells under different light intensities and colors, and the effectiveness of dyes on the performance of photocells. Higher light intensity, and sunlight at 12:00 noon allowed the cell to produce the most current. Beet dye stained cell proved the most effective under lightbulbs.

An improved procedure was developed to build 2x2cm dye-sensitized solar cells. Dyes extracted from Raspberry, Blackberry and Beet were tested. The cells effectiveness in producing a current was measured in mV units with a digital Multimeter. The intensity of the light bulbs tested were 40 W, 75W, and 100W white light bulbs and 4W LED bulbs. Daylight produced the most current in the Blackberry cell. Interestingly, a linear relationship between the light intensity and the produced current was found. The Blackberry cell had the highest efficiency under the sun light, presumably due to its great number of Anthocyanin Pigments. It proved the most effective by producing up to 378.1 mV Win daylight. On the other hand, the beet cell was found most effective under 100W daylight lamp, reaching a maximum of 321 mV. Furthermore, the beet cell had higher current in the LED bulbs than the blackberry cell. These results provide proof of concept for the application of dye sensitized solar cells as being efficient tools for harvesting energy from the sun.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT EE CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

177

Fair Category

P8

Project Number

5516

Title: Does Brand Matter?

Student Name(s): D. Gibbs

## Abstract:

The objective of my study was to learn if brand matters when it comes to toothpaste and its effectiveness. I also wanted to find out which brand would work best when it came to whitening teeth. My hypothesis was that brand does matter and Crest 3D White would whiten teeth the best.

I purchased 1x2 in ceramic tiles. Mixed one teaspoon of coffee for every 4 ounces of hot boiling water. Placed tiles in bowl with hot coffee. I let tiles soak in coffee for 24 hours. I brushed each tile for 2 minutes with a toothbrush. I repeated it 24x to simulate 2 weeks of brushing.

Arm and Hammer Advanced White was the best whitening toothpaste. It was also the most expensive brand purchased. But its close competitors were the least expensive brands. Dollar Tree Sensitive and Walgreens Radiant White, each priced at 1.00 and 1.99.

In conclusion I found that brand does not matter because Dollar Tree Sensitive White came in second and Walgreens Radiant White came in third. My hypothesis proved wrong. Brand does not matter.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

240

Fair Category

P8

Project Number

5517

Title: Crystallization Creations

Student Name(s): N. Daniels

## Abstract:

Have you ever wanted to visit the largest cave of crystals in Chihuahua, Mexico? Have you ever wondered how crystals grow or get so big? Well, the project that I have can show you. My project can simulate the growth of crystals and show you how crystals are made. Using ammonium monophosphate basic( $\text{NH}_3\text{H}_2\text{PO}_4$ ); that can represent the minerals in the earth. Adding water to the powdered substance causing the solution to mix and the humid heat of the cave causes the crystals to grow.

The reason I chose this project is because of a TV show I watch called Bey Blades. Crystal fragments were found by humans and they changed the crystals into something that all humans buy and use for battles. It inspired me to want to learn more about crystals and to learn how they grow.

I heated the solution, to simulate the environment where the crystals grow. I have tested my hypothesis on five different solutions; Amber, Citrine, Ruby, Emerald and quartz and recorded different results on each mock crystal. My results included if crystallization occurred or not, how large the crystal grew after each cycle(3 days). After I kept the crystals away from the sunlight, to represent the darkness in the cave, I saw immediate results. (within 24 hours) When I finished the project, I found that my hypothesis, that each solution would give me different results due to the different mineral, was correct.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

222

Fair Category

P8

Project Number

5518

Title: Magnetic Power

Student Name(s): F. Thomas

## Abstract:

Abstract:

Power is a necessity in people's lives today. In the future our current power sources; petroleum, natural gases and coal may eventually run out, forcing us to explore other methods to create electricity. This experiment will explore a new way to create energy. Magnets could very well be the key to accomplishing a new way to create energy in the future. Using electromagnetic induction as a model, I intended to explore the possibility of generating electricity using the perpetual motion theory. I took DC fans, attached rare earth magnets to the blades, and used a separate magnet to perpetuate the magnets around the center point of the fan. This should have caused the fan to spin and generate a current. To-date none of my tests created a current. My experiment is composed of many different builds. My fan bases ranged from 122mm to 60mm with a variety of differently-sized neodymium magnets. The fan would not spin by itself, no matter how I built it. This was due to a term called cogging. Cogging is the neutral position that magnets find in between DC motors. There was no way to get it to work unless I could get passed this cogging. One of the things I would do differently is to use slimmer magnets on a slimmer, neater fan model.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

P8

Project  
Number

5519

Title: Extinguish-Bot

Student Name(s): W. Yuan

## Abstract:

Every day in the United States, 1,500 homes burn down and over \$15 billion dollars are lost every year due to house fires. Better methods to detect and fight house fires are therefore needed. The objective of this project was to research, design, and construct a model robot that can demonstrate that a robot can perform all the actions needed to detect temperature, move towards a fire, and extinguish it. To accomplish this, a robot prototype capable of detecting temperature, moving forward, and pressing down on a container cap was designed, constructed, programmed, and tested. The body frame of this robot was 3D printed and an Arduino Uno was used to control the robot. A servo and a temperature sensor was also attached to the robot and wired to the Arduino, which was programmed to demonstrate that the robot was capable of meeting the objective. To test the prototype, the robot was programmed, using Arduino IDE, to move a certain distance as well as have a servo press down on a container cap when the temperature sensor detects a certain temperature. Other sensors including the gas sensor and flood sensor were tested so that the robot could exchange sensors which let the robot able to perform multiple tasks. In the future, other sensors could be added to detect other hazards or dangers. This robot has the potential to make our home safer and more secure.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CS EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P8

Project Number

5520

Title: Does the Surface Really Matter?

Student Name(s): F. Kosior

## Abstract:

Ever wonder which surface of grass provides the least amount of force needed to kick a soccer ball? The purpose of my experiment was to find how much force is needed to kick a soccer ball so that the ball will have the same velocity on three different surfaces; short grass, long grass, and wet/long grass.

For my experiment, I built and used a wooden pendulum adding different weights, which acted as the consistent force. I tested seven different weights for three trials on each of the three surfaces.

The results showed that the short grass required the least amount of force and the three surfaces got the same amount of velocity when the short grass needed no weights added. My hypothesis was supported because the short grass needed a lesser force compared to the long grass and wet/long grass. My experiment also supported Newton's Laws of Motion. The ball was in motion and would stay in motion unless an outside force (rolling friction) acted on it. For the second law, the more weights I added to the pendulum, the greater acceleration the ball had proving  $\text{Force} = \text{Mass} \times \text{Acceleration}$ . The largest error in my experiment was due to the ball bouncing around a lot causing a steep decrease in acceleration for the short grass trials.

In final analysis, each surface needed different amounts of force acting on the ball to achieve the same velocity, with short grass needing the least and wet/long grass needing the most.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

198

Fair Category

P8

Project Number

5521

Title: Silicone-filled Drumsticks can Reduce Vibration Impact in a Drummer's Hand

Student Name(s): S. Todeasa

## Abstract:

Many drummers have wrist injuries, such as carpal tunnel syndrome, because of long exposure to vibration from drumstick impact force. I believed that filling a drumstick with a shock absorbing material would help reduce vibrations. After my background research, I filled one drumstick with spray insulation foam, filled another with silicone, and left the last stick normal for my control group. My hypothesis was, "If I fill a drumstick with silicone or insulation foam, the vibration of a drumstick when beating a drum will be reduced." I built a device that hits each drumstick with an equal force, and I used a vibrometer to measure how much each drumstick vibrated at the hand area. The device is a pendulum that swings from a 60° angle and hits the drumstick, which is clamped to a certain spot. The results were not as expected, because the insulation spray-filled stick actually vibrated more than my controlled normal stick, but my silicone-filled drumstick had a big difference from my controlled stick. The silicone stick had very little vibration compared to the others. This means that filling drumsticks with silicone would reduce the amount and severity of injuries related to drumming.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

120

Fair Category

P8

Project Number

5522

Title: Tidal Times

Student Name(s): M. Arvidson

## Abstract:

In my introduction I explained why a mathematical model was more viable than a physical model and why creating a physical model that was reliant upon the same forces that the actual tides were was essentially impossible. In my methods section I explained where I found my local tidal data and the supplies that I used to create my equation. In my results section I explained how my equation found the estimated tidal heights and in the discussion section I explored how accurate my equation is and how accurate it could be. Lastly, in my conclusion section I reviewed all of the complex concepts that I learned about while making this model like gravity in relation to the Earth's rotation.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

P8

Project Number

5523

Title: Tracking the movements of a human being.

Student Name(s): E. Lavi

## Abstract:

**Background:** Falling and loss of consciousness are a major health risk for seniors. Currently, there is no way to detect and report such an event. Current device technology relays on its user to trigger an alert manually to receive appropriate help.

**Methods:** A portable device (pocket lab, Myriad Sensors) with the ability to measure changes in its position, orientation, and movement was attached to a model human, and tested in various scenarios. Compared were a sequence of situations replicating daily living activities and falls to identify unique parameters that will aid in differentiating between these events.

**Results:** Collected and performed were 52 experiments. Both acceleration scalar ( $m/s^2$ ) ( $32 \pm 16$ ,  $5 \pm 2.8$   $p=0.005$ ) and angular velocity (degrees per second) of the Y ( $-181.98 \pm 60.852$ ,  $-46.4 \pm 4.4$   $p=0.002$ ) and Z ( $-200.98 \pm 104.956$ ,  $-48.52 \pm 10.784$   $p=0.006$ ) axis were able to differentiate between an abrupt fall and daily activities. Furthermore, the qualitative analysis for acceleration scalar indicates a specific pattern; immediately after the fall, the acceleration decreases to 0 and remains static. This lack of change was most likely produced by lack of movement. None of the daily activities produced a similar pattern. The pressure altitude sensor's accuracy limits its ability to predict changes.

**Conclusion:** Combining the data collected by the gyroscope and accelerometer can predict sudden falls. Incorporating advanced sensors in devices like life alert, heart rhythm monitors and pacemakers could not only predict falls but may also identify and respond to specific activities.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P8

Project Number

5524

Title: Oobleck

Student Name(s): C. Macci

## Abstract:

In my Science Fair experiment, I tested adjusting the ratios between water and cornstarch of Oobleck, a non-Newtonian fluid to see how they would act upon wooden cubes. I predicted the more water added the less force the Oobleck would have and the more cornstarch added the more force it would have. My independent variables are ratio of water to cornstarch and the block sizes. My dependent variable is the time it takes the blocks to pull out of the Oobleck. The outlier of my data was will the 1/2, water to cornstarch ratio. The three blocks took the longest to pull up. For the setup, I mixed the Oobleck in a container (the same container every time) and taped a ruler marked with a line so the pulls would be consistent. I tested each block and timed them on a phone timer. Some problems were as I added more cornstarch and less water, the mixture wouldn't mix well and stayed powder. Another problem was the spring scale setup I originally had planned didn't work and I winded up using a rubber band with the scale. In the end, the spring scale was pointless because it only measured to force of the rubber band. Doing this experiment helps explain the difference in the force of thinner and thicker substances. The non-Newtonian aspect of the fluid didn't have much of an effect on the cubes because the cubes pulled up slowly. This was my overall Science fair experiment.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

248

Fair Category

P8

Project Number

5525

Title: Waterbot

Student Name(s): J. Fischman

## Abstract:

The average distance that women and children walk to get water in Africa and Asia is 3.7 miles. Getting water often keeps them from attending school or working. The water they collect often carries bacteria and protozoa. Exposure to this unsafe drinking water is one of the leading causes of cholera and other dangerous diseases.

The objective of the project was to design and prototype a robot that can drive to a destination, collect water, filter it, and drive back to the starting point. A prototype was designed and engineered using an Arduino microprocessor, a motor shield, a 3d printed water pump, and other components. The robot was designed and programmed to travel to its destination, lower its arm into the water, and activate the water pump. The goal was for the pump to pull water through the filter, where it is made potable, and then send it to the container, where it is stored. Once it has collected the water, it drives back to the starting point.

The robot prototype was tested. It was successful in that it could travel to its programmed location, stop, lower its arm, activate the pump, raise its arm, and drive back to the starting point. However, the pump was unsuccessful. It could not create enough suction to pump the water.

The overall robot prototype was a success, although future iterations would include a working water pump. With further developments, the Waterbot could help millions of people gain access to clean water.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CS EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

119

Fair Category

P8

Project Number

5526

Title: Getting the most out of your battery

Student Name(s): C. Ivers

## Abstract:

I did this experiment to see if I could make batteries last longer. My question is does the temperature of a battery affect how long it lasts. My hypothesis was that if batteries are made hot or cold they will not last longer than a room temperature battery. To do this I placed batteries on the counter, in the freezer, and right next to a fireplace and compared how long they lasted. I found that room temperature batteries last longer than hot or cold batteries. If you want to get the most out of your battery then you should keep it at room temperature. My hypothesis was correct in saying hot and cold batteries last shorter than room temperature.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P8

Project Number

5527

Title: Hoverboards

Student Name(s): A. Alibali

## Abstract:

I wanted to make a real hover board and make it so it does not emit any form of air pollution. First I started to make the requirements for my prototype. Then I brainstormed a list of prototypes. After I chose a prototype that meets all my requirements, I started to gather the materials for it and I was ready to build. With my father I measured the board then I marked where the magnets should be placed, while I was doing that my father was getting the hot glue gun and the magnets. When I finished and the hot glue gun was ready I got the magnets and started placing them and hot gluing them to their needed location. After placing all the magnets my father drilled four holes and put four copper bars in them so it could remain stationary. When I was finished building my hover board I had a huge challenge ahead, making sure it does not emit any form of air pollution. This was complex because I barely found any information on how to test this, so instead of testing it I decided to look at how magnets are made and check out the six common forms of air pollution. Once I was done checking the whole formula of a neodymium magnet and comparing it with the six common forms of air pollution. I ruled out that they have no connection so that means the hoverboards did not emit any form of air pollution.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

P8

Project Number

5528

Title: Is There a Tapiolite Vein in Connecticut?

Student Name(s): G. Reiter

## Abstract:

In 2013, a sample of tapiolite was found in Hale Quarry, Portland Connecticut. Tapiolite is a mineral that is scarcely found in Connecticut. Being identical to columbite and tantalite in chemical composition, the tapiolite sample was initially identified as columbite. Upon proper identification as tapiolite, a question was formed: Did this sample come from a native tapiolite vein? In order to answer this question, Hale Quarry and two other quarries which were known to have tapiolite, Koss Pit in Wyoming and the Albera Massif in France, were researched. When comparing the lists of minerals in the three quarries (all of which are comprised of granite pegmatites), it was found that: they each had many of the same minerals, variants of tantalite and columbite, hafnian zircon and Nb-Ta oxide minerals (minerals that when in a granite pegmatite, denote a special environment in which tapiolite can grow), and several other elements that are similar to tapiolite. The existence of many of the same minerals in the three quarries denotes that similar conditions exist in them. From the presence of hafnian zircon and Nb-Ta oxide minerals in Hale Quarry, it is known that the pegmatite is right for the formation of tapiolite. Finally, from the existence of tantalite, columbite, and other similar minerals in Hale Quarry, it can be deduced that the proper elements exist for the formation of tapiolite. It can be concluded that because the conditions are right and the proper elements are there, there is a tapiolite vein in Connecticut.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

P8

Project Number

5529

Title: Soiled Soil

Student Name(s): J. Akin

## Abstract:

The pollution of water and soil can have a major effect on the health of humans. One example of ground water contamination begins when ground water comes in contact with contaminants produced by the leakage of chemicals from gas stations. Research states that one gallon of gasoline can contaminate more than one million gallons of water, making it unfit to drink. Additionally, if the soil is contaminated, the crops growing on that soil are now contaminated too. This pollution of soil is making huge areas of land, once fertile, become hazardous to the health of humans.

To determine the level of contamination at gas stations compared to the surrounding area, I collected soil samples from each. I tested and compared the PH values to determine if the results showed a higher PH value at the stations than the surrounding areas. My results were conclusive showing a higher PH in the samples collected at the gas stations.

Knowing my results are that gas stations do pollute the soil, appropriate steps should be followed to reduce the incident rate. The gas station's lot should be free of damage, so that in the case of an accidental spill or leak the gasoline is not allowed to seep down into the soil. When a spill occurs, EPA guidelines should be adhered to for proper clean-up. Finally, when a gas station leaves a site, the soil requires remediation, which is the process of removing the pollution and contaminants that infected the soil.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P8

Project Number

5530

Title: Thermal Insulative Properties of Various Lightweight Concrete Aggregates

Student Name(s): A. Sadlowski

## Abstract:

With ever increasing awareness of energy conservation and resource protection, materials used in construction must protect these as much as possible. Concrete is the most widely used building material in the world, so improving its formulation to protect these resources could have a very large impact.

This project's Hypothesis is to evaluate various materials which, when used as a substitute aggregate in concrete, will provide greater thermal insulation while lightening the weight of the finished product.

The process involved mixing batches of concrete. They were then thermally tested by placing them above a halogen bulb, which served as a heat source. The surface temperature was tested at the start and at 30 minutes. I utilized several substitutive aggregates including cork, sunflower seeds, oyster shell, polystyrene foam pieces, walnut shell and wood pellets, with the later two mixes failing to create usable concrete.

The results were then calculated by determining the weight ratio  $r=s/c$ , where  $s$  = sample weight and  $c$  = the conventional aggregate (stone) mix weight. I then determined the insulative factor  $i=d/r$ , where  $d$ = temperature delta, and  $r$ = weight ratio. The results showed that standard concrete had a  $i$  of 41, oyster shell 47, cork 65, foam 70, and sunflower 76. I determined that foam is the best because it was nearly both the lightest material and the best thermally, and is also a recycled material made from waste packing foam. Further experimentation is advisable to determine the optimum mix ratio and foam piece size.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P8

Project Number

5531

**Title:** The effects of different flours on the breaking point and decomposition rate of an edible spoon

**Student Name(s):** S. Chinthak

**Abstract:**

In this project, the issue of plastic pollution was addressed. Plastics have been accumulating in landfills around the world for decades, taking centuries to decompose. Seeing that there has been no substantial decline in the plastic waste of our world, this project was engineered. In this project, an edible spoon was created as an alternative to a disposable plastic spoon. The spoon was made out of a chosen flour, cornstarch, powdered sugar, cinnamon, and water. The three flours used in this experiment were wheat flour, rice flour, and sorghum flour. After the spoons were created, the breaking point and decomposition rate of each spoon was tested. To test the breaking point, the spoons were put into a crusher where weight would be placed on the spoons until they broke. To test the decomposition rate, the spoons were placed in water for up to 24 hours. These tests were specifically chosen to anticipate if the edible spoons were durable and eco-friendly. Following the completion of these tests, it was seen that an edible spoon made out of wheat flour had the highest breaking point and an edible spoon made out of sorghum flour decomposed the fastest. These results show that wheat flour and sorghum flour would be best to use when making an edible spoon. These spoons are both important to society and to the scientific community because they can change the amount of plastic humans throw away on a daily basis, therefore reducing the amount of plastic in landfills.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

162

Fair Category

P8

Project Number

5532

**Title:** The Effect of Biuret Test as a reagent to egg proteins in raw, cooked and baked eggs that cause allergic reactions

**Student Name(s):** A. Piraneque

**Abstract:**

This project studies the effect of biuret test as a valid reagent on egg proteins in raw, cooked, and baked egg that can cause allergic reactions to about 15 million Americans who suffer from egg allergies. Biuret test was added to small portions of raw, cooked, and baked egg whites in search of proteins. It was expected that the biuret test would find proteins and cause a violet color reaction. Any reaction was compared to the control of an equal amount of biuret test in distilled water. However, due to the lack of a spectrophotometer, the concentration of egg proteins in each reaction could not be found. It is hoped that this is a beginning of further study into reagents that could detect specific egg proteins in common foods. Furthermore, one could anticipate an eventual portable and easy-to-use device that delivers a reagent on a food containing egg proteins, alerting those who suffer from egg allergies to avoid such food.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CH ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

233

Fair Category

P8

Project Number

5533

Title: The Best Conductor

Student Name(s): L. Walton

## Abstract:

The problem I am investigating is what type of wire conducts electricity the best? My hypothesis for this experiment is: If copper wire is used in a circuit, then it will conduct the best and have the lowest resistance. I used several different tests to determine which wire had the highest level of conductivity as well as the lowest resistance. I did four tests determining which material has the highest level of conductivity. In the first test I used a multimeter to determine the resistance of the three wires. In this test I found that the copper had the lowest resistance and the alloy had the highest resistance. In the second and third tests I used a simple circuit to find the level of electrical conductivity. The first version of this test had too large of a resistor. So in the second test, I used a smaller resistor. In these tests I found that the alloy conducted the most electricity. In the last test I used the Wheatstone Bridge circuit to compare the wires. This was the most reliable circuit because it doesn't rely on the amount of power being put out by the battery. In this test, I found out that copper had lower resistance than steel and alloy, and steel had lower resistance than alloy. In conclusion, the copper had the lowest resistance and alloy had the highest level of conductivity.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

210

Fair Category

P8

Project Number

5534

Title: Boyle's law

Student Name(s): J. Spell

## Abstract:

This experiment is a modernized version of Robert Boyle's original experiment. This law demonstrates the difference between volume and gas using a syringe, two wooden blocks, and weights. This is a simplified version of Boyle's very complex experiment.

I experimented to find the relationship between the volume of gas and pressure when the gas is held at a constant temperature.

I used a syringe and two wooden blocks to hold it in place. To substitute for pressure I used weights. I set the air to 40 ml of air in the syringe and placed weights to see how it affected the volume of the air in the syringe.

I found that as the pressure increased the volume of the gas decreased when the gas was held at a constant temperature. In all three of my trials it displayed this. The data was all very similar and didn't contain any outliers.

After conducting my experiment, I have concluded that I have achieved my objective to demonstrate Boyle's law. Using an independent variable, the pressure placed on the syringe, and a dependent variable, the volume of air in the syringe. I only changed the independent variable and kept all my scientific instruments and measurements accurate. This led my experiment to become successful.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

266

Fair Category

P8

Project Number

5535

Title: Password Security How easily can your password be hacked?

Student Name(s): K. Adcock

## Abstract:

This project investigated characteristics of strong passwords and methods for cracking them. Password security affects personal and financial safety. Banking, shopping and email accounts can be accessed from mobile devices. Careful password selection maximizes the time it takes a hacker to decode the password.

The original idea came from Science Buddies, with some modifications. PyCharm with an integrated text editor and Python Console was a better program choice for a beginner, than Python 3. Four methods for hacking passwords were tested and evaluated. Multiple passwords were used to test each method. Method-1 used passwords with only numbers. Method-2 assumed passwords included digits, and uppercase/lowercase letters. Method-2 was modified to reduce the time to decode passwords by breaking the password space into multiple sections and running multiple programs. Method-3 searched for passwords from a dictionary of common passwords. Method-4 assumed the password was made up of two words (from the dictionary) connected with one of 26 punctuation marks.

Results showed fewer than  $10^n$  tests are required for Method-1, where n is the number of digits in the password. Method-1 only works for passwords containing digits. Number of tests required for Methods-3&4 depend on the number of words in the database. These methods are not successful unless the database contains the password. Methods-3&4 took longer to run than Method-1, but the total time for these methods was less than 2 minutes. A five character alphanumeric password took more than 22 hours to decode(Method-2). Stronger passwords have more characters and multiple character types.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS MA AT

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

P8

Project  
Number

5536

Title: Induced Levitation and Movement Applying Lenz's Law

Student Name(s): M. Luzzio

## Abstract:

I demonstrated levitation and movement by applying Lenz's Law. My hypothesis stated that if a ring of neodymium magnets mounted in a circle are rotated against a metal plate, that is metallic and nonmagnetic, then the magnets will repel the nonmagnetic metallic plate causing the plate to levitate away and move away from the magnets. Six neodymium magnets were mounted in a circle on a round plastic disk that can be rotated. A nonmagnetic metal plate was held close to the rotating magnets. The rotating magnets caused electrons to move in the nonmagnetic metal plate. This caused the metal plate to become magnetic. This induced magnetism caused repulsion between the plate and the magnets, and levitation was observed. I observed that a minimum speed was needed to rotate the magnetic disk to induce magnetism. The faster the magnets rotated, the stronger the induced magnetism and more levitation was observed. Maximum levitation reached about 3/4 inches. When the round metal plate was mounted on an axel, rotation occurred, so movement and levitation was observed. The disk rotated the same direction as the rotating magnets. The faster the magnets rotated, the faster the disk rotated. When the plate was put on wheels, it moved away from the rotating magnets in a straight line. To better demonstrate movement, I attached a moving track to the axel of the aluminum disk. The experiments that I performed supported my hypothesis. My experiment successfully applied Lenz's law to cause levitation and movement.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH EE EN

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

254

Fair Category

P8

Project Number

5537

**Title:** Developing a Prototype Atmospheric Water Generator System as a Clean, Safe and Sustainable Water Source

**Student Name(s):** J. Oei

## Abstract:

Safe water is the basis for human health and wellbeing and the foundation to healthy economies and communities. Each year, > 2 million deaths are attributed to unsafe water, sanitation and hygiene practices. 90% of these deaths are among children, mostly in developing countries. 780 million or 1 in 9 people on Earth lack access to safe drinking water. Sustainable, cost-effective solutions to provide clean and safe water for everyone must be developed.

A solar powered Peltier and evaporative coil AWG systems were built. A solar panel was connected to a rechargeable battery that in turn was connected to a dc to ac inverter. Each AWG system was connected to the inverter. Water was collected in a reservoir and then drawn through a water filtration system. The system is completely sustainable by virtue of the use of solar power as its energy source.

For each AWG system, the water generation rate (ml/hr; glass/hr) was measured for various levels of humidity. At 70% humidity, a 1000W Peltier and evaporative coil AWG system generated 2.81 and 7.21 glasses of water per hour respectively.

An H2O OK Kit was used to test for key contaminant levels at both the pre-filter and post-filter positions. This includes Nitrite, Nitrate, Copper, Iron, Total Coliform Bacteria, Pesticide and Lead. In addition, samples were sent to an independent laboratory (KAR) where a full contaminant test was performed on 97 various contaminants. All tests showed the water obtained from both systems were devoid of any contaminants and deemed potable.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT EM

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

P8

Project Number

5539

Title: Unsupervised Machine Learning for Text Categorization

Student Name(s): A. Pourkavoos

## Abstract:

Institutions such as libraries, museums, and universities have large databases of unsorted text documents containing terabytes of useful information which is very difficult to retrieve. This computational linguistics project utilizes an unsupervised machine learning model which is able to automatically categorize text documents by content and therefore can aid in the retrieval of a desired text. This program accepts as input a corpus, i.e. a database of text files, and outputs labels categorizing the documents. The algorithm was tested on the Manually Annotated Sub-Corpus (MASC), a publicly-available database of 390 documents containing 500,000 words. The automatically-generated labels were compared with the manually-generated categories of the MASC. The program analyzes word frequencies in the documents and generates document vectors, whose tips represent points in a high-dimensional space. The number of dimensions of this space equals the number of distinct words in the corpus, because each coordinate of a given document's vector corresponds to the frequency of a word in that document. These vectors are subsequently separated into 2 to 9 clusters using the k-means algorithm. The program was able to successfully identify and sort out large portions of spam messages, newspaper articles, and emails in the corpus. These results indicate that a program consisting of only 75 lines of Python code is able to sort through 8 megabytes of text in 42 seconds with significant accuracy. In the future, refinements of this algorithm would allow it to categorize larger databases more accurately.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MA CS AT

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

P8

Project Number

5540

Title: How does the fill density of a flying disc effect how far it flies?

Student Name(s): B. Nordlinger

## Abstract:

I have been playing frisbee for about a year and a half now, and an issues I deal with every time I play is wind drop, that cause the frisbee to sink in an instant. One day I thought, can I make a frisbee that reduces wind sink? I did a bit of research and decided the closest thing to fixing this was fooling around with the fill density. This was when my project was born. Then I needed to do my experiment. I had to 3D print one frisbee with a zero percent fill density, 3D print one frisbee with a fifty percent fill density, and 3D print one frisbee with a one hundred percent fill density. I designed the frisbee launcher using SketchUp. After that I had to build frisbee launcher. Then the testing. I had to launch each frisbee three times and measure their distance each time. I rounded to the nearest yard each time. The hollow frisbee flew 9 yards, 12 yards, and 15 yards making the average distance 12 yards. The 50% fill density flew 12 yards, 14 yards, and 16 yards, making the average 14 yards. Finally the 100% fill density one flew nine yards every time so the average was nine yards. So in conclusion the 50% frisbee flew the farthest. I believe this happened the 50% fill density was perfect because it was heavy enough to fight off the wind, where it was still light enough to float.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN PH AT

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P8

Project Number

5541

Title: How Do Chemicals Such As Potassium Permanganate Affect Water Filtration?

Student Name(s): S. Abbineni

## Abstract:

My project shows how traditional home water filters are not efficient. This is because they take a long time to filter water which goes through them. They are also limited by the fact that water flow is slow, taking a long time for the water to be filtered. To solve this problem I created a new water filtration system. I first compared two different water filtration techniques to find which one was most reliable. I did this by taking 500 milliliters of water at 40 degrees Fahrenheit and filtering it using potassium permanganate and regular water filters. I chose to use a regular water filter which filter the water in 3 minutes 52 seconds. Then, I improved the filter by making more holes for the water to flow through and creating a reservoir which would let the water flow through the filter faster. The reservoir was made using plastic bottles and would increase water flow. I was also able to improve the lifespan of the filter by mounting a small mesh in the water reservoir. This strained out big particles in the water which could have damaged the water filter. In the end, the new filter was able to filter 500 milliliters of water in just 2 minutes 59 seconds, almost a minute faster than the traditional household filter. Not only was the new filter design able to filter water faster than the traditional household filter, it was able to have a longer lifespan, lasting over 4 months in use.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH BI PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

218

Fair Category

P8

Project Number

5542

Title: Air Tunnels: Generating Wind Power in Low-Wind Areas

Student Name(s): A. Meehan

## Abstract:

The purpose of this experiment is to see if air tunnels can be used to increase wind velocity and create more electric power from wind turbines. Wind turbines are used to convert wind to electrical energy. They are an inexpensive and clean source of energy. However, a difficulty with using wind turbines is that the amount of electrical energy produced depends on how fast the wind is moving. Land areas that do not have high wind velocities will not be able to use their wind turbines to produce much electrical energy. In my experiment, I used a 20 inch box fan to produce wind for a small wind turbine. I also used a digital voltmeter (a device used to measure the amount of electricity) to measure the electricity produced by the turbine. I then used three air tunnels of different shapes. Two of them, I built using cardboard and duct tape. For the third tunnel, I I taped the tunnels to the fan, turned on the fan and measured how much electricity each one produced and recorded my results. The results do not support my original hypothesis. The circular air tunnel was able to produce the most voltage from the turbine. If engineers wanted to use wind turbines in low wind areas, they could build circular wind tunnels.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE EE EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

P8

Project Number

5543

Title: How does weather vary across the city?

Student Name(s): J. Cayer

## Abstract:

The purpose of my experiment was to investigate how weather patterns vary across the city of Shelton. Four types of weather data was gathered over a two week period, temperature, humidity, atmospheric pressure, and wind speed in two locations on opposite ends of Shelton, Huntington and Long Hill. It was hypothesized that due to elevation, the Huntington portion of town would have cooler temperatures and greater wind speed, while the Long Hill area would have greater humidity and greater atmospheric pressure.

In order to collect data two identical weather stations were constructed. Each weather station consisted of a Raspberry Pi (mini computer programmed to collect data), humidity,, atmospheric pressure and temperature sensor, and a homemade anemometer. Stations were placed in the Long Hill and Huntington areas of Shelton. Weather data was wirelessly uploaded ThingSpeak (a service to display live data) every 10 minutes, over 14 days.

The preliminary data supports all of my hypotheses. The temperature was an average of about two degrees Fahrenheit cooler in Huntington than in Long Hill. The humidity was about 4.2% greater in Long Hill than in Huntington. There was more atmospheric pressure, an average of 3.03 hPa higher in Long Hill than in Huntington. The wind speed was about 0.04 RPMs greater in Huntington than Long Hill.

In conclusion, Huntington was colder and experienced more wind due to its higher elevation, while Long Hill was more humid and experienced more atmospheric pressure due to having a lower elevation.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

156

Fair Category

P8

Project Number

5544

Title: Creating a Platformer Game

Student Name(s): B. Hart

## Abstract:

This project was conceived with two purposes. The first was to identify a software tool allowing a technically adept non-programmer to create a platform game; the second was to deploy the identified tool to create a level of a platform game. Internet sources were surveyed for candidate platform game creation programs. Of the programs identified, Construct 2 was selected as the most suitable based on target run environment (HTML5), available development operating system (Windows) and applicable documentation. Applying principles illustrated in published tutorials, a general understanding of Construct 2 was achieved and used to create a prototype platformer level through a typical 3-step development process. First, code was written to achieve a playable portion of a level, then the segment was tested for bugs and revised until there were no more bugs. After repeating this process until a fully playable level was created, the game was published to be played outside the development environment.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS AT

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

P8

Project Number

5545

Title: Constructing a CoreXY Dual Extruding Fused Filament Fabrication Apparatus

Student Name(s): C. Larocque

## Abstract:

Can I engineer a homemade 3D printer that is more cost efficient yet as effective as popular market printers? I got this idea from The Reprap Project, which is a group of people who in 2004 started creating self-replicating 3d printers at a more affordable price. With the cost of market 3d printers continuing to drop I wanted to test if the Reprap Project is still an affordable method. In order to test this I designed and constructed a 3d printer. I constructed the 3d printer with aluminum extrusion in a coreXY belt gantry system. I used stepper motors controlled by a 32-bit 120mhz controller running Smoothieware. The 3d printer is using a dual extrusion system. The motors run at 1/256 micro stepping making all movement precise. My printer's frame is structurally strong however it doesn't look as clean as other high-end market printers. After testing, my print the quality is not at the level of a quality home 3d printer. I had some issues with blobs and stringing of plastic. With more software tweaking the performance of my printer should increase, something I would like to test in the future. The price of my machine is \$607.36. A similar and common affordable home printer is the Prusa MK2 with multi extrusion that costs \$948.00. My printer is \$340.64 cheaper than the Prusa MK2. In conclusion constructing a 3d printer using readily sourced materials is a viable method for hobbyists but will require tinkering to achieve high quality prints.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE AT

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

P8

Project Number

5546

Title: Multi-Purpose Home Automated Motion Sensor

Student Name(s): R. Vaddiraju

## Abstract:

Motion sensors, they've been around since the 1950s, and since then, nothing has really changed. So why are they still expensive? Motion sensors that give you notifications are around \$80-150, and ones that are bundled with security systems require you to pay monthly for years. I have solved this problem, with a do-it-yourself motion sensor that only costs \$48 to assemble and some python, C++ code. There were three broad steps in conducting this experiment: quick assembly, testing the components, coding, and exterior casing. After assembly, I had to run a simple C++ code to test if the motion sensor was functioning properly. The code runs a script, and as soon as I wave my hand across the motion sensor, the serial monitor (the interface that monitors the system messages) indicates motion. Once that was successful, I downloaded python and an add-on called pyserial, which helped me create the script that sends email notification upon motion detection. Finally, I designed and developed a slim exterior casing using a 3D printer. My device has a range of about 25 feet, so it will work in most rooms of a house. It is compact and can fit on most walls. My prototype requires a power source and internet, but I have plans to improve this device to be fully wireless using a rechargeable battery and a Wi-Fi module. With these enhancements, I plan to deliver an inexpensive, compact and a feature packed solution to a standard motion sensor.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

136

Fair Category

P8

Project Number

5547

Title: Creating a Cosmetics Foundation with Natural Ingredients

Student Name(s): J. Gregory

## Abstract:

Multiple store-bought foundation include chemicals that could be potentially harmful to your skin. I wanted to see if there was a viable and functional alternative that did not include the harmful ingredients and was made all natural. I mixed various ingredients in different ratios when testing according to the background research I did. First, I assessed whether it seemed like a viable foundation. If it was too liquidy or too dry I would not test it further. Then I would apply the viable prototype foundations by applying to my skin. Then I assessed the coverage, feel, and softness. It was very hard to come up with a working formula as a lot of the foundations separated. Further research could include coming up with different formulas and trying to match the color to different skin tones.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

P8

Project Number

5548

Title: Why Wifi

Student Name(s): N. Sapire

## Abstract:

“Why Wifi?” aimed to understand why wifi connections can be poor in a home and how it can be improved. The signal strength of a wifi connection between a laptop computer and a wifi router was tested in a variety of ways. The first test established a baseline of wifi signal strength and measured whether the wifi signal was blocked with different materials. The second test explored how an antenna might boost the wifi signal under the same conditions. The third test used a parabolic antenna to see if this device might additionally strengthen the wifi by focusing the signal and at which angle. Once the optimal angle was identified, the wifi signal was measured while blocking the router with materials again. The fifth test measured the wifi signal at a longer distance and in a different location of the house using the parabolic antenna at multiple degrees. The results showed that metal interfered the most with a standard wifi signal. The wifi signal could be improved by adding an antenna, even when the material was blocking the wifi router. A parabolic antenna was most effective in improving the wifi signal strength, even when materials were blocking the wifi signal and when placed far from the router base. It can be concluded that most household items do not significantly affect wifi signal strength, however, distance from the wifi router does. Adding a parabolic antenna to a wifi router setup will help improve the wifi signal in people’s homes.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

P8

Project Number

5549

Title: Great Balls of Fire Astrophotography Experiments

Student Name(s): A. Northrup

## Abstract:

Cameras are amazing mechanisms with undermined abilities; there is much to them. How do they capture a photograph? How does photography work in a larger scale - outer space? This project looks at how accurate using photography to calculate the weights of celestial bodies is, and if the accuracy varies by weight. Using spherical objects of different weights (replacing celestial bodies) and a Canon PowerShot G10 (replacing a NASA telescope/camera), I measured the distances the objects traveled in photographs using different F Stops. I put my data into a graph that could calculate the weight of any object based on its movement in a photograph. I measured distances traveled by 50g, 75g, 85g, and 185g balls using 1/500 and 1/250 F Stops. From my background research, I learned that faster F Stops cause the distance traveled by a light object to decrease because they fall slower. Thus, the camera would capture the wiffle ball traveling a short distance during the fast F Stop. I hypothesized that the wiffle ball, 50 grams, would travel the shortest distance in the 1/500 photographs. Therefore, it would have the least amount of weight calculated by the graph. The calculation would be somewhat accurate, though. This is because of what I described earlier. In the end, the results of my experiment supported half of my hypothesis because the average distance the wiffle ball traveled in the 1/500 photos was 1.25 ft, but the calculation of its weight was very accurate.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

145

Fair Category

P8

Project Number

5550

Title: Suspense of the Pocorn

Student Name(s): N. Camera

## Abstract:

My purpose for this science project is because I was curious if the water content in popcorn kernels affects which popcorn popped the most and if I'm going to pop some popcorn, I want to get the best out of it. My scientific question is "Does H2O in popcorn kernels affect the amount of kernels that pop". My hypothesis is if Orville Redenbacher is the most expensive, then it will work the best in terms of popping and have the least amount of H2O. For my procedure I get all my materials, weigh my kernels before popping, pop them, then see how many kernels did not pop after and see the results between the different brands and price points! Then for my results my averages after three trials was close. In terms of my conclusion Orville Redenbacher had the most popped making my hypothesis correct.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

188

Fair Category

P8

Project Number

5551

Title: Hot Socks

Student Name(s): M. Van Buren

## Abstract:

The purpose of conducting this experiment was to find out if different types of fabric softener affect the flammability in clothing. To start off this experiment nine socks were washed. Three socks were washed with liquid fabric softener, six socks were washed regularly without fabric softener. Three of the six socks were dried with a fabric softener dryer sheet while the other three were dried with nothing added. Then a sock was put two inches above the flame, and the length of time it took for the sock to catch fire was recorded. This was done three times using the same sock used in the beginning. Each set of three socks were tested and timed in this same manner. The times it took each sock to catch fire was recorded and the average was calculated. The average time for socks washed with liquid fabric to catch on fire was 26.3 seconds. The average time for socks dried using fabric sheets to catch on fire was 69 seconds. The socks dried with nothing did not catch on fire. This showed that using fabric softener increases the flammability in clothing.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

P8

Project Number

5552

Title: Name Brand vs. Homemade vs. Value Brand

Student Name(s): J. Apotheker

## Abstract:

For my science project I tested three different store bought stain removers against a homemade stain remover. I did this to see which one would work the best and to see which one would get the stains out of my clothes. Knowing which type of stain remover works best will save people money because it will keep them from buying a bunch of different ones to see which one will work the best, and so that people will know what stain remover will clean their clothes the best. In order to test my question I bought three types of name brand stain removers: Tide-To-Go, Zout, and Spray n' Wash. I tested these stain removers against a homemade remedy. I cut up a white shirt into twenty pieces and stained five with mustard, cranberry pomegranate juice, mud, and green food dye. I kept one of each of the stain swatches stained while I tested all the stain removers against one of each type of stain. By doing this and comparing the washed stain to the stained piece I learned that the homemade stain remover worked best for removing each of the stains except the mud, which was best removed by the Zout. The discovery met every expectation of my project because I learned which stain remover will remove will clean my clothes the best which will keep me from trying all different types of stain removers and wasting money.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

107

Fair Category

P8

Project Number

5553

Title: Fruits vs Vegetable

Student Name(s): S. salas

## Abstract:

For this experiment, I tested the voltage and amperage of fruits and vegetables. I used multiple fruits and vegetables, L.E.D lights, a meter, copper wire, cable wire, and paper clips. I used paper clips instead of nails because the galvanized nails that I originally intended to use did not give enough amperage. As a result, all of the fruits lit up because the paper clip gave off enough amperage to power my L.E.D lights. The fruits had a higher amperage than the vegetable because of the acidity. Though I had a hard time throughout this experiment, in the end I came up with a solution that worked.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

242

Fair Category

P8

Project Number

5554

Title: The Relationship Between Aerodynamic Shape and Wind Drag

Student Name(s): K. Cook

## Abstract:

I conducted my experiment to better understand why different building shapes are considered more 'aerodynamically efficient' than others. I created three structures, with the same area, volume, and height, using a 3D Printer. These structures were a cylinder, a rectangular prism, and a triangular prism. I tested them in a wind tunnel, at speeds of 18-54 meters per second squared, and recorded the wind drag on the buildings. My hypothesis was based on the fact that an object closest to a perfect sphere would experience the least drag and therefore, the cylindrical building would produce the least drag due to its similarities to a sphere.

After conducting the experiment, I found that the cylindrical building produced the least amount of drag, supporting my hypothesis. The cylindrical building had an average drag of -7.7767453 Newtons across all wind speeds. The triangular structure produced the second least drag. Its average drag was -11.4765605 N. Finally, the rectangular building experienced the most drag. Its average was -11.9166847 N.

I found it interesting that the results were not as simple as first, second, and third. The cylindrical building was the clear winner, with all of its data points having the least absolute value. However, at 40 m/s<sup>2</sup>, the rectangular data point had an absolute value closer to zero than the triangular prism.

After reviewing the data, I can conclude that my hypothesis was supported and that aerodynamic shape does have an effect on wind drag.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE AT ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P8

Project Number

5555

**Title:** The fabrication and testing of various fruit juice dye-sensitized solar cells with the addition of preservatives

**Student Name(s):** R. Brooks

**Abstract:**

Dye-sensitized solar cells (DSSCs) have the ability to produce electricity utilizing organic dyes. Though these organic dyes are cost effective and environmentally friendly, power production levels degrade quickly when utilized in a DSSC. The purpose of this experiment was to determine which juice, black currant, raspberry, or strawberry, utilized as a sensitizer in a DSSC produces the most photovoltaic power and, if by adding a preservative to each berry juice, the degradation rate of the solar cell would decrease. It was hypothesized that the berry juice with the highest levels of anthocyanin, a pigment in plants which absorbs sunlight, would produce the most power. DSSCs were fabricated, involving a titanium dioxide coated slide sensitized with berry juice, a carbon coated slide, and an electrolyte. Each cell was illuminated and tested using a multimeter, over a duration of 60 hours. Without preservatives, black currant juice DSSCs produced the most power on average, 287.35 microwatts. However, raspberry juice contains the least amount of anthocyanins, and DSSCs with raspberry juice produced more power than those sensitized with strawberry juice. This could be due to other organic compounds in the berry juices, besides anthocyanins. Concerning preservatives, of the two tested, sodium benzoate decreased the average degradation rate of all DSSCs. It can be concluded that black currant juice is the preferred sensitizer of those tested, and that preservatives effectively decrease power degradation. With further research, sodium benzoate combined with an organic dye could allow DSSCs with organic dyes to be used commercially.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BI EE ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

171

Fair Category

P8

Project Number

5556

Title: A Change In the Winds

Student Name(s): T. Jargalan

## Abstract:

According to Bernoulli's principle, an object within a horizontal flow of fluid, points of higher fluid speed will have less pressure than points of slower fluid speed. But will the air pressure be the same if two objects are closer or farther? The experiment tests the effects of distance between object and how the air pressure on it changes due to it. The independent variable is the distance between the objects tested, in this case, two cans. The dependent variable is the air pressure on the objects when the speed of air is being changed. The hypothesis is if the distance between the cans decrease, the less air pressure exerted on the can when the air accelerates, causing the cans to collide faster. This hypothesis was rejected by the results of the experiment. The results show that objects that are closer will have more air pressure, which will therefore have less movement. This can help designers use this in real life applications, as Bernoulli's principle is used frequently with flying projectiles.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

214

Fair Category

P8

Project Number

5557

Title: Air engine: Can it be an alternative to a gasoline engine?

Student Name(s): R. Vallabhajosula

## Abstract:

Abstract

By. Rahul.Vallabhajosula

My project was Air Engine: Can it be an alternative to a gasoline engine? This was an engineering project. My goal was to create an engine that works on air instead of gasoline and that one-day air engines can replace hydrocarbon engines, and save the planet from pollution. There were two items on the research agenda. The first was to learn about how and what powers an engine. The second item was research on waste and emissions emitted from gasoline engines. Most of the research was done on the Internet using research databases like "CQResearcher" and statistics were collected on the pollutants released into the environment by gasoline engines.

I followed a process to design and build my engine. The process included making schematics and designing the parts to build an engine fuelled by air. The next part of the process was to actually build the prototype and test with compressed air. I created six different prototypes learning and refining the design from each prototype till I had a successful prototype. One of the main problems encountered during the build process was developing a slider mechanism, crankshaft and piston mechanism driven by air. In the end, I was able to successfully build and demonstrate a working engine fuelled by air.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE ET EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

226

Fair Category

P8

Project Number

5558

Title: Where's The Paper Airplane?

Student Name(s): H. Vivas-Nava

## Abstract:

My project is based on how a stealth airplane is for instance my project is does the type of paper affects the amount of lux makes it visible to a radar. But my hypothesis was that I thought that the binder paper would work best to not get detected. My procedures for making the testing environment was fairly simple. It was simple because I got a box from dollar tree ( but asked if I could take an unused box). Then I measured half of the box to put the LED flashlight then I did half of that to put the lux sensor. Then I made a lego stand to put my airplane. It was a science project study but the data collected by the meter. There were 4 airplanes I used a lux meter, flashlight, lego, and 4 different types of paper. The result of this experiment was that the construction paper was less visible and the napkin was more visible and the binder paper & copy paper were in between. My conclusion was that then construction paper was less visible, but the napkin paper was more visible. I think the light and the white napkin paper reflected the light. Therefore I think that if I had to do this project again I will need to use white construction paper. But in other words my hypothesis was wrong.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

156

Fair Category

P8

Project Number

5559

Title: Vision Shoe

Student Name(s): S. Viswanathan

## Abstract:

The objective of this project was to design an electronic device which will allow a blind person to navigate without a cane. This was accomplished by designing a special shoe with a solid state ultrasonic transducer controlled by an Arduino microprocessor. The shoe emits bursts of ultrasonic waves at each step which can bounce off obstacles and can be received back. Upon detection of a nearby obstacle, a warning signal is sent to the wearer by means of a buzzer placed in his right ear. The other ear is left free for environmental awareness. To test the prototype, a student researcher was blind folded and placed in a safely staged room with several obstacles. The student was able to successfully navigate the room without disturbing the obstacles using signals from the shoe. This project will contribute to improve the quality of life of visually impaired and enable them to confidently get around without depending on others.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CS EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

189

Fair Category

P8

Project  
Number

5560

Title: Fiery Fabrics

Student Name(s): C. Mezzetta

## Abstract:

This experiment will be helpful to determine if using fabric softener will affect the clothing in a negative way, when it comes to flammability. I discovered if washing a piece of fabric in fabric softener affects its flammability, meaning it will catch on fire more quickly. The fabrics used were cotton, silk, nylon, and polyester. The first samples of fabrics were only washed in detergent, this was the control group. The next samples of fabrics were washed in detergent and fabric softener. The eight fabric samples were all timed to see how quickly they caught on fire. The times for the control group were compared to the fabrics that were washed with fabric softener, this determined if the fabric became more flammable or not. I determined that nylon and polyester were the two materials that became more flammable when they were washed with fabric softener. The flammability of silk and cotton was not affected in a negative or unsafe way. Their flammability actually lessened by a very small amount. The results of this experiment can make people feel more assured when buying safe clothing for themselves, and especially infants.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

P8

Project Number

5561

Title: SINGING WINE GLASS AND BOTTLES

Student Name(s): S. WEED

## Abstract:

Abstract:

The following are two easy experiments that can cause both a wine glass and a glass bottle to “sing”. The glass should have a stem. The bottle should have a narrow neck and smaller opening, to make life easier. Put a specific amount of water in the glass and hold the glass firmly on the counter by the stem. Wet one of your fingers and trace it around the rim of the glass. This produces a vibration inside the glass which then produces a sound. The glass resonates which means you’re causing the crystals in the glass to vibrate together and create one tone. This is the “singing” effect. You can change the pitch (highness or lowness) by adding to or subtracting from the amount of water in the glass. The volume (loud or soft) can be changed slightly by increasing or decreasing the pressure from your finger.

With the bottle, again put a specific amount of water inside. You will then blow across the top of the opening of the bottle trying not to blow directly into the bottle. You will likely have to adjust the angle at which you are blowing. Eventually, the bottle will whistle. The pitch will change when you either add more water or take some out. This relatively fun experiment will show that these glass items use two different acoustic principles.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

P8

Project Number

5562

Title: Depth vs. Velocity

Student Name(s): D. Sandow

## Abstract:

While coming up with an idea for my project, inspiration struck from an unlikely place. A movie. As I was watching The Impossible (2012), a movie about the Indian tsunami I suddenly became interested in the science behind waves. Specifically their speed. So after doing some research about the actual mathematical equation behind waves, I created an experiment a little less complex and easier to understand and conduct. I started by finding a suitable "ocean", a plastic storage container. I then had my dad cut a piece of wood. I filled the tub up with an inch of water, this was the first part of my "depth" variable. I dropped the piece of wood from a measured point above the tub and timed the wave from creation to when it hit the end of the tub. I did three trials for each water height, recorded my results and looked for a correlation. It was surprisingly easy to find, my data corresponded perfectly with my hypothesis and research. I curated a graph, with my averages and thought about what this could mean. And although at the level I experimented with there is little to no worldly use, if it was done on a larger scale it could potentially helped people that live in heavily hit areas know how much time they have. Depending on the depthness of the water surrounding their home. After all, tsunamis are one of nature's scariest quirks!

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

195

Fair Category

P8

Project Number

5563

Title: Dam Water Reservoir Height and Hydroelectric Power Production

Student Name(s): A. Bowling

## Abstract:

How does water reservoir height affect dam hydroelectric power production? This research of dam water reservoir height is important because it, and the water flow rate, are the two most important factors in determining how much electricity a hydroelectric power plant can produce.

A milk jug, which acted like a dam, was prepared by poking holes at three different heights (bottom, middle, and top), and covering the holes. The jug was filled with water, a hole was uncovered, and the water stream distance and the lowering water reservoir height was measured. The data was recorded every 30 seconds during the experiment. The procedure was repeated for the other two holes, and three trials per hole were conducted.

The hypothesis was that the lowest position on a dam to release water will produce the longest water flow, or fastest flow rate, and give the best production of electricity because it will have the largest water reservoir height. This hypothesis was rejected because the middle hole had the longest average water flow length, and maintained the highest reservoir height. This research and its conclusion highlight the need for a thorough engineering design process for optimal dam construction.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT EN ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

P8

Project Number

5564

Title: Pen-nik: A Reloadable Epinephrine Auto Injector

Student Name(s): N. Mali

## Abstract:

The epinephrine auto-injector is used to treat anaphylactic shock, which is an extreme, life-threatening allergic reaction. These life saving devices are very expensive and expire in 12-18 months because the drug inside, epinephrine, is unstable. Replacing the injectors every year is bad for the environment and very expensive for the patient.

The objective of this project was to design a reloadable epinephrine auto-injector, which would have an easy-to-replace epinephrine cartridge. To accomplish this, the device was designed so the cartridge could be easily replaced when the epinephrine expires. A prototype was designed using a CAD program and the parts were 3D printed. The prototype allows access to the cartridge, which threads directly into the outer casing. The prototype was also designed to contain a spring loaded mechanism to deliver the correct dosage of the drug when triggered. During an emergency, the injector will be loaded and ready to use.

The design concepts were tested using the 3D-printed prototypes, water as a substitute for the epinephrine, and a blunt measuring syringe for safety, and the prototype worked as intended. The design allowed easy access to replace the cartridge, and the spring mechanism worked as designed when triggered, delivering a dosage of liquid. The design could be improved so that a safety is added that prevents people from accidentally triggering the device. The reloadable epinephrine auto-injector has the potential to offer an affordable and green alternative to the current epipen.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT EE ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

P8

Project Number

5565

Title: How does fabric softener affect the flammability of different fabrics

Student Name(s): B. Luna

## Abstract:

### Purpose of the Experiment

The intended purpose of this experiment was to find a safety risk for children and adults. another is to see if fabrics are more flammable than others

### Procedure

1. We will first buy different fabric softeners and liquid detergents.
2. After we will buy lighter.
3. then we will set up where we will hang the rags after they have been in the washer and/or dryer.
4. We will put the same type of rags into different softeners and detergents.
5. We will take them out, hang them, and put on goggles and gloves.
6. We will then measure the distance between the fire and rag.
7. Once we determine this we will see how fast it lights. If it does not light from a certain distance we will move it in closer.

### Observation/Data/results

My conclusion did support my hypothesis because-fabricsoftener does increase the flammability,bit some didn't burn even though most did.I got the result because I got good help and support.

### Conclusion

After conducting this experiment, I came to the conclusion that fabric softener does increase the flammability of most fabrics, but only by a small margin.

Some fabrics actually became less flammable after being treated with fabric softener. The only fabric that I would call an exception to this is cotton flannelette. The flammability of cotton flannelette was increased significantly. In fact, the cotton based fabrics all were significantly increased, more so than the other types of fabrics.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

154

Fair Category

P8

Project  
Number

5566

Title: Stains Away!

Student Name(s): A. Timmerman

## Abstract:

Stains are a part of our everyday life. Whether you're a businessman in an urban city, or a stay-at-home mom in a rural community, we have all been cursed by these mishaps. I wanted to experiment with items found in all households to see if they could compare with the king of all stain removers. I tested several methods for removing a ketchup stain, making an educated guess that bleach would work the best. I conducted my experiment by letting fresh stains set on a shirt overnight. I then used a different stain remover to see which one was most effective. Bleach removed the stain effortlessly, proving my hypothesis correct. Bleach whitens clothes through the process of oxidation. Big molecules make clothes dirty. Bleach breaks up these molecules into smaller ones that are not colored. I also discovered a surprising alternative stain remover, more readily accessible than bleach, with above average results.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

P8

Project Number

5567

Title: Battery Power

Student Name(s): A. Notis

## Abstract:

The purpose of this project was to determine if the brand of battery used to power a flashlight makes a difference in the useful life of the battery. My hypothesis is that the store brand battery (CVS) will provide the least amount of useful life and the Duracell battery the most useful life. My hypothesis is based on the expense of the batteries. This project is designed to determine if the higher priced batteries are worth the additional expense.

Four brands of two AA batteries (Duracell, CVS, Rayovac, and Energizer) were chosen. The batteries were placed in four identical mini-flashlights. The flashlights were turned on simultaneously, left on, and monitored. As the light from each flashlight went out, the batteries were replaced with new batteries of the same brand to assure that the flashlight failed due to battery failure as opposed to bulb failure. The length of time that the lights were on were recorded and compared.

Based on the results obtained, the Duracell battery lasted the longest (average time of 85.5 hours over two trials). The CVS brand battery lasted for an average of 78 hours, the Rayovac lasted for an average of 56 hours, and the Energizer lasted for an average of 36.5 hours. My hypothesis was supported by the Duracell battery lasting the longest but not supported as the CVS brand battery was not the first to fail.

Based on these data, CVS brand batteries provide the most useful life for the price paid.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

230

Fair Category

P8

Project Number

5568

Title: Optimizing Fin design for compressed air water rockets

Student Name(s): G. Syme

## Abstract:

The purpose of this experiment was to ascertain which of several fin designs and materials will work the best on compressed air water rockets. Rockets, no matter the size, shape, or propulsion method, need some sort of fins to work. They act as a stabilizing force so that the rockets don't just tumble all over.

My hypothesis is that the 60% size wooden curved fins will work the best, because they are a nice balance between being too big and too small, and I think they have the most streamlined shape. In addition to this, the wood is rounded on the leading edge to reduce drag even more. During testing, I used 15 different fin configurations. 3 shapes, 3 sizes for each shape, and 2 different materials, minus the 3 corrugated plastic 40% fin configurations. My tests consisted of 82 launches, due to some fin configurations failing, or me deciding that the next set was not going to be stable enough based on other similar configurations. I did not test any of the smallest corrugated plastic fins because the previous corrugated plastic fins were much less stable than their wooden counterparts. After watching the rocket wobble in flight with the fastest wood fins, we decided it wasn't worth breaking the rocket. The results show that the curved, 60% size wooden fins worked the best, as I predicted in my hypothesis.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

P8

Project Number

5569

Title: Injur-Knee

Student Name(s): C. Luciano

## Abstract:

Football, and other contact sports and activities can be dangerous. Players are prone to many injuries, such as knee injuries. When a knee injury does occur, it is often dismissed as a simple bruise or strain, when it is actually something more serious.

The objective of this invention was to research and utilize various materials and design configurations to create a prototype capable of preventing knee injuries, from serious ones like ACL sprains to mild ones like tendon strains that can occur while partaking in rigorous activities, such as football. Moreover, the objective was also to design and construct the prototype to detect an amount of impact force. To accomplish this objective, an Arduino Uno, a red LED, and a force sensor were utilized. Specifically, The force sensor was connected to the Arduino Uno via breadboard, and the Arduino Uno was programmed to flash the red LED when the amount of force detected soared above a set threshold. To test this prototype, an amount of force equal to the set threshold was applied to the force sensor, and it was successful in flashing the red LED only when the set threshold was reached. Further, tests indicated the sorbothane was a shock absorbing material that proved successful in reducing the amount of impact force.

Therefore, this device has the potential to detect and prevent knee injuries right from the moment that they happen and revolutionize contact sports as we know it.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN AT EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

P8

Project Number

5570

Title: Organic Waste: A Renewable Source of Energy

Student Name(s): M. Illindala

## Abstract:

The earth is running out of electricity faster than predicted, hence a need to develop other renewable energy sources. One way to do this is by using a microbial fuel cell to harvest the power of bacteria in benthic mud and other organic materials, which are abundant and readily available. A microbial fuel cell consists of two chambers, one with organic material, the other with water from a second order stream. When bacteria digest the organic material, they produce protons and electrons, generating electricity. The materials used in this experiment were benthic mud, fallen leaves, and fruit and vegetable peels taken from apples, carrots, and potatoes. The hypothesis was that the fuel cell containing benthic mud with fallen leaves as additional food source would generate the most electricity. The second cell contained the benthic mud sample, and the third had just vegetable and fruit peels. The fuel cell with leaves generated the most voltage, peaking at 32.4 millivolts. The fuel cell with mud spiked at 28.4 millivolts. The fuel cell with vegetable and fruit peels only produced a maximum of 2.4 millivolts. These results were likely seen because the mud and leaves acted as another food source for the electrochemically active bacteria. Future experiments can be conducted using different types of organic materials to generate larger amounts of energy. The benthic mud and leaves fuel cell could be assembled in a scaled-up format. More research is needed to determine which substances can generate sufficient amounts of electricity for practical usage.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE EM CB

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

P8

Project Number

5571

**Title:** Multi-color CCD photometry of the variable star Delta Cephei using a home-built six inch reflecting telescope

**Student Name(s):** A. Chang

**Abstract:**

Delta Cephei is the first Cepheid variable star discovered, with a period of 5.66 days and varies from magnitude 3.5 to 4.4. Cepheid variables are extremely important in astronomy because their variabilities have been used as cosmic yardsticks to measure the size of the universe. Delta Cephei is a pulsating star and it is important to keep observing this star to see if its variability changes over time. Observations of Delta Cephei is almost always done by eye, and it is not known whether its magnitude change is the same at different wavelengths. To answer this question, I ground and polished a 6 inch f/9 parabolic mirror and built a Newtonian telescope around it. Over a 17-day period from September to November 2016, the variability of Delta Cepheid was monitored with a ST-7 CCD camera attached to my telescope. Photometric data were collected using red, blue, and green filters and data points from each filter plotted on separate graphs. I discovered a “shark fin” shaped light curve in each graph, with a period of 5.7 days. However, each filter showed different magnitudes of variability. Delta Cephei is brightest in the red wavelength (magnitude varies from 3.19 to 3.98) and dimmest in blue (magnitude varies from 3.75 to 4.95). Using the period luminosity relationship, I calculated that Delta Cephei is 595 light years from Earth. My research shows that it is important to observe Cepheid variables in several wavelengths to get an accurate measure of its variability and distance.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

P8

Project Number

5572

Title: HOW FAR WILL IT STRETCH?

Student Name(s): J. Kerr

## Abstract:

For this science fair project, I wanted to test how temperature affects the elasticity of a rubber band. My hypothesis was if the temperature increased the elasticity of rubber band would also increase. First, I gathered 15 rubber bands in all. Five went into the freezer for ten minutes, five went into the microwave for 1 minute and the remaining five remained at room temperature. Second, I used a weight of 7 ½ pounds to stretch out the band, all of the rubber bands stretched but none broke. I then used a weight of 9 ½ lbs. The frozen one was about to break and the room temperature and microwave bands had no major affect. After, I used a weight of 11 ½ lbs. and the frozen rubber band broke while the room temperature rubber band was close to breaking. I applied the same weight to the remaining three frozen rubber bands and they all broke at 11 ½ lbs. I concluded that the frozen rubber bands had the least elasticity when they became frozen. To test how much weight would be needed to break the room temperature bands, I applied 12 ½ lbs. and it broke. The remaining three room temperature rubber bands all broke as well. The microwave rubber band was still holding up so I kept on adding weights until they all broke at 14 lbs. In future experiments, I would be interested to study the results of dyed rubber bands and bands of various lengths.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

129

Fair Category

P8

Project Number

5573

Title: Solar Producing in the Polar

Student Name(s): M. Emerson

## Abstract:

My project involved testing whether outside weather affected the power produced by a solar cell. I built an automated data collector using an Arduino to perform the experiments. I predicted that the colder the temperature was, the more power would be produced. I tested the solar cell outside on three different days, measuring the cell power, temperature, and amount of light. I found that there was a lot of noise in the temperature data. At any given temperature, the power could vary from 0 Watts to 0.3 Watts. The amount of light was more important than the temperature. The noise in the data happened because brighter days were also warmer days. Therefore, temperatures from 40 degrees F to 75 degrees F have little effect on the solar cell performance.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

241

Fair Category

P8

Project Number

5574

Title: How WiFi Affects the Growth of Plants

Student Name(s): H. Skiba

## Abstract:

According to the World Health Organization (WHO), small amounts of electromagnetic radiation can increase the risk of cancer. There are 64.2 million public WiFi hotspots worldwide, and WiFi emits electromagnetic radiation therefore exposing billions of people.

This project investigated the effects of WiFi on plant growth. The hypothesis of this experiment was that the higher the levels of electromagnetic radiation, the slower the plants would grow.

To conduct this experiment, two different plants species were grown with exposure to varying amounts of WiFi radiation. Six different kinds of Wisconsin Fast Plants were grown and one type of asparagus fern. A total of 27 plants were grown. The plants were split evenly among three levels of WiFi radiation exposure: 10 feet, 50 feet, and 250 feet away from WiFi routers. All plants were grown in similar environments, and their growth was tracked and recorded.

After a month of growth, all the high WiFi plants were shorter than the low WiFi plants, 67% of the medium WiFi plants were taller than the low WiFi plants, and 83% of the medium WiFi plants were taller than the high WiFi plants. Although there was not enough data to accurately conclude whether plant growth depends on electromagnetic radiation linearly or quadratically, the data does support the hypothesis.

The results of this project indicate that increased exposure to WiFi radiation can negatively affect the growth rate of certain plants. The project suggests that further research is needed.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV PS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

155

Fair Category

P8

Project Number

5575

Title: Got Sugar

Student Name(s): M. Coyle

## Abstract:

For my project I tested if the grams of sugar written on bottles of sodas match the grams of sugar that I find when I conduct my experiment. The sodas I chose were Coke, Pepsi, Mountain Dew, and Sprite. I used a hydrometer to determine the specific gravitates in each of the sodas. Using this information I used the formula  $y = -280.044 + 279.83(x)$  to find the percent of sugar that was in these beverages. From there I used the equation  $y = -5596.597(x)$  to convert the percent into grams. I then compared my output to what was stated on the label. My data showed that the amount of sugar that I found in the soda came very close to what was written on the label. In conclusion the amount of sugar that is recorded on labels of sodas is the same amount that will be ingested when consuming Coke, Pepsi, Mountain Dew, and Sprite.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

P8

Project Number

5576

Title: Project CASH: Relational Effects of Cold, Acid, Starch and Heat

Student Name(s): A. Simpson

## Abstract:

This year's science fair, I continued experimenting chemical reactions with food. The idea popped into my head when my grandmother talked to me about a lab she used to do with her students to determine if objects were acids or bases using pH values. Using acids digested in everyday food consumption (lemon, lime, orange and tomato) and sweet potatoes, I wanted to know if:

1. The type of acid introduced affected the chemical reaction/breakdown of the starch.
2. If the state of the starch (raw vs cooked) affected the breakdown.
3. Does the presence or absence of a peel quicken or hasten the breakdown?
4. What role does temperature have on the reaction?

I hypothesized that stronger acids (lemon and lime juice) would break down the starch more so than tomato or orange juice.

I tested the ph of my acids and starch on day one of the experiment, Jan 1st and left the samples in the numbered container. Day 4 I could see a film forming on some samples. Day 7 the presence of mold was observed. Day 10, a strong smell developed. Lemon and lime juice samples felt mushy. Day 11 the samples were placed in refrigerator and observed through day 14.

As hypothesized, the less acidic juices (tomato and orange) did not break down the starches. The lemon and lime juices which had lower ph value (highly acidic) had eroded the potatoes, whereas the orange and tomato juices specimens formed mold, which acted as a barrier to breakdown.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

BI CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

232

Fair Category

PS

Project Number

6002

Title: Hot Glass

Student Name(s): J. Zuklie

## Abstract:

The problem that this product was designed to solve was the inability to know if a piece of lab glassware is too hot to handle. The product that was designed worked and fulfilled the criteria that was put on it, it was able to heat and cool rapidly and slowly, change colors when pain would start to be felt, and was able continue to work with no noticeable color reduction or speed in which it changed.

The design that was used was very simple. It was a 1 to 1 mixture of silicone, both parts weighing 2 grams, to 1 gram of thermochromic pigment, and it was mixed thoroughly. A small strip was first poured that would activate a little above body temperature, that was then placed inside the main mold. The silicone pigment mixture, that activated when you feel pain from heat, was added over top. This allowed for the creation of a thin band of silicone that was temperature sensitive and could wrap around and stretch to various circumferences.

The design that was chosen was successful and was able to withstand the many tests that were carried out on it and was able to successfully complete these tests while passing all test criteria. Though the tests the product withstood 100+ trials with no noticeable change in color intensity when at room temperature, but the product had stretched a minimal amount.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

PS

Project Number

6003

**Title:** AN INVESTIGATION INTO THE CAPABILITY OF GRAPHENE TO PRODUCE ELECTRICITY DURING RAINSTORMS AS AN ADDITION TO A TRADITIONAL SOLAR PANEL

**Student Name(s):** S. Siveyer

**Abstract:**

Ever since graphene was discovered in 2004, Scientists have been looking at applications for its properties, especially its strength and electrical characteristics. One possible application is in the next generation of solar panels. An issue with solar panels is that they are only effective in bright sunshine. I wanted to see if I could use graphene to allow solar panels to produce electricity during rainstorms. Studies have shown that when salt water passes over graphene it can make an electrical charge. To test this I made Graphene out of Graphene Oxide solution with water, putting it onto a disk, and then light scribing it. I used distilled, rain and a salt water solutions. After dripping the solutions over the graphene I was able to produce an electrical charge. Preliminary testing showed 10 times and 30 times higher electrical charge with the rain and salt solutions respectively than tap water. In further testing the data showed inconsistent results, and I had many challenges with both the graphene production and the test due to the fragility of the graphene. I made and used Polyvinyl Alcohol to stabilize the graphene. After experimenting, I found that an electrical charge was produced from pouring each type of water over the graphene. The results showed the distilled water produced the most electricity. After doing my experiment I am not able to make an accurate conclusion because of inaccuracies of the data, but I see potential in its use in the future solar panels.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CH EN ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

PS

Project  
Number

6004

Title: Analysis of Mercury Content in Sediments of New Haven Harbor

Student Name(s): K. Yuan

## Abstract:

Mercury pollution can be detrimental to marine organisms and humans. New Haven Harbor is located directly across from the Long Island Sound. The Quinnipiac, Mill, and West Rivers flow into the harbor. Along these rivers lay several coal-burning industries, the largest contributor to mercury contamination. The purpose of this project was to study the spatial trends of mercury contamination in New Haven Harbor, as well as determine how organic content affects mercury concentration. Samples from 15 locations in the harbor were analyzed using the DMA-80 Direct Mercury Analyzer following EPA Method 7473. Higher mercury concentrations were found in the inner harbor, with the highest being at 0.4330 mg/kg. The lowest concentration was in the outer harbor/Long Island Sound at 0.0060 mg/kg. None of the stations had a concentration exceeding the NOAA effects range median (ERM 0.710 mg/kg) toxic level, however, nine of the stations exceeded the effects range low (ERL 0.150 mg/kg), meaning that it is possible that the mercury has some effect on the organisms, and twelve of the stations exceeded the crustal abundance (0.060 mg/kg), suggesting that the mercury is the result of anthropogenic input. Data also shows that mercury concentration has a positive correlation with silt, organic content (LOI), and heavy metal copper. Future studies include looking into the synergistic effects of multiple metals on marine organisms. The results from this study could provide evidence about the health of the harbor and help in policy making regarding dredging and environmental management.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV CH EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

Fair Category

PS

Project Number

6005

**Title:** A Novel Rapid Diagnostic Test for Zika Virus NS1 Protein using Nanoribbon Microfluidics

**Student Name(s):** L. Low

## Abstract:

As the Zika virus (ZIKV) global health epidemic continues to emerge, the necessity for rapid and sensitive viral detection methods is critical in advancing diagnosis. Current methods of ZIKV detection, which use ELISAs coupled to colorimetric readouts, are available but require large sample volumes and are time consuming. The integration of microfluidics and silicon nanoribbon technology (narrow strips of highly sensitive, low electrical noise transistors) provide potential advantages over current systems, including sensitive, low volume, and time efficient readouts.

The experimental objective is to compare the nanoribbon, pH meter, and optical detection systems of Zika virus Non-Structural Protein 1 (ZK NS1) at various concentrations ranging from 0nM to 28nM. ZIKV trials include three comparative experiments: (1) a well plate ELISA (Enzyme-Linked Immunosorbent Assay) with horse radish peroxidase and optical readout; (2) a well plate ELISA with urease and pH and nanoribbon readouts; and (3) a microfluidic ELISA with urease and nanoribbon readout. Each experiment has yielded stepwise increases in color, pH, and voltage steps which paralleled increases in ZIKV concentration, demonstrating relative concentration dependence.

Though results of this ongoing experiment are pending, the nanoribbon system, while still early in development, holds promise as a sensitive method for ZK NS1 and other proteins associated with epidemic viruses. Studies to improve the sensitivity by reducing drift and noise will enhance the development of this system.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AT BI EE

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

230

Fair Category

PS

Project  
Number

6006

Title: Increasing the Efficiency of Wires

Student Name(s): N. Keklik

## Abstract:

More and more objects in our world are becoming dependent on technology. The power in this technology is created by the flow of electrons through a system of wires. Like any system, some of this electrical energy will be transformed into other forms of energy limiting the efficiency of any electronic device. Therefore, this project focuses on how one may go about diminishing the amount of energy lost in a wire conducting electricity. In this investigation, I decided to test three factors that I thought would affect the flow of electrons. These include the cross-sectional area of the wire, the length used in a given circuit, and the temperature of the environment. In order to quantify the efficiency of a factor, I decided to use a resistance meter and measure the ohms of the wire. The more resistance in a wire the less efficient it is. Testing the effects of temperature was more demanding, as it required me to use ice baths with dissolved salt and open flames to heat up the wire. From the experiment, it is clear that as the cross-sectional area goes up resistance goes down and as the length of the wire goes up so does the resistance. Lastly, as temperature decreases so does resistance in the wire. Using this information many common electronic components can be improved on making our world more efficient.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT PH CH

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

115

Fair Category

PS

Project Number

6007

Title: Harnessing Magnetic Perpetual Motion Machine to Generate "Free Energy"

Student Name(s): S. Flynn

## Abstract:

A perpetual motion machine is a hypothetical machine that can do work indefinitely without an outside energy source. This kind of machine is suppose to be impossible, as it should normally violate the first or second law of thermodynamics. But if one can build one of these machines, one can make it into a way to generate electricity. This lead me to ask, Can a motor that is self propelled by magnets be made into efficient energy solution to be an alternative energy source? My goal was to build a perpetual motion machine using magnets and then attempt to harness electricity efficiently from it as "free energy" without using any additional our constant fuel sources.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE ET

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

PS

Project Number

6008

Title: Radioactive Beta Decay Cell to Charge Electronics

Student Name(s): N. Garcia

## Abstract:

Often times while playing videos games in the middle of a match the batteries short out. This is a huge inconvenience for gaming and it has a great effect on the gaming community. The purpose of this experiment is to create a source of energy that is not reliant of and external recharge. In order to achieve this the experiment called for 12 vials of tritium(phosphorous included), 5 amorphous solar panels, 1 solder-less circuit board, Arduino kit with wiring, .8 step up converter , 2.5 v L.E.D and rechargeable battery. The Solar panels were wired in series, and then a diode was placed to charge the battery without discharging into the solar panels, after the previous step the leads were connected to the power rail. The voltage was stepped up by the converter to 3 volts and illuminated the L.E.D with a push of a button. The efficiency observations clocked in at .3 volts from the beta Cell. This was stored in the battery; it took 3 hours to charge the 1.5-volt Battery. The L.E D has the potential to light for 8 to 10 minutes on a full charge. Findings at the end of my engineering experiment were that the Cell made, could be scaled up so that it would not require a battery and can have a constant flow of electricity, which will be useful for handheld devices and remote controllers.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE ET

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6009

Title: The Efficacy of Lichens as Bioindicators of Air Pollution

Student Name(s): A. Gianukakis

## Abstract:

Air pollution is a major issue today due to cars and burning of fossil fuels, causing respiratory and cardiovascular diseases. Different lichen species have varying tolerances to air pollutants, therefore making them bioindicators. The purpose of this experiment is to determine the effectiveness of lichens as bioindicators of air pollution. Based on the hypothesis that the abundance of lichens is affected by air quality, the prediction was tested that areas with increased fine particulates and ozone levels will have a lower abundance of foliose lichens. Yearly air quality measurements were obtained from the Connecticut Department of Energy and Environmental Protection for four testing sites in the towns of Cornwall, New Haven, Danbury, and Westport. At each site, a 100 m<sup>2</sup> plot was divided with transects every 10 meters to create a grid of 25 sample points. At each transect, a 5 meter rope extending from the center of the sample point was used to indicate a circular sampling area. Within the sampling area, lichen abundance was determined using a point-intercept method on all trees with heights above 20 feet. Data was analyzed using a Chi-Square Test of Independence and a correlation analysis. The abundance of foliose lichens strongly correlated to PM 2.5 levels, but not ozone. Therefore, the abundance of foliose lichens can be used as a bioindicator of air quality. Due to the slow growth rate of lichens and varying age of test sites, future work for this experiment includes testing sites of the same approximate age.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EV PS

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

201

Fair Category

PS

Project  
Number

6010

Title: Novel Low-Temperature Carbon Capture Using Aqueous Ammonia and Organic Solvents

Student Name(s): E. Novek

## Abstract:

Current post-combustion CO<sub>2</sub> capture technologies are energy intensive, require high-temperature heat sources, and dramatically increase the cost of power generation. This work introduces a new carbon capture process requiring significantly lower temperatures and less energy, creating further impetus to reduce CO<sub>2</sub> emissions from power generation. In this process, high-purity CO<sub>2</sub> is generated through the addition of an organic solvent (acetone, dimethoxymethane, or acetaldehyde) to a CO<sub>2</sub> rich, aqueous ammonia/carbon dioxide solution under room-temperature and -pressure conditions. The organic solvent and CO<sub>2</sub>-absorbing solution are then regenerated using low-temperature heat. When acetone, dimethoxymethane, or acetaldehyde was added at a concentration of 16.7% (v/v) to 2 M aqueous ammonium bicarbonate, 39.8, 48.6, or 86.5%, respectively, of the aqueous CO<sub>2</sub> species transformed into high-purity CO<sub>2</sub> gas over 3 h. Thermal energy and temperature requirements for recovering acetaldehyde, the best performing organic solvent investigated, and the CO<sub>2</sub>-absorbing solution were 1.39 MJ/kg of CO<sub>2</sub> generated and 68 °C, respectively, 75% less energy than the amount used in a pilot chilled ammonia process and a temperature 53 °C lower. The findings exhibit the promise of economically viable carbon capture powered entirely by abundant low-temperature waste heat.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH ET EM

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PS

Project Number

6011

**Title:** A Novel Approach for Assessing Alzheimer's Disease Risk through Natural Language Processing-Based Analysis of Aphasic Patterns

**Student Name(s):** D. Michael

**Abstract:**

Alzheimer's Disease (AD) currently affects a staggering 5.4 million people in the United States alone, and it is anticipated that the annual number of new cases of AD will double by 2050. Recent research suggests that the underlying pathology of AD may be linked to a neurological communication disorder known as Primary Progressive Aphasia (PPA). This research presents a novel approach to AD diagnosis through the creation of a web-based natural language processing (NLP) system that assesses AD risk through the detection and analysis of aphasic patterns. Utilizing Python's Natural Language Toolkit, I developed an NLP engine that analyzes both audio and text input to detect aphasic patterns corresponding to the major symptoms of PPA through comprehensive syntactic and fluency assessments. The engine achieves syntactic assessment functionality by integrating the Stanford Parser's stochastic context-free grammar to dynamically construct parse trees. In order to achieve fluency assessment functionality I devised an algorithm that utilizes likelihood ratios to perform collocation extraction. Upon completion of the assessments, the system automatically generates a comprehensive, easily understandable report. Sample inputs modeled after publicly available PPA data served as the training and testing corpora for the NLP engine. The system achieved an 82% accuracy rate across all symptoms, showing that this NLP engine is capable of accurately and efficiently detecting aphasic patterns indicative of AD in an easily accessible manner, thus greatly facilitating AD diagnosis. Furthermore, this research shows the social and commercial impact NLP applications could have in the medical field.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CS ME

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

PS

Project Number

6012

Title: ELECTROMAGNETIC PROPERTIES OF POTENTIAL REGULATED SPIRAL ION CHANNELS

Student Name(s): T. Ersevrim

## Abstract:

All mesoporous materials that have been studied, including arrays of chelating agents such as porphyrins, have ridged crystal lattices that allow current to move only linearly through them. Resistivities of arrays of porphyrin rings have been shown to be as low as  $500 \Omega \cdot \text{meters}$ , making high currents within porphyrin rings possible. If these porphyrin rings are crystallized in an upwards spiraling fashion, spiraled ion channels (SIC) will form. Because this structure resembles coiled wires, SIC molecules should have properties similar to those of solenoids. This research aims to explore the electromagnetic implications of SIC. For this structure, pyridine serves as the central planar backbone from which hydroxyl groups and bromine groups are bonded to facilitate the proper arrangement of molecules within the crystal. Off of the pyridine is bonded a porphine, thus resulting in a final structure resembling that of a spiral staircase. In order to help facilitate the spiraling structure, an electric current must be passed through the fully synthesized molecule while it is still in a semi-liquid phase known as the nematic mesophase. This liquid is fully cooled to lock in the alignment of the chirality of the SIC. Because the nanowires within SIC have an expected turn density of greater than  $1 \cdot 10^9$  turns per meter, extremely large magnetic fields are expected to be produced when a small current is passed through it. Conversely, a small change in magnetic flux through the crystal is expected to produce a large current within the crystal.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH EN PH

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4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

PS

Project Number

6013

**Title:** Optimization of Vertically Aligned Boron Nitride Nanotube Membranes via Magnetic Arrangement in a Lyotropic Precursor for Water Transport Applications

**Student Name(s):** C. Li

**Abstract:**

Boron nitride nanotubes (BNNTs) have significant potential in water transport applications, possessing a water flux greater than that of carbon nanotubes and 5x higher than contemporary reverse osmosis membranes. Larger-diameter BNNTs are also capable of harvesting osmotic power with efficiencies exceeding 1000x that of its pressure-driven counterpart. The factors limiting the application of these properties, however, are the difficulties associated with performing widespread characterization of BNNTs within a nanocomposite and the lack of research dedicated to BNNTs. Prior work in this research developed a facile, scalable method for fabricating vertically aligned BNNT polymer nanocomposite membranes by exploiting the self-assembling properties of cylindrical micelles containing BNNTs in a lyotropic liquid crystalline (LLC) precursor. The micelles orient with their long axes parallel to an applied magnetic field, templating the alignment of sequestered BNNTs. Briefly, raw BNNTs were purified and dispersed in deionized water. The solution was then incorporated into a LLC precursor in thin and bulk film geometries, and magnetically aligned at 65°C. This research extends this work by investigating how to optimize the nanocomposite membrane and its fabrication process. Molecular dynamics (MD) simulations are used to investigate differences between BNNT chiralities to determine which are most suitable for water transport applications. First, molecular models of (9, 0) zigzag, (6, 4) chiral, and (5, 5) armchair BNNTs were made. MD simulations of pressurized water traveling through each of these BNNTs demonstrated that the zigzag BNNT transmitted water faster than the other tested BNNTs.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN EM ET

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6014

Title: The Performance of a Battery with a Graphene Based Anode

Student Name(s): D. Islam

## Abstract:

Graphene is an allotrope of carbon whose conductivity exceeds that of silver, copper, and gold. The hexagonal lattice of graphene allows for low resistance for electrical currents and almost complete free flow of electrons over its surface. The creation of graphene involved using graphite powder and concentrated sulfuric and phosphoric acid to oxidize graphite powder into a solution of graphene oxide. Then, the solution was painted onto aluminum foil sheets and soaked in hydrochloric acid to bind the materials into a purer form of graphene strips. The goal of the experiment was to create superconductive graphene strips to use as the anode in a homemade battery. Pure, one-atom thick graphene sheets are almost unreachable, so the aluminum was used as the structure for the graphene. The graphene was used in the construction of a battery cell using a graphene strip as the anode, and aluminum foil as the cathode. The two materials were wrapped around copper wire and connected. The wire ran through a solution of lithium chloride, acting as the electrolyte to trigger the chemical reaction and produce energy with large electrode surface area and relatively low internal resistance. The amateur battery was made to mimic a battery that outperforms a lithium ion cell of the same parameters and caliber. The battery performance was tested using a motor. Although the resistance of the aluminum foil decreased when it became graphene, it became brittle and difficult to fold around the wire. The battery design requires further alterations and adjustments.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN EE

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

260

Fair Category

PS

Project Number

6015

**Title:** Development of a visible light induced CNT/ZnO/TiO<sub>2</sub> membrane for photocatalytic degradation of organic pollutants and bacteria in water

**Student Name(s):** M. Xiong

**Abstract:**

With 780 million people without access to a potable water source, the development of a simple, self-powered, and point-of-use water system is desirable to remove waterborne bacteria, and chemical pollutants. Recently, semiconductors have shown promise as nanomaterials that can help clean water, using sunlight, through photocatalysis. This research designed a simple, inexpensive, and solar powered filtration device, that removed bacterial contamination, as well as chemical pollutants, such as 2,4-Dichlorophenoxyacetic acid (2,4D), a herbicide that is often found in agricultural water runoff. TiO<sub>2</sub> nanowires and ZnO/CNT nanorods were incorporated into an unique membrane for concurrent photocatalytic oxidation and separation. The structure of CNT/TiO<sub>2</sub> composite is advantageous, as CNTs add strength and chemical stability to the filter membrane, while providing necessary heterojunctions at the CNT/TiO<sub>2</sub> interface for efficient translation of sunlight for photocatalytic decomposition. Because contaminants are degraded at the surface, the membrane also has low fouling potential. TiO<sub>2</sub> nanowires were synthesized via hydrothermal process and CNTs were doped with ZNO with an acid treatment. The materials were layered on 3 filter paper to form the CNT/ZnO/TiO<sub>2</sub> composite membrane, that was then installed in a hand-held, solar-powered filtration system. At 3lumens illumination, the system removed as much as 85.3% 2,4D; removal was dramatically increased to 99.7% at 990lumens. The system's disinfectant abilities were studied with E-coli k12. The membrane removed 90% of bacteria at 3lumens and 97% of bacteria at 990lumens. With typical sunlight at 377lumens, the filter will have 97% and 91% remediation for organic pollutants and bacteria respectively.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM EN EV

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

188

Fair Category

PS

Project Number

6016

Title: IDEAL PRINTING CONDITIONS FOR FUSED DEPOSITION MODELING WITH ABS FILAMENT

Student Name(s): J. Kral

## Abstract:

3D printing, while a quickly-advancing technology, is still heavily flawed, especially when printing with acrylonitrile butadiene styrene (ABS) plastic filament. Issues commonly seen in ABS printing include lacking bed and layer adhesion during printing and flawed detailing. These issues will likely be resolved when print raft height, print nozzle temperature, print layer thickness, and extrusion speed are altered to provide more optimal ABS 3D printing conditions. Data was collected to find the optimal setting for each of the aforementioned conditions. When these optimal settings are combined, the optimal ABS 3D print will result from them.

Overall, most of these variables have a window of optimal print success. Nozzle temperature, print layer thickness, and extrusion speed all hinder print quality when both too high and too low. Raft thickness, however, causes lower print quality when it is lower, and only stabilizes prints more and more the higher it is. This considered, while a combination of each variable's most ideal condition did not provide the ideal print, it is notable that the tested variables do interact with each other, and that this interaction effects the quality of each print.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN EE

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

178

Fair Category

PS

Project  
Number

6017

Title: An Investigation of Factors Affecting Catalytic Functions.

Student Name(s): E. Sansevero

## Abstract:

Catalysis are not well studied in public schools because the labs are complicated and sometimes dangerous. I wanted to find a way to replace the acid being used as a blocker and make the lab easier to understand so it can be used in classrooms. The first step to doing this was to understand catalysis so my first lab was done studying the effect of enzymes on substrates. I measured the reactivity level using a spectrophotometer to determine the amount of freed trypsin in each test. Next I will study what factors could be used to change those results like incubation time and temperatures. Finally I plan to replace the acid blocker with a boiling water bath. That will in theory change the shape of the enzyme and cancel the reaction. As of right now I have done test studying catalysis and seen that the amount of enzyme does affect its production of freed trypsin until  $V_{max}$  which is the saturation point. My future work will include changing incubation time and temperature and also boiling the test samples.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

BI CH

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

228

Fair Category

PS

Project Number

6018

**Title:** The Design and Fabrication of a Zero Carbon Emissions Compressed Air Engine  
Eliminating Batteries and Other Associated Environmental Impact

**Student Name(s):** J. Immanuel

**Abstract:**

The design goal was to design and fabricate an engine that runs solely on compressed air. The purpose of this project is to create a method of transportation that does not emit carbon emissions and does not require toxic materials to build, as is required with batteries. It is also designed to prove that compressed air can be a viable energy storage source and prove that it applies energy similarly to more established means of transportation. This can then be used to power automobiles or other vehicles. In order to fabricate the engine, a 2 stroke internal combustion engine was modified to run on air. This was done using pneumatic and plumbing parts. The engine ran successfully on varying air pressures. The only measured results were frequency, time taken to reach maximum frequency, and pressure measured in psi. Torque figures, horsepower, and air efficiency were then calculated. When the results were graphed, many were logarithmic in shape. Most importantly, the graph showed high torque at a low rpm. Based on the success of the experiment and the data collected, it can be concluded that not only can a compressed air engine be built, but it has a torque curve similar to that of an electric motor and better than an average internal combustion engine. Based on the results, a compressed air powered engine deserves future development and testing.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EE AT ET

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

PS

Project Number

6019

**Title:** The Effect of Adding a Second Polymer to Polyethylene Terephthalate on the Mechanical Properties and Morphology of the Polymer Blend Systems.

**Student Name(s):** N. Bhat

**Abstract:**

Americans throw away 33.6 million tons of plastic each year, and of that amount, barely five percent is recovered and reused in other sources. Two of the most common types of plastic discarded are polyethylene terephthalate (PET) and polybutylene terephthalate (PBT). These materials are used in everything from clothing, containers, tape, electronics insulators, yarn and computer keycaps. This investigation focuses on the mechanical properties of a miscible blend system of PET and PBT. The goal was to create a blend ratio which with mechanical properties greater than those of either PET or PBT. Blends were created that had 0%, 28.6%, 50%, 71.4%, and 100% additions of PBT to PET. The polymer blends were made by heating and mixing the homopolymers at 120 C and then air cooling them as discs. The polymers, and their respective blends, were subjected to 3-point bend flexural testing. Blends were assessed on three criteria: ultimate strength, Young's modulus, and toughness. The Young's modulus was measured from the initial slope of the stress strain curve, and the toughness was measured from the area under the stress-strain curve. The ultimate strength of the material was examined by noting the peak of the stress-curve curve. It was found that the region with 28.6% and 50% PBT added to PET had synergistic effects in all three of these properties. Attempts to use light microscopy to examine the morphology of the fracture surfaces was inconclusive thus far.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

242

Fair Category

PS

Project Number

6020

Title: Fluorescent Nanofiber Matrices as Extracellular Matrix Tissue Substitutes

Student Name(s): H. Zaidi

## Abstract:

Current polymer tissue scaffolds are difficult to implant and analyze within lab specimens without the death or major surgical alteration of said animal. These scaffolds are necessary for stem cells to proliferate (they act as extracellular matrices) into their respective function and structure (tissues, organs, etc.). As such, the field of modern tissue engineering relies heavily on biodegradable, affordable, polymer scaffolds. Unfortunately, current scaffolds are not easily studied (stem cells themselves, however, can easily be made fluorescent) within living specimens -- thereby resulting an inordinate number of lab animals injured or dead by the conclusion of an experiment. Labs must dedicate large amounts of money and resources in response, and researchers have difficulty analyzing their research. Fluorescent polymer scaffolds solve this problem (by making it easier to view the scaffold), but are fairly expensive to produce and are not as durable.

This project aims to add fluorescence to biodegradable polymer scaffolds, without reducing their durability (as commonly occurs) while still being affordable. Polymerized cAMP and Poly-Caprolactone (PCL) were in varying ratios. The resulting mixture was combined with ethyl alcohol and DCM in a 1:4 ratio. Next, the mixture was electrospun and tested mechanically and under a UV light. The final nanofiber matrix was as durable as common polymer scaffolds, responded to UV light, and was cheap to produce. This shows that cAMP can be used as a way to elicit a UV response without degrading durability if it is combined with PCL.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN CH ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

227

Fair Category

PS

Project Number

6021

Title: Lending a Hand

Student Name(s): D. Kadis

## Abstract:

In hope of pursuing a career in prosthesis, I built an artificial hand to get a better understanding of what my future may hold. The purpose of this hand is to provide a possible solution for people living in third world countries that can't afford the current prosthetic replacements. A prosthetic was constructed using low-cost materials such as wood, pvc pipe, springs, and rope for a pulley system. A working prosthetic hand was constructed that could imitate the basic motions that a real hand can such as grasping a cup. The design originally exhibited limited finger recoil, but was improved with the addition of a spring system. The most challenging part to replicate was the finger tendons. The Digitorum Superficialis was found not to be the best way to connect the digits to the forearm as it does in real life. Instead the Digitorum Profundus was used to give a wider range of motion in the fingertips while still remaining realistic to the structure of the hand. A viable prototype was developed that would be an inexpensive option for third world countries. Further research is needed to get the extension of the pulley system in order to achieve motion from a person who is actually missing their hand. Finding a more comfortable solution and a realistic extension would be the next step in improving this device.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN PH EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

PS

Project Number

6023

Title: Biodegradable Plastic Study to Prevent Oceanic Pollution

Student Name(s): M. Peck

## Abstract:

The purpose of this experiment was to create a plastic using different combinations of starch and coatings that would resist degradation in freshwater, but completely degrade in saltwater. A total of 36 plastic samples were created, 18 consisted of potato starch, and 18 consisted of corn starch. The 18 potato starch samples were broken down into 3 groups of 6, then the samples were coated in paraffin, beeswax, or honey wax. Half of the 6 samples were put into a freshwater fish tank and the other half went into a saltwater tank. The exact same process happened to the 18 corn starch samples. The control group was a conventional plastic water bottle cut into a total of 6 pieces, half went into the freshwater tank and the other half went into the saltwater tank. The mass of the samples was taken prior to them being placed into the water, once in the water they were measured every 3 days. On the tenth day the samples were removed and left to dry for 3 days. Once completely dried they were massed a final time, and the percent change was calculated. The samples showed a significant decrease in mass anywhere between 2.41% - 27.16%. Once compared the combination of corn starch and paraffin had the greatest average decrease in mass; 23.75%. Unfortunately, it is not confirmed that this plastic will not degrade in fresh water which would significantly reduce its number of uses, but it degraded significantly more than the conventional plastic.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

270

Fair Category

PS

Project Number

6024

**Title:** Investigating the Efficacy of Magnesium Nitrate Hexahydrate in the Synthesis of 2,5-Dimethylfuran Biofuel

**Student Name(s):** C. Stearns

**Abstract:**

2,5-Dimethylfuran (DMF) is an extremely potent biofuel, as it possesses a 40% higher energy density ratio than ethanol and presents non-polar hydrophobic characteristics, therefore not retaining atmospheric moisture, a main cause of engine corrosion with ethanol-based fuels. 5-HMF is a platform chemical, meaning it can be used to synthesize a wide array of useful chemicals. However, its current synthesis is cost-prohibitive, making ethanol a more economically viable option. The synthesis route of fructose to DMF is a two-part process, beginning with the acid-catalyzed dehydration of fructose to 5-Hydroxymethylfurfural (5-HMF), leading to Pd/C-catalyzed hydrogenation. It is proposed that the current organic solvent, 1-butyl-3-methylimidazolium chloride, used in the acid-catalyzed dehydration of fructose, be replaced with molten Magnesium Nitrate Hexahydrate,  $Mg(NO_3)_2 \cdot 6H_2O$ , realizing a ~99% solvent cost reduction. Magnesium Nitrate Hexahydrate, a Nitrate Salt, is also a Class 1 Oxidizer, meaning its combustibility is negligible while still retaining its tendency to form solvates. The reactions performed were conducted in an Erlenmeyer flask placed in a sand bath at ~90-100C, and 2g of fructose were poured into 20g of molten Magnesium Nitrate Hexahydrate with a HCl catalyst for ~10-15 minutes. High Performance Liquid Chromatography was performed, providing conclusive evidence with a peak retention time of 8.03 minutes appearing in both the standard and experimental sample, indicating a measurable amount of 5-HMF, demonstrating 80-90% yield. This substitution of Magnesium Nitrate Hexahydrate for 1-butyl-3-methylimidazolium chloride in this crucial reaction offers a fresh path towards realizing a full integration of DMF into the conventional fuel industry.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CH BI ET

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

247

Fair Category

PS

Project  
Number

6025

Title: Identifying sustainable processes for capturing and converting CO<sub>2</sub> to chemicals.

Student Name(s): A. Roychoudhury

## Abstract:

Electricity generation, transportation, and industrial processes account for 77% of the CO<sub>2</sub> generation in the US and are major contributors to global warming. Capturing and separating atmospheric CO<sub>2</sub> is a slow process. However, extracting CO<sub>2</sub> from concentrated sources, such as flue gases, is more effective. Utilization of CO<sub>2</sub> for making synthetic chemicals is well known. Most of these processes, however, are energy intensive. Identifying breakthroughs for capturing and reducing CO<sub>2</sub> to carbon or converting it to fuels or chemicals will play an important role in limiting the rate of increase in atmospheric CO<sub>2</sub> levels. Towards this end, I examined CO<sub>2</sub> capture and conversion approaches.

CO<sub>2</sub> Capture: I examined several routes for CO<sub>2</sub> sorption and reversible release of the sorbed CO<sub>2</sub> via amines, zeolites, and calcium compounds. I examined typical of exhaust from combustion processes. I compared it with published data, and identified practical rates of CO<sub>2</sub> capture from these streams. I also examined the effect of pressure and heat on sorption and desorption rates and the possibility of using a solar concentrator as a heat source as a route to obtaining concentrated CO<sub>2</sub>.

Conversion: I examined several approaches to convert CO<sub>2</sub> to chemicals: the Bosch process, the Sabatier reaction, reverse water gas shift, electrolysis of CO<sub>2</sub>, co-electrolysis of CO<sub>2</sub> and steam. I experimentally and analytically identified reaction rates and suitability for conversion of CO<sub>2</sub> to solid carbon or high value chemicals. Means to use renewable energy were studied and a viable and sustainable pathway was identified.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN CH EV

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

Fair Category

PS

Project Number

6027

**Title:** Using a Driving Simulation Model to Measure Variations in Foot and Hand Reaction Times Across Age Groups

**Student Name(s):** C. Kirschbaum

**Abstract:**

The purpose of my experiment was to measure foot and hand reaction times in response to a stimulus, and show how these vary between different age groups. I developed a driving simulation apparatus that measures a driver's braking reaction time in response to visual stimuli. The model is structured much like an actual car, with a seat for the subject, as well as a makeshift brake and gas pedal. I utilized the programming languages HTML and CSS to develop the basic structure of the program, and Javascript to allow the program to function in a web browser. The subject presses the brake with their foot in response to a stimulus on the computer screen. When the brake pedal is pressed, a lever is pulled that presses the spacebar of a keyboard attached to the back of the contraption. The time it takes for the subject to react is immediately recorded. Each subject was tested using both feet. I then tested the time it took each person to react to the stimulus by pressing down the spacebar of the keyboard with their hand, rather than using their foot on the brake. My data showed that older subjects tended to have a larger difference between hand and foot reaction times than their younger counterparts. This relates to the significantly slower foot reaction times of the older subjects.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AT CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

231

Fair Category

PS

Project Number

6028

**Title:** Development of an Economical Single Stream Recovery Protocol of LiCoO<sub>2</sub> via Biological Sequestration

**Student Name(s):** Z. Gottlieb

**Abstract:**

Due to their lightweight and easily rechargeable abilities, lithium-ion batteries, LIBs, are the most ubiquitous form of rechargeable batteries. While electronic devices are often recycled, the process only recovers heavier materials such as zinc and nickel, while lithium remains a waste product. Along with prices for raw lithium stagnating at a relatively inexpensive \$2,000 per ton, any efforts to recycle lithium have been rendered economically unviable, and are thus non-existent. Fungi, such as *Aspergillus niger*, have been previously demonstrated to be able to sequester various metals, and could be employed as an economical and environmentally beneficial alternative to the extraction of raw lithium. *Aspergillus niger* was cultured on LiCoO<sub>2</sub> infused sabouraud plates, resulting in a lack of development of mycelia and inducing a phenotypic change from black to white, an indicator of a wA2 mutation known to influence fungal phenotype. Following microwave digestion, samples exhibited a pink color-- an indicator of cobalt at high levels of pH. Following flame atomic absorption, sample values lay outside of Beer's Law parameters due to medial values, resulting in data values of lithium above the detection limit of the instrumentation employed. Due to the high levels of lithium detected, *Aspergillus niger* would serve as an efficient sequester for LiCoO<sub>2</sub>. Additional research on the isolation of lithium from the mold itself, possibly via biodegradation, would enable this method to be employed for commercial use.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM BI CH

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

PS

Project  
Number

6029

Title: The Synthesis Of Silica X-Aerogels Through the Sub-critical Process

Student Name(s): W. LeMay

## Abstract:

Silica X-Aerogels are a revolutionary technology restricted by the fact that researchers must choose between exceptional strength or reasonable densities. Researchers have been able to manipulate density by changing the chemical used to initiate polymerization, but it has had many limitations, it always results in worse strength. Researching ways to create aerogels that solves this problem is essential to making aerogels an applicable technology. The purpose of this research is to manipulate the ratio of methanol and ethanol in the purification process to see how it will effect the end density of the Silica X- Aerogels. This is manipulating a different aspect of the procedure, and uses chemicals that researches tend to only use in conjunction with others, like the hazardous TMCS which is being left out of this project for safety concerns. To produce the Silica X-Aerogel, Tartaric acid solution will be added in drops to Sodium Silicate solution. Then, after it is washed with water, different ratios of Ethanol and Methanol will be used to soak the gel and clean out internal salts as well as manipulate the structure of the gel to allow for dying in sub-critical temperatures and pressures. Finally, the gel will be dried at room temperature for 24 hours, 50 degrees Celsius for one hour, and then at 200 degrees Celsius for one more hour. Comparisons made to other X-Aerogels will be used to determine the quality of the aerogel

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN CH

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

PS

Project Number

6030

Title: A New Fast Algorithm for Finding Eigenvalues in Vibrating Structures

Student Name(s): S. Kim

## Abstract:

As with the case of the collapse of Tacoma Bridge, the natural frequency of an object is key aspect in building sturdy structures. The natural frequency depends on the material and structure of the object, and can be the cause of major damage when another vibration resonates, amplifying the damage on the object. Because the natural frequency can be expressed in a matrix form of eigenvalues, it can be solved through the use of algorithms such as the Jacobi method or QR method.

However, there might be a more efficient algorithm to solve for the natural frequency, as the aforementioned algorithms hold some natural flaws. Jacobi method, for example, takes longer time to converge when there are off-diagonal elements of large magnitudes.

The presented algorithm therefore focused on more efficiency on getting the eigenvalues of a given matrix. The algorithm uses household procession to reduce a symmetrical matrix into a tridiagonal matrix, then uses eigensolution for tridiagonal matrix with a modified iteration.

The end result is an algorithm that makes getting eigenvalues a matter of plugging in values for certain variables and repeating the same process, which means that heavy calculations used in other methods could be avoided.

The algorithm written programmatically also yielded precise results for various structures with natural frequency. With enhanced efficiency and ease of implementing, the algorithm could help reduce the computational workload in solving for natural frequencies in the design phase of many structures.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

MA EE PH

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project  
Number

6031

**Title:** Determining the Optimal Implementation for Secure Multiparty Computation of the Logistic Function

**Student Name(s):** A. Benz

## Abstract:

Secure multiparty computation is a technique in cryptography that allows for two or more parties to compute an arbitrary function over their inputs without revealing their inputs to the other parties. Yao's circuit protocol provides a method of implementing secure multiparty computation between two parties over any arbitrary function by first converting the function into a Boolean circuit and then converting each gate in the circuit into an encrypted form. This research compared various implementations of the logistic function, a mathematical function commonly used in artificial intelligence, in order to determine which method is most efficient in the secure multiparty environment. These implementations were written in Obliv-C, a wrapper for the GCC compiler that allows for secure multiparty protocols to be implemented in the C programming language.

Due to the computational overhead of computing floating-point operations using Yao circuits, fixed-point calculations are used instead. This fact prevents traditional methods of computing the logistic function from being used; the algorithms compared in this experiment include a Taylor series approximation for the logistic function, a piecewise-linear definition of the logistic function, a polynomial approximation generated by Remez's algorithm, and a variant of the first method involving the Taylor series expansion for the exponential function. Performance was measured using the wall-clock time elapsed for each method, collected by averaging the time elapsed for 100 trials with randomly generated input values. The results determined that the first Taylor series approximation method was marginally more efficient than the other methods.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

148

Fair Category

PS

Project  
Number

6032

Title: Using Octadecanol to Limit Freshwater Evaporation

Student Name(s): K. O'Connor

## Abstract:

One of the largest problems facing areas with droughts is evaporation. Long periods of hot days and warm sun evaporate large bodies of public water supply resulting in a water shortage, major crop death, etc. Octadecanol is an organic compound which is effective at preventing evaporation at rates of up to 80 percent. This allowed for water to continue to evaporate into the atmosphere, but prevents large scale evaporation resulting in water shortages. In a small scale application, water and octadecanol will be placed in a 250 mL beaker. By having differing ratios of octadecanol to water, determined by molar mass converted to grams, in regulated environment with a heat lamp placed over the beaker to simulate the sun, it can be determined if octadecanol has any effect on the rate at which water evaporates and can be used as a viable method for preventing large scale evaporation.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM CH EA

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

269

Fair Category

PS

Project Number

6033

**Title:** A Novel N-Doped Carbon Nanotube/Copper Electrode for the Reduction of CO<sub>2</sub> to Biofuel

**Student Name(s):** M. Woo

**Abstract:**

In 2013, 40 billion tons of CO<sub>2</sub> were released into the air to power our increasingly industrialized world. This high rate of CO<sub>2</sub> release necessitates a manner in which the carbon cycle can be closed, turning CO<sub>2</sub> back into fuel. In prior literature, difficult-to-synthesize and relatively high cost cathodes have been shown to convert CO<sub>2</sub> into several light-hydrocarbon products, tunable with the magnitude of overpotential applied to the cell. In this research, a novel, low-cost, and simple-to-manufacture nitrogen-doped carbon nanotube (N-CNT) electrode with copper nanoparticles was synthesized simply by mixing cyanamide (nitrogen precursor), a carbon source (acid-prepared carbon nanofibers), and a transition-metal salt (copper(II)acetate) in IPA. After stirring, the solution was heated under flowing N<sub>2</sub> and manually ground into a powder. The resulting N-CNTs with copper nanoparticles were examined via SEM, demonstrating 200nm N-CNT diameter tubes. The Cu/N-CNTs were applied to conductive carbon cloth soaked in Polytetrafluoroethylene and compressed at 200psi to synthesize the cathode. CO<sub>2</sub> reduction was performed in a 5ml H-cell filled with 4ml of 0.1M KHCO<sub>3</sub>, both with and without additional copper nanoparticles electro-nucleated onto the cathode. An anion exchange membrane separated the anode (platinum) and cathode. Negative voltage was applied to the cell with a 1.5V AA-battery. GC analysis of the reduction products highlighted the synthesis of ethanol; significantly higher efficiencies were achieved for electrolysis experiments where additional copper was added to the cathode. Overall, equal or higher efficiencies for CO<sub>2</sub> conversion were observed compared to prior literature, while using a simpler, and inexpensive cathode design.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ET EM EN

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

265

Fair Category

PS

Project Number

6034

**Title:** Increasing Fuel Efficiency in Ferry Transportation Through the Use of Hydrofoils on Two-Hulled Motor-Craft

**Student Name(s):** W. George

**Abstract:**

The objective of this project was to increase fuel efficiency for multi-hulled fast-ferrys by creating the most efficient hydrofoil design. The model of a high-speed ferry boat was designed using 123D Design and #D printed using PLA plastic filament. Each double-hulled prototype allowed for the addition of 2 sets of hydrofoils. The hydrofoils were also designed on 123D and 3D printed. Two different types of hydrofoils, including a set of T-foils and V-foils, were printed and tested. The testing environment included two, 2 by 4 anchors were nailed into a lake at a depth of about 3 feet and a motorized pulley was mounted on one of them. The boat was pulled from the motorized end of the system to the non-motorized end while tied to a continuous piece of line that ran through the block and the motor. Lift, distance-until-foiling, and stability were measured in several trials for each prototype. Results were calculated and analyzed for statistical relevance. Over all, the T-foils produced the most amount of lift considering the measurements used to calculate lift. From observation and measurement, the T-foils were noticeably more stable than the V-foils and the T-foils allowed the boat to stay on a hydroplane longer than the V-foils. In conclusion, simpler is better in the sense that the least complex foil design proved to be the most efficient. Future research might include prototyping more complex shaped hydrofoils or creating a new hybrid-shape that would include the best qualities from each of the previous designs.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ET

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PS

Project Number

6035

**Title:** A Radio Transceiver-Based Wearable Device to Help Visually Impaired Users Avoid Vehicles

**Student Name(s):** E. Campanella

## Abstract:

With the increased use of quiet electric cars, crossing the street is becoming dangerous for visually impaired(VI) pedestrians. This arising issue can be resolved by providing VI pedestrians with a wearable car-tracking system using radio transmitters and receivers. The radio transmitter and receiver send out radio waves, and receive the ones which have, and have not reflected off of cars/metal during the transmission process.

For this system to run successfully, a strong and constant communication between the two devices (transmitter and receiver) using radio waves is necessary. The variables coded into the waves used for communication, are used to display the number of the radio wave, and calculate the transmission time.

It was discovered through observation that the clocks on each device must be synced in order for the transmission time algorithm to work. In order to do this, a reset button and clock algorithm were written and added.

There was also an absence of radio waves reflected from metal. It was found that the frequency of the transmitter and receiver(433MHz) was too low. The update to the new 2.4GHz transmitter and receiver required a change in the sending and receiving algorithms, and the hardware setup.

When this version was tested, some bounced waves were received, but the data did not support a solid conclusion for the wave bouncing portion. The communication between the devices succeeded though. Each variable was fully transmitted and produced the expected result when run through the transmission time algorithm.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CS EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

205

Fair Category

PS

Project Number

6036

Title: Does Industry Concentration Effect the Variability of Human Capital investment?

Student Name(s): S. Mediboina

## Abstract:

My research project is about the relationship between the variability of human capital investment and industry concentration. Industry concentration in the monopolization power that a firm has in its respective industry. Human capital investment is the company's spending on its labor force. These costs include training for employees, and firing and hiring expenses. The variability of human capital investment is informative of how often the amount of human capital is changing and to what extent it is changing. There seems to be a negative relationship between the variability of human capital investment and industry concentration. As industry concentration increases, the variability of human capital investment is decreasing. The labor costs of a company are becoming stagnant, and the variability is diminishing. This is supportive of the theory that monopolization inhibits innovation. When the majority of industry concentration of a particular industry is concentrated among a few select firms of the industry, innovation can be decreased. Similarly, the increase in monopolization is inhibiting the variability of human capital investment. Human capital is an important component of a firm because it creates a competitive edge to a firm that is hard to recreate. So, the lack of variability of human capital investment can harm a company's competitiveness.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

PS

Project Number

6037

**Title:** Thermodynamic Analysis of Fullerene Nano Molecules and Its Derivatives Used in Cancer Treatment

**Student Name(s):** Y. Lim

**Abstract:**

Certain reactive oxygen species in the body can cause oxidative stress to biological cells by causing uncontrolled radical reactions. Methods applying fullerenes to control adverse reactions were studied to evaluate if fullerenes are suitable for cancer treatments. The growth of phaseolus vulgaris seeds with chemiluminescence that were treated with oxidizing solutions was recorded to compare to those of seeds in a vitamin E solution and distilled water to determine if reactive oxygen species caused any harmful stress. Molecule simulators such as Avogadro were also used to measure the optimized energy and electrostatic forces acting on the fullerenes when attached with hydroxyl and carboxyl groups to analyze thermodynamic stability. The results confirmed the hypothesis that plants treated with oxidizing solutions would have the highest number of reactive oxygen species shown by the longest chemiluminescence. Results also indicated H<sub>2</sub>O<sub>2</sub> and C<sub>60</sub> were the most effective treatments in reducing oxygen radicals as chemiluminescence times were the shortest out of all the test subjects, confirming the effectiveness of fullerenes as a treatment. From simulating various fullerenes, fullerenes with lower enthalpies were found because of their chemical stability apt for medical usage. Although fullerenes such as C<sub>40</sub> had decreasing enthalpies when combined with hydroxyl and carboxyl groups, they had higher enthalpies ranging from 24,000 to 27,000 kilojoules per mole. Fullerenes such as C<sub>82</sub> were more apt as they had a much lower range of 11,000 to 17,000 kilojoules per mole even though their enthalpies increased when combined with other groups.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

BI EN ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

219

Fair Category

PS

Project Number

6038

**Title:** The Application of Ferrofluid paired with Neodymium Rare Earth Magnets to Reduce Friction

**Student Name(s):** P. Santandrea

**Abstract:**

Ferrofluid is a fluid that interacts with magnet fields due to nanoparticles of iron suspended in the solution. When the fluid is paired with a magnet it is proposed that resistance through friction will be reduced. This reduction in friction will lead to more efficient bearing for generators or other machinery. To validate this proposal an experimental design apparatus was constructed consisting of; a variable angle incline plain which is currently set to an angle of 30 degrees, a glass surface, and a pair of photogates placed 30 cm away from each other which calculate the time up to the hundredth thousand decimal it takes for the Magnet to slide the 30 cm between them. The data indicates that the control, a magnet with no lubricants sliding down the incline plain, has an average velocity of 95.4328 cm/sec. The second control, using fully synthetic motor oil as a lubricant, produced an average velocity of 34.7233 cm/sec. Using ferrofluid as a lubricant produced the highest average velocity of 120.0697 cm/sec. This is a 25.82% increase in velocity for the ferrofluid over the no lubricant test, and a 245.79% increase in velocity for the ferrofluid over the motor oil test. After testing further applications include the design and prototyping of a reduced friction Ferrofluid based lubricated bearing system.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

AT EE ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

227

Fair Category

PS

Project Number

6039

Title: Bioluminescent Pyrocystis Fusiformis In A Changing Environment

Student Name(s): C. Toldo

## Abstract:

The purpose of this experiment was to determine the effect of ocean acidification and light duration on the bioluminescence of dinoflagellate Pyrocystis Fusiformis. I did this by having 3 separate sterile boxes that held 80ml of the organisms. The boxes blocked out all natural light, allowing me to control how much light the organisms each box were exposed to. In each box there was a 15 watt light strip.

Using sulfuric acid I decreased the pH of two different experimental groups to 7.35 and 7.34 respectively, while the control group remained at a pH 7.7. In the experimental groups, adding sulfuric acid increased the bioluminescence produced. Also, in both experimental groups the pH's buffered back to 7.59 and 7.86. Seeing this I made the conclusion that they have the ability to buffer back to a pH that was more favorable. I took a time-lapse photo every day by using a vortex to disturb the dinoflagellates, which would make them produce bioluminescence.

For the second experiment, I varied the light duration that the dinoflagellates where exposed. The control group received 12 hours of light, the experimental group's received 16 hours and 8 hours of light. The dinoflagellates that showed the greatest bioluminescence was ones exposed to 16, 12, 8 hours of light, respectively. Enabling me to draw the conclusion that increased light exposure leads to increased bioluminescence.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

AS EA EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

262

Fair Category

PS

Project Number

6040

**Title:** Application of flexible PVDF nanofibrous membrane coated carbon fiber for tunable low cost solvent recycling

**Student Name(s):** A. Araki

## Abstract:

From the scientific industry, where use of methanol, acetonitrile, and ethanol are commonplace in both reaction syntheses and analytical methodologies, to the automotive industry, where liquid cleaners are used for part cleaning and reconditioning, an extraordinary amount of solvent waste is produced, with a disposal cost that continues to rise. Specifically, current solvent waste disposal techniques include pyrolysis and use of injection wells, which are both harmful to the environment. Concurrently, the cost for new solvents continues to rise, due to escalating manufacturing costs. The need for solvent recycling is readily apparent. This research investigates and develops a safe and eco-friendly solvent purification method, based on filtration with PVDF-coated carbon foam. In such a filter, an organic solvent is attracted and retained by the PVDF-coating, while "purified" water is permitted to pass through the filter. To begin fabrication, 0.25grams of PVDF-HFP:PFDTMS, in varying weight ratios, were co-dissolved in 50:50 Acetone/N,N-Dimethylacetamide, and coated onto circular 80 and 100PPI carbon foam disks (with a cubic area of ~6.5cm<sup>3</sup>). After overnight drying, SEM analysis of the completed filtration disks highlight uniform dispersion of the dried PVDF-coating within the pores of the carbon foam. To verify solvent separation and recycling, 20ml of 0-5% methanol in water was passed through the PVDF-coated filter. GC-FID analysis of the filtrate suggests that as much as 67% and 78.3% of the methanol was retained by the 80 and 100PPI carbon foam filters, respectively, with a purified water filtrate. Recycled methanol can be recovered by squeezing the foam filter.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EM AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

219

Fair Category

PS

Project Number

6041

Title: Development of New and Efficient Metamaterials

Student Name(s): D. Lee

## Abstract:

Metamaterials are an artificial type of matter created by combining two different media, usually a metal and a dielectric. Their precise shape and size affects waves of light propagating through in an unconventional manner, such as increasing the photonic density of states or inducing various refractive indices; the physical structure is more important than the chemical make-up. The structure has to be sub-wavelength size by the Effective Medium Theory of left-handed materials.

Hyperbolic metamaterials (HMMs) are metamaterial with a dielectric tensor which is extremely anisotropic. The name is derived from the isofrequency curve of the medium which is hyperbolic as opposed to circular as in conventional media. An example of such is the deposition of smooth thin films of silver (for the multilayer design) on a germanium layers. Presented research is about the use of metamaterials. Metamaterial is a material that is not found in natural materials with a negative refractive index. Metamaterials can be made by having very thin layers of metals and non metals. In this project, have specific angles for combinations of metals and non metals that will produce a negative refractive index were studied and found. The refractive index of each combination of metals and non metals was used in order to see if any angle can produce a negative refractive index.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH AT EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

204

Fair Category

PS

Project Number

6042

Title: Cheap Heat

Student Name(s): G. Corsale

## Abstract:

As the health of the planet is becoming a reoccurring issue in modern society, the debate over renewable and nonrenewable resources such as wind, solar, coal, and oil respectively has lead to the creation of efficient producers of energy. This project glances at the efficiency of a solar soda can heater, which employs sunlight to warm a chamber of soda cans, thus heating the air within the cans, producing heat like a baseboard radiator. Following construction, the ability of the heater to produce heat (independent variable) was tested in both sunny and cloudy conditions, with the temperature of the air exiting the box through a small computer fan being measured and recorded every 30 minutes (dependent variable). The hypothesis stated that the heater would be successful in producing heat, regardless of the weather conditions. Following a series of tests, the heater did indeed generate heat on cloudy and clear days, as it was able to produce temperatures that were 15 to 50 degrees higher than the surrounding outside temperature. In addition, this experiment displayed that even if the weather is not optimal, the heater is still able to capture the sheer amount of sunlight passing through the clouds to produce a source of heat.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE ET EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6043

Title: The Fabrication of a Graphene Supercapacitor

Student Name(s): J. Silliman

## Abstract:

Supercapacitors are able to hold hundreds of times the amount of electrical charge as standard capacitors, and are suitable as a replacement for electrochemical batteries in many industrial and commercial applications. Graphene supercapacitors are very important towards more efficient energy use in the future. Graphene is a fullerene consisting of bonded carbon atoms that form a sheet one atom thick. These graphene sheets, when fabricated will be bonded loosely together and stacked upon one another. The goal is to fabricate a graphene supercapacitor using these sheets of graphene. To make the electrodes of our supercapacitor, we must first yield these multi-layered sheets of graphene. This was done by thermally reducing graphene oxide on an aluminum foil substrate using a chemical vapor deposition furnace for 30 minutes at 300 degrees Celsius. The graphene sheets that we obtained using this method are looked at using a Scanning Electron Microscope (SEM). We used these newly obtained sheets of graphene as electrodes in an electric double layer capacitor. We used paper soaked in potassium hydroxide as a material that would be between the two electrodes acting as a sort of dielectric. We constructed the materials in a vacuum bag to reduce the amount of air and therefore distance between the electrodes. We then tested the supercapacitors' capacitance using a multimeter. Next we fabricated the same supercapacitors, however mixed metal nanoparticles into the graphene oxide before thermally reducing it. We then tested these new supercapacitors and found an improvement in capacitance from the previous supercapacitors.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT EE ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

241

Fair Category

PS

Project Number

6044

**Title:** Optimizing Efficiency of Long Distance Tube-And-Pod-Based Low Friction Transportation Systems

**Student Name(s):** W. Peisch

**Abstract:**

The objective of this project was to digitally design and prototype a novel approach to long-distance transit with a tube-and-pod-based low-friction transportation system, popularly referred to as the "Hyperloop". The most practical location for early Hyperloop investment in the form of tube links will be in areas of high population, with little distance between cities. Using the Macbook Air Laptop, a program was designed in the java-based language Processing which simulated transportation within the United States. The program interpreted data from the US census and other databases to construct a virtual map of the United States and transportation connections between US cities. The program then "sent" "passengers" through the system and mapped out passenger travel between major hubs and determined which links would be the most "valuable" in terms of usage per mile. Data was analyzed and at the conclusion of the experiment, the original hypothesis was supported with statistical significance. The Hyperloop gets the most per-mile usage in high-density regions of the United States, except when a line in a low density area was used for transportation between multiple cities on each end of the line. Future studies may include an analysis of the speed at which the pods would have to travel in order to match airplane time efficiency. Additionally, further research can be done into the effects of modifying specific characteristics of the Hyperloop system, like pod capacity or speed.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ET CS MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

Fair Category

PS

Project Number

6045

Title: Recognizing emotions through speech with Matlab

Student Name(s): H. Zhang

## Abstract:

One of the major breaches between machines and human beings is definitely the exchanging of emotions. Being able to decipher the emotional state of a person is critical for robots to get closer to a real human, enabling them to make more "warmhearted" responds. Aside from facial expression, speech is definitely the most important media for emotions. To divide the problem even further, this project is to facilitate the recognition of emotions through the mere physical features of the sound wave. I recorded dozens of sentences attributing to different emotional states. Then, I plotted the magnitude against time, and magnitude against frequency using Discrete Fourier Transform for each sentence in Matlab. This allowed me to extract the magnitude(intensity), frequency(pitch), and prosody for the voices. With the help of Albert Mehrabian's Pleasure-Arousal-Dominance(PAD) model, I am able to identify every emotional state based on these three factors. By putting the graphs together and comparing them, I found that voices with positive trait pleasure have a higher frequency; voices with positive trait arousal have shorter syllables; voices with positive trait dominance have a greater magnitude. I developed a GUI using Matlab that can tell one's emotion based on these observations I made. Although its accuracy is limited, this can help robots understand the emotional states of the speaker and make more sensible responds.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

210

Fair Category

PS

Project Number

6046

Title: Cycling Assisted Brake

Student Name(s): K. Young

## Abstract:

The purpose of this experiment is to determine if a computer brake device can outperform human reaction time when an object is detected. The initial project started with a simple code on an Audrino to control a servo motor with a distance sensor. I have created and evaluated many designs to demonstrate this principal and effectively apply the back brake. The best design was then put into a 3D model software and then printed. Once the structure was complete, an Audrino board was wired with the brake and a distance sensor. Several modifications were completed to produce the most effective distance sensor brake. To test the performance of the device, a separate tool was created to measure the exact time of activation between the device and human reaction time when an object is detected. When using the device in the last trials, eight of the ten trials showed that the device outperformed human reaction time by a few fractions of a second. The difference between these trials was an average of 183 milliseconds. It is evident from the initial data that the device is faster than human reaction time. In the future, additional tests will be performed to collect data to determine the overall performance and effectiveness of this device.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

PS

Project Number

6047

Title: A Weather-Based Rainwater Irrigation System

Student Name(s): K. Krawczuk

## Abstract:

Water shortages are becoming an increasingly serious issue not only in places such as California, but throughout the country and the entire world. In fact, according to the World Wildlife Federation, by the year 2025 two thirds of the world's population may face water shortages. Irrigation makes up for one third of the amount of water used within the United States, making it vital to find a way for farms to conserve water. This project is a weather-based rainwater irrigation system that can help farms be more conservative with their water. The way it does that is by collecting rainwater which can be used to water the plants, while also having the ability to use city water if needed. It also uses an algorithm that takes into account the weather forecast, which it finds via Ethernet, and the moisture of soil, through the use of sensors, in order to determine how much water crops should receive. Such a system could help farms/homeowners with irrigation systems use water more efficiently while still having healthy crops. After all, if every farm in the United States saved at least one gallon of water a week, that would be 114 million gallons of water saved annually . That much water is enough to support an entire city the size of New Britain for approximately two weeks. Yet a system such as this can help farms save more than one gallon of water a week, meaning more surplus water as farms save money.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CS EM AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

Fair Category

PS

Project Number

6048

Title: Efficient Wind Turbine Blade Design Using Computational and Numerical Analysis

Student Name(s): S. Lee

## Abstract:

The wind turbines have been applied all-throughout the continent due to its efficiency as a renewable energy resource; there have been series of studies that tried to enhance its efficiency and I also decided to jump in after sighting the falling of the maple seeds. When I first saw the spiral motion of the falling of the maple seeds, it gave me an insight of the ideal shape of the wind turbine that can allow it to turn itself very smoothly. The unique shape of the maple seeds make it fall with continuous spiral shapes and it is varied from each maple seeds. Then, I moved onto researching some studies regarding the spiral motion of the maple seeds and some universal designs of the wind turbine. Even though the current wind turbine designs were designed well enough, it didn't provide enough energy efficiency compared to other renewable energy resources. Trying to find a better design, I used QBlade in order to design a wind turbine that imitated the maple seeds. While designing, I realized that there were many more factors that I had to consider including the alpha angles of the wind turbine, angle-of-attack, and the material of the blade. This made my work load more burdensome, but such obstacles allowed me to build an ideal wind turbine with much more efficiency.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET EM AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

235

Fair Category

PS

Project Number

6049

Title: Improving the Outbrain Click Prediction

Student Name(s): J. Bi

## Abstract:

Outbrain is an online advertising company specialized in presenting sponsored website links. Outbrain is hosting a competition on kaggle, an online platform dedicated to predictive modeling and analytic competitions that statisticians and data miners compete in. The specific purpose of the project was to improve upon Outbrain's algorithm to predict which recommended content each user will click and submit a script to kaggle by the deadline January 18th. Specifically, the objective of the intended script was to predict whether or not a user would click on the advertisement using preexisting data. The script would be able to do so with the use of a training data set containing the features. Classification was to be done with the Random Forest Algorithm which would create an array of decision trees split on random features using the existing training data. The predictions for the testing data would be evaluated by the result of the majority of trees in the forest. Prediction rate using a separate testing data set would be used to evaluate the proficiency of the script. Coding was done at home through a device directly on the kaggle website, using the Python language and the various csv files containing the data sets. Due to an unidentifiable error, the script could not be completed. Additional circumstances with the online script editor extenuated the issues. However, the procedures involving the creation of Random Forests were still thoroughly explored.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

176

Fair Category

PS

Project Number

6050

Title: Liquid Reflectiveness and its effect on temperature

Student Name(s): N. Ames

## Abstract:

The reason I did this experiment was because of my interest in exoplanets. The surface temperature of a planet can change drastically depending on if or what kind of liquid the planet has on its surface. This is because the reflectiveness of a planet's liquid can change the amount of heat that the planet absorbs. For this experiment, I set out to demonstrate this on a small scale using household objects. I used a heat lamp and a gallon bucket of water to demonstrate a star and a planet's liquid respectively. I used the lamp to expose heat to a normal bucket of water, a bucket of water made murky by dirt, and a bucket of water made reflective by glitter, before recording their temperatures and comparing. My hypothesis was confirmed, as the reflectiveness of the water did change the temperature. The murky and reflective water were both cooler than the plain water after being exposed to heat. In conclusion, I was able to correctly demonstrate the connection between liquid reflectiveness and temperature of a planet.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

PH EA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

174

Fair Category

PS

Project Number

6051

**Title:** Design, build, and code a cellular/WiFi enabled smart thermostat using a microcontroller and a custom Android app to increase energy efficiency for homes and workplaces.

**Student Name(s):** B. Bruder

## Abstract:

I proposed to make a ‘smart’ thermostat at a fraction of the cost of current units, in order to make energy-efficiency more affordable for consumers and businesses. Over the past couple months, I have sketched, diagrammed, developed, and programmed my thermostat to meet my vision of it. In this time, it has grown from a few drawings, to a basic model with a rotary encoder, to a completed, functioning prototype. I call it a “HomeBox.”

Using a Particle microcontroller, along with Java, C and Android Studio, I have created a touchscreen, programmable, smart thermostat and a companion mobile app. The unit uses the app to manage its features remotely via WiFi connection. And unlike existing units such as Nest, HomeBox can connect over cellular connections as well. I added Eco Mode, an option to let users select a range of temperatures to be set so the furnace, condenser, etc. won’t have to work as hard to keep the environment at a specific temperature. Hopefully my low-cost thermostat will enable “Eco for Everyone.”

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

240

Fair Category

PS

Project Number

6052

Title: AdaBoost Shrinks Noisy Volumes in Decision Space

Student Name(s): N. Wee

## Abstract:

Boosting is an algorithm in machine learning that uses a set of weak learners to create a single strong learner. A weak learner is a classifier that does slightly better than chance when predicting the true classification where a strong learner is a classifier that correlates well with the true classification.

Boosting depends on the data and weak learner; boosting may not perform well if there is not enough data, or if the weak learners are too complex or too weak. We want to investigate the cause of why Adaptive Boosting is resistant to overfitting on noisy data. Because of how it is designed, AdaBoost has an innate ability to identify noise points that are mislabeled or ambiguous and hard to categorize. AdaBoost increases the weight of points it gets incorrect in the current training round to be carried over to the next round. Over multiple rounds, the hardest examples with the highest weights often turn out to be noise points or outliers.

In conclusion, we have found experimentally on real world datasets that AdaBoost tends not exhibit the overfitting phenomenon even when trained for large numbers of boosting rounds. We hypothesized that noise points don't contribute heavily to the test error because they take up negligible volume, especially as the number of training rounds increases. We have verified experimentally that the volume that a noise point occupies shrinks dramatically as the number of training rounds increases, supporting our hypothesis.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS MA AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6053

**Title:** Renewable Energy Generation Using a Hybridized Saltwater Electrochemical and Hydrokinetic Energy System

**Student Name(s):** B. Hawley

**Abstract:**

Methods of hydrokinetic energy generation today lack efficiency or economic viability for use in both developed and developing countries. The massive turbines associated with these generators require large-scale manufacturing, expensive and specific site-installation, and costly maintenance budgets. This research presents a newly-invented, hybridized hydrokinetic design that lowers the cost of energy production, with an overall technology that is clean and efficient. The design incorporates a vertical-axis turbine that allows kinetic energy to be generated by the rapid movement of ocean saltwater currents from any direction. The unique design leverages extensive networks of buoys because of its mobility, scalability, and low cost. First, optimization studies of electrochemical fuel cell design investigated various combinations of materials, to maximize energy production from the redox of saltwater. A fuel cell composed of magnesium, PBI performance membrane, and a 2x4" air cathode generated an average of 1.15 volts, with a maximum voltage recorded at 1.4 volts. This shows a measurable increase over current designs. For the remaining portion of the hybrid design, an original vertical axis turbine (31') was designed in Solidworks, and its energy production evaluated using Solidworks Flow Simulator. Research is continuing to determine the voltage produced by the hydrokinetic turbine under typical coastal conditions and the combined voltage produced by the hybridized system. Energy output, low cost, and ease of maintenance the proposed prototype, provide compelling evidence that the hybridized saltwater electrochemical and hydrokinetic energy system can be a viable option to today's expensive hydrokinetic energy and generation technology.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ET EE EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

237

Fair Category

PS

Project Number

6054

Title: The Application of Tracking and Learning Objects in A 6 Axis Robotic Arm

Student Name(s): H. Mo

## Abstract:

This project presents a robot-human cooperation system by combining multiple object tracking methods, such as SURF (Speeded-Up Robust Features), Color Range Features and TLD (Tracking-Learning-Detection). Color Range Features filter the general image and provide a stable range of information for other detectors and descriptors. SURF outperforms many other schemes with respect to repeatability, distinctiveness, and robustness. This is achieved by relying on integral images for image convolutions; by building on the strengths of the leading existing detectors and descriptors (specifically, using a Hessian matrix-based measure for the detector, and a distribution-based descriptor); and by simplifying these methods to their essential parts. This leads to a combination of novel detection, description, and matching steps. Finally, the object detectors are trained through labeled examples, which can make the tracking system more accurate. At the same time, the 6-axis robot arm performs with extraordinary flexibility while carrying a payload of around 300 grams. It can react to the operator's hand movement and finish different tasks such as Object Tracking and Hand Gesture Recognition. I would like to call this system "The Third Arm". In the future, this system can be developed as a wearable device and replace electrode-sensor based artificial limbs. Third Arm can function as a human arm and cooperate with humans through Machine Learning and Computer Vision, which would help people with paralysis or enhance people with normal physical ability.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CS AT EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

PS

Project  
Number

6055

Title: So You Want To Be a Rock Climber?

Student Name(s): N. O'Leary

## Abstract:

Rock climbing is a sport much more complex than simply grabbing a rock and pulling yourself up. The purpose of this experiment was to analyze the challenges rock climbers face and determine how and to what extent climbing shoes, climbing chalk, and one's own technique aid in a rock climber's ability to climb well. The hypothesis was that all three variables were equally important and that each one was equally dependent on the other two to be effective. The procedure involved analyzing data from three experienced rock climbers of varying weight. Climbing the same route, the number of rock climbing holds achieved by each climber, per trial, was used to quantify the effects of the three variables. By taking videos and analyzing pictures, the technique of the climbers was analyzed. These varying techniques and their effects were compared against each other to produce five main areas of technique that benefit climbers the most. In addition, the average number of holds achieved per trial was compared across the three variables, for each climber, to determine their effectiveness. It was found that climbers in larger weight classes saw more benefits than those in lower weight classes when using climbing chalk and climbing shoes. In addition, the results provided evidence that climbing technique is the most important factor because it is the determining factor in whether or not climbing shoes and climbing chalk help a climber. Overall, all three variables play critical roles in positively impacting an individual's ability to climb well.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH BE MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

258

Fair Category

PS

Project Number

6057

Title: AprilTrack: A Particle-filter-based AprilTag Tracker

Student Name(s): D. Pfrommer

## Abstract:

The AprilTrack algorithm proposed and used in this experiment seeks to bridge two existing fields of research in computer vision literature: visual fiducial (or simply fiducial) detection and monocular object tracking. With a rise in the popularity of fiducials, or artificial markers, as a source of ground-truth position data for mobile robots, there has been a considerable interest in designing robust and blur-resistant fiducials. Rather than devising an entirely new marker as others have in the past, the AprilTrack algorithm attempts to improve on existing fiducials, such as the popular AprilTag marker, by augmenting fiducial detection algorithms with a particle-filter based monocular object tracker which reliably tracks both a fiducial's position and orientation (i.e six degrees of freedom), allowing for tag-based localization in situations where still-frame-based methods would be unable to do so. This is accomplished by discretely approximating the probability distribution of possible tag poses given a sequence of input images as a set of particles which are updated each iteration (each time a new image is processed) with a SIR particle filter. The AprilTrack algorithm was also extended in this experiment to simultaneously and accurately track multiple tags, allowing for the use of the AprilTrack algorithm in more complex scenarios. The algorithm was evaluated on several sequences and was compared to a hand-labeled ground truth, demonstrating that it is capable of providing ground-truth position data for evaluating performance on visual odometry datasets and allowing for the accurate tracking of blurred tags in high-motion scenarios with poor illumination.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6058

Title: The Efficient Application Of Resonant Energy

Student Name(s): M. Kichar

## Abstract:

The basis of this engineering project was to construct a working design capable of transferring electricity over a distance without the use of wires. Materials were gathered in accordance to the project proposal, as well as suggestions from a professional in the field of electrical engineering, who was responsible for mentoring this engineering project. Multiple past experiments, patents, and designs were considered, eventually leading to a circuit diagram for the design utilized. A transmitter unit was assembled corresponding to these plans, and was connected to a device to control the output frequency, which used AC power from a wall outlet. Another coil with the same design was created and connected to a device to graph the electrical outputs. The coils were placed an inch away from each other, and the transmitter was powered. A current from the receiver coil was then measured and the data was recorded and graphed. After measurements were taken, the coils were moved another inch apart, and the new current was measured. Results obtained showed how the voltage was enough to power a phone over a short distance of 10 centimeters. As distance was increased, there was an exponential decrease in the amount of energy transferred, due to a loss of efficiency in the system. The results of a maximum of 10 centimeters for 5 volts are also similar to those found in previous related studies done, though it is planned to go into further studies regarding specific elements of the project to increase design efficiency.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

193

Fair Category

PS

Project Number

6059

Title: Most Powerful Wind Turbine Blades

Student Name(s): E. Cruz

## Abstract:

We conducted an experiment to design the wind turbine blade that produces the most power by investigating blade surface area to determine which size produces the most power. It was hypothesized that if the shape of the blade has a larger angle and surface area then the blade would produce more power because the angle and surface area will allow the more lift to be generated. It was discovered that a high surface area blade produced 1.70 volts and the low surface area blade produced 1.52 volts. Throughout the experiment, designing a blade using balsa wood did not produce the amount of power we expected. We originally suspected that the balsa wood to produce more because it was a longer blade and had a larger surface area too. We also concluded that if 3D could have been printed, the blades that originally designed using CAD software and a lighter material and more aerodynamic design we would have produced significantly more power. What I concluded was that as the blades generated more lift the amount of energy increased. What I also concluded was as the surface area increases, the amount of energy also increases.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

231

Fair Category

PS

Project Number

6060

Title: Hybrid Solar/Wind Turbine

Student Name(s): S. Wehelie

## Abstract:

With my hybrid wind turbine project, it is still in the hypothetical phase, as I will name it. I am still planning it out, and researching the best method to construct and employ a layout that will create the most efficient version of it possible. Since the deadline, however, I have not been able to do much with it. Although I strongly resonate with the idea of a hybrid and theoretically perpetual wind turbine, due to time constraints and heavy workload, i have been unable to necessarily put forth anything to present at this year's science fair. I intend to continue researching my project, and put it forth for the 2018 Science Fair, with a fully operational prototype.

As of now, the current plan is to have a wind turbine that utilizes a solar panel to harness both solar and wind energy. The purpose for this is to have two different inputs of energy into a storage utility or battery. With this, some energy can be used to distribute to electronics and power other, larger things such as homes on a grander scale, but in the case of there not being enough wind, some energy will go toward a motor within the wind turbine. The objective in this is to get the wind turbine to generate more energy than is being used to run it, creating a net profit in energy.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

232

Fair Category

PS

Project Number

6061

**Title:** Comparative Study of Self-Designed Direct Formic Acid Fuel Cells (DFAFCs) versus Hydrogen Fuel Cells

**Student Name(s):** E. Lopez-Wortman

**Abstract:**

Alternative sources of energy have recently risen to global prominence, and sources such as solar and wind power are dependent on uncontrollable external factors. While hydrogen fuel cells are an ideal alternative energy source, production and transportation of hydrogen gas are inefficient and volatile processes; however, formic acid (HCOOH), a stable liquid compound, has been shown to be a successful substitution for hydrogen gas in fuel cells. This study aimed to design a Direct Formic Acid Fuel Cell (DFAFC) from a standard PEM hydrogen fuel cell that optimized electrical output and avoided producing carbon monoxide. The design consisted of an air pump and HCOOH pump that supplied the fuel cell with oxygen gas from air and HCOOH. After measuring the DFAFC's electrical output over a 1650-sec. interval, 1.25 M was the optimal concentration of HCOOH, producing a mean of 492 mV and having an overall voltage decay of 0.0306 mV/sec.; meanwhile, the same fuel cell fed by hydrogen electrolyzed from water through solar power produced a mean of 26 mV and had an overall voltage decay of 0.00541 mV/sec with an overall pH increase of 0.123. Furthermore, a CO detector detected no significant CO emissions during each experimental run. This design could easily be applied large-scale, thus allowing for future applications of much larger DFAFCs that could power devices and machinery in a safer manner than hydrogen gas.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

ET EE CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

PS

Project Number

6062

**Title:** An investigation of the structural integrity of wood species used for tops of acoustic guitars.

**Student Name(s):** E. Porter

**Abstract:**

The purpose of this experiment was to investigate the strengths of different wood types when subject to the compression forces created by an acoustic guitar. The hypothesis was that softer wood types can handle lower amounts of force through compression than harder woods, however the softer wood's vibration capacities are still favored in guitars and thus a trade-off is required between strength and softness. The investigation involved the use of three wood types; cherry, cedar, and pine. The force of compression that each type of wood could handle before breaking was found by adding incremental masses to uniform pieces of each wood type until breakage. These forces were compared to the force created by guitar strings to conclude that cherry is the strongest of the three wood types while cedar was the weakest, yet cedar is used for guitar tops due to its soft nature and vibration tendencies. Upon further research, conclusions on the practicality of each wood for use as a guitar top was analyzed, and pine is much less durable in terms of rot resistance than cedar despite both being a soft wood. Thus, it was concluded that there are many variables that determine an ideal material for each part of a guitar. Further investigation could involve analyzing the strength of different wood types of a more particular range of softness to then compare vibration tendency to strength with the hope for more practical results.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN PH

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

255

Fair Category

PS

Project Number

6063

**Title:** Carbon Capture and Storage via Silver Nanoparticle Catalyzed Hydration of Carbon Dioxide

**Student Name(s):** A. Stefani

**Abstract:**

To reverse the rise in atmospheric CO<sub>2</sub> content, researchers continue to investigate ways to sequester the greenhouse gas in what is known as carbon capture and storage (CCS). In CCS, CO<sub>2</sub> is mineralized to carbonic acid, and later neutralized, however the rate-determining step of this process remains from the hydration of carbon dioxide to carbonic acid. Carbonic anhydrase enzyme can catalyze the reversible hydration of CO<sub>2</sub> to H<sub>2</sub>CO<sub>3</sub>, however this process is limited by both cost and narrow operating parameters (pH of 7 to 10, at 4-30oC). Bahduri reported the reversible hydration of carbon dioxide, by nickel nanoparticles (NiNPs), in a process that occurs at room temperature, and is pH independent. However, the technology is limited by the toxicity of nickel itself and cannot be used for underground CO<sub>2</sub> sequestration. This research uses biofriendly silver nanoparticles (AgNPs) as a metallic catalyst in the reversible hydration of CO<sub>2</sub> to carbonic acid. 0.07ml/min of CO<sub>2</sub> was bubbled into 1L of deionized water; sequestration of CO<sub>2</sub> to form carbonic acid was measured as a function of pH reduction. For 1L of di-water, pH was lowered in 2 hours from 6.8 to 5.01, corresponding to 0.4 mg of CO<sub>2</sub> sequestered. Similar experiments were separately carried out for 20mg AgNPs and 20mg NiNPs, each suspended in 1L water with 2% PVA. For NiNP's, pH was lowered from 6.8 to 4.44, corresponding to 1.6mg CO<sub>2</sub> sequestered, or 0.08mgCO<sub>2</sub>/mg NiNP. Finally, for AgNPs, pH was lowered from 6.8 to 3.85, corresponding to 6.2mg CO<sub>2</sub> sequestered, or 0.31gCO<sub>2</sub>/gAgNP.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EM AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

227

Fair Category

PS

Project Number

6064

**Title:** An Engineering Approach to Developing Sustainable Technology: Piezoelectric-Powered Shoe Inserts

**Student Name(s):** L. Pawlowski

**Abstract:**

Developing sustainable technology is the best way to go green in today's world of high consumption and resource use, and harvesting an untapped resource (footsteps) provides a new source of electrical power. Piezoelectric discs incorporated in a practical shoe insert model convert mechanical energy into electric power, flowing through a double piezo circuit design to charge a AAA rechargeable battery. Three different insert designs with piezo discs were tested for comparison by walking and running: one single-sided piezo, two single-sided piezos, and two dual-sided piezos. It was concluded that walking on the double-piezo circuit insert generated and sustained the highest voltage output and thus the most power. This is due to the additive voltage (current) and voltage duration provided by the two single-sided piezo disc circuits and the longer duration of the compression phase on each piezo while in motion. The design proved to be durable and comfortable, although future improvements need to be made in the field of piezoelectricity to create more efficient piezo discs for lower cost. Also, with improved technology, new rechargeable batteries could be charged in a shorter amount of time. This would enable consumers to purchase this product for a cheaper price and use the insert and battery pack ankle strap design to power their cell phones and other electronic devices all from one simple resource: footsteps.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EE ET AT

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

239

Fair Category

PS

Project  
Number

6065

Title: The Impact of Methyl Ester in Oils on Swimsuit Speed

Student Name(s): K. Gray

## Abstract:

The purpose of this experiment is to find out if methyl esters in different acids can increase the speed of competitive swimsuits. Oleic, palmitic, and myristic acid were used. The predicted result was that the combined acids in the oils with the methyl ester would increase the speed. Methyl esters are “products that are produced by an alkali-catalyzed reaction between fats or fatty acids and methanol” (Chemicalassociates.com 1). It is a non-toxic chemical to humans. This experiment was conducted by soaking the ping pong balls covered with swimsuit material and a magnet attached in each individual oil. Then, it was placed into a glass tube with water and the magnet from underneath the tube was released. The time it took for it to rise to the top was recorded. The same procedure was done except combining the oils to form one solution. Calculations were done to find the speed. To find speed, the time it took for the ball to rise to the top of the tube was divided by the length of the tube. The data revealed that when the three oils were used simultaneously, the speed was faster than any one of the individual oils and was equivalent in speed to the control due to an increase in hydrophobic properties. This experiment was unsuccessful and it would not be beneficial for swimmers to use. Therefore, the methyl esters didn't increase the speed of swimsuits significantly.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH MA BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

208

Fair Category

PS

Project Number

6066

Title: Correlation of CTNNB1 Gene and Ossifying Fibroma (OF)

Student Name(s): N. Hora

## Abstract:

Ossifying Fibroma (OF) is a benign neoplasm that specifically affects the craniofacial bones, and is characterized by the substitution of normal bone by fibrous tissues and newly formed calcified products. This research serves to investigate the correlation of the CTNNB1 gene and OF to determine the cause of this tumor. OF samples were sent to Genewiz company for whole exome Next Generation Sequencing (NGS). The resulting data were analyzed to select candidate genes for further analysis. Multiple recurring mutations in the CTNNB1 gene were observed in sequencing data which led to its selection. Primers were designed and Polymerase Chain Reaction (PCR) was carried out to amplify DNA segments in which mutations were observed. Successful PCR amplification was confirmed by gel electrophoresis. PCR products were then prepared and sent for Sanger Sequencing at Genewiz. Resulting sequence data were compared to a reference sequence through chromatograms in search of discrepancies which would confirm mutations recognized from the NGS data. Thus far, we have failed to confirm that CTNNB1 mutations are present in OF, and further testing is being conducted to arrive at a more concrete conclusion. With further research, this study could lead to the discovery of the cause OF, early diagnosis of the tumor, and development of a cure.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CB ME

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6067

**Title:** Computer-Aided Bleeding Detection in Wireless Capsule Endoscopy Images Using Deep Convolutional Neural Networks

**Student Name(s):** E. Lee

**Abstract:**

Wireless capsule endoscopy (WCE) is a minimally invasive alternative to traditional endoscopy focusing on the small intestine; however, it is costly due to physician labor costs for manual analysis. Existing solutions for bleeding detection in WCE images have low accuracy and utilize complicated preprocessing. In this project, a deep convolutional neural network (CNN) method is employed to address these problems. For the CNNs, Google's TensorFlow is utilized with Python code. First, a simplified preprocessing procedure is proposed by converting color images to normalized greyscale. For training of CNNs, three different sizes are selected, i.e., 70%, 80%, and 90% of the dataset accordingly, while the remainder is used for testing. Then, the number of convolutional layers and sizes of filters are optimized for each training size. After training and testing for the three architectures, the CNNs' results are evaluated through comparison with ten other machine learning methods from Python's sklearn library. The CNN architectures with 80% and 90% training sizes both achieve accuracies, sensitivities, and specificities of 100%, while the 70% size achieves a 93.34% accuracy, 94.44% sensitivity, and 91.67% specificity accordingly. However, the accuracies of Python's sklearn methods range from 40% to 86.7% with large discrepancies between sensitivities and specificities. The results show that the proposed CNN approach can provide an accuracy of up to 2.5 times higher than common machine learning methods. In addition, the CNN approach uses less training data and simpler preprocessing, which demonstrates efficiency. Future research includes testing full-length WCE videos and classifying bleeding by severity.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CS ME EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

159

Fair Category

PS

Project  
Number

6069

**Title:** THE DESIGN AND SYNTHESIS OF [RuII(tBu<sub>3</sub>-tpy)(5-methyl-2-(pyridin-2-yl)-4,5-dihydrooxazole)Cl]PF<sub>6</sub> AND ITS EFFECT ON CO<sub>2</sub> REDUCTION

**Student Name(s):** T. Hettiarachchi

**Abstract:**

This project involves studying the Ruthenium catalysts involved in CO<sub>2</sub> reduction reactions. The objective of this project is to replace the bipyridine (bpy) ligand of [Ru(tBu<sub>3</sub>-tpy)(bpy)Cl]PF<sub>6</sub> with 5-methyl-2-(pyridin-2-yl)-4,5-dihydrooxazole (me-pyroxa) and then study the effect the changed catalyst has on CO<sub>2</sub> reduction. This change in ligands from bpy to me-pyroxa will maximize the likelihood of electron presence, causing an increase in the rate of reaction. Therefore, the ligand change should cause the CO<sub>2</sub> reduction to occur faster. I plan to successfully synthesize the ligand and catalyst. The evidence for the synthetic success of the proposed ligand and complex will be found via nuclear magnetic resonance spectroscopy and mass spectrometry. Then, to benchmark the proposed catalyst as a CO<sub>2</sub> conversion catalyst, electrochemical and photochemical experiments will be conducted. The results from these experiments will be used to analyze the effect the ligand change has on CO<sub>2</sub> reductions.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

215

Fair Category

PS

Project Number

6070

**Title:** Feasibility of Radio Frequency Technology To Potentially Create a Wearable Distance-Sensitive Device to Help Young Adults Avoid Forgetting Epi-Pen.

**Student Name(s):** C. Piraneque

**Abstract:**

The purpose of this project is to test whether radio frequency (RF) technology is feasible to support a distance-sensitive bracelet and corresponding radio to help young adults with allergies that could lead to anaphylactic attacks avoid forgetting their Epi-Pen. Being that radio waves are part of the electromagnetic spectrum, the transmission of data through such radio waves between two devices—in this case, two XBee radio modules—should be the ideal way to create such a bracelet. Two XBee radios were configured to be in the same mode; meaning they would be able to transmit data to each other on the same frequency. Jumper wires were soldered onto the second radio (endpoint radio) and connected onto a Basic Board Stamp, used in this project as an external power source. Next three trials were conducted at several distances to perform a range test that was found on the XBee radios configuration program: two trials were done outside, line-of-sight, and the third trial was done inside, with interference. Through the data it was observed that the average power level difference between the radios, both local and remote, needed to retain a signal strength (measured in dBm) was small enough to become a feasible avenue for the development of the distance-sensitive bracelet system.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AT EE CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

Yes  No

# CSEF Official Abstract and Certification

Word Count

245

Fair Category

PS

Project Number

6071

**Title:** Is It More Effective to get Achilles Surgery or use Physical Therapy After a Ruptured Heel Cord?

**Student Name(s):** H. Molot

**Abstract:**

Despite being the strongest and largest tendon in the body, the Achilles rupture is a common injury to professional and everyday athletes alike. Having to choose between a possibly dangerous surgery or a long and arduous PT process is an important choice. This project will attempt to compare operative vs nonoperative treatment following a full achilles tendon rupture based on 4 main criteria: calf atrophy, rerupture rate, strength level, and prevalence of post treatment complications. The hypothesis is: while operative treatment will result in lower rerupture rates and higher strength levels, operative treatment will yield a lower risk of serious post injury complications. The means of data collection will come from various online databases such as PubMed, Medline and the American Journal of Sports Medicine. Statistical analysis will be conducted on the data after a broad literature review has been conducted. After collecting data, it has been found that the data shows statistical significance favoring the hypothesis. The re rupture data shows that operative treatment will reduce the chance of re ruptures, while the complications data indicates that non operative treatment will be most effective when trying to reduce post treatment complications. The operative group also showed a lower prevalence of calf atrophy in comparison to the nonoperative groups. This data indicates that professional athletes should use operative treatment for a quicker return and a small chance of re rupture, while casual athletes should choose non operative to reduce the chance of post treatment injuries.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

PS

Project  
Number

6073

Title: A Small Spectrometer to Find Peanut Ingredients in Food

Student Name(s): Z. Service

## Abstract:

In a continuation on the general idea from last year, I have yet again returned to the question on how I may find the ingredients within a food with ease and efficiency. Contrary to what I said last year in my abstract, upon more research, I do believe that it is entirely possible to use a mass spectrometer to search specifically for peanut allergens within food. If made with a detector acute to specifically noting molecules only hitting on a specific spot where molecules such as Ara H1, Ara H2... Ara H8 may hit, then this spectrometer would not have much to search for. Thus, a spectrometer could not only be feasible, but if built correctly, it could very well be portable and affordable. With this mentality, I set out to obtain the initial blueprints this year, with the hopes that next year I could attempt a crude model for the spectrometer. Thus, you will also see with my poster blueprints of the spectrometer and a 3D printed model on which to base next year's prototype. These plans, however, contain two imprecisions. Firstly, I do not quite know the exact size of the magnets I would need for the spectrometer; those seen in the pictures are merely fill ins for where the real ones would go. Secondly, my picture of the electron gun is crude and undetailed as I am still working out how I would build one so small, most likely through the means of a vacuum tube.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

252

Fair Category

PS

Project Number

6074

Title: Reliably Jammed Disk Packing: A Novel Feature of a Classic Geometry Problem

Student Name(s): S. Ma

## Abstract:

The packing problem has a long history that dates back to the 17th century. A packing of spheres is defined as the placement of spheres into the space without overlap. In this project, I study a type of packing called jammed packing, where no spheres in the packing can be moved without overlapping with other spheres. In addition, I introduce a novel packing feature called reliability. A packing is defined as reliable when the packing remains jammed even when several spheres are removed. I focus my study on the reliability of lattice packings in both 2D and 3D. In 2D, I prove that (1) a minimum of two disks must be removed to locally unjam (at least one of the disks in the packing can move) the hexagonal disk packing, and (2) any other lattice packing becomes globally unjammed (all disks in the packing can move) after just one disk is removed. In 3D, I prove that (1) a minimum of three spheres must be removed to locally unjam the face-centered cubic packing, and (2) any other lattice packing can be locally unjammed after two spheres are removed. These results imply that the hexagonal packing of disks is the most reliable 2D lattice packing and the face-centered cubic is the most reliable 3D lattice packing. Application wise, when packaging shipping boxes, I recommend filling up the empty space with material in the face-centered cubic configuration as it can protect fragile items even if some of the packaging material breaks.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

MA CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

236

Fair Category

PS

Project Number

6075

**Title:** The Gravitational Effect Of The Galilean Satellites  
On The Shrinkage Of The Great Red Spot

**Student Name(s):** A. Obrzut

**Abstract:**

The purpose of this research investigation was to determine whether the cause of the shrinkage of the Great Red Spot of Jupiter is the gravitational attraction between Jupiter and its four major moons. The gaseous atmosphere of Jupiter behaves much like ocean water in its flowing tides and eddies, so it was hypothesized that the moons of Jupiter might exert tidal gravity on the anticyclone that is the Great Red Spot. To test this hypothesis, data was taken for the first day of every other month in the years 2010 to 2015 for each of the four moons, namely the distance of each moon from Jupiter. Knowing this and the orbital period of each moon, the angular position of each moon in relation to the GRS was calculated and from this, the vector of the force of gravity of each moon was determined. The key results of this experiment were that the composite vector of the force of gravity of all four moons combined follows a cyclical pattern that matches the cyclical pattern of Jupiter's rotation. This means that for as many times as the moons are aligned with the GRS, they are not in alignment, which could explain the constant expansion and contraction of the GRS. This constant motion may translate to a net energy loss, or shrinkage, due to the changing magnitude of the force of gravity that the moons exert on the spot.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

232

Fair Category

PS

Project  
Number

6076

**Title:** Designing a Flexible Finger Support System to Minimize Finger Hyperextension Injuries in High-Impact Sports Applications

**Student Name(s):** C. Thompson

**Abstract:**

Finger injuries are highly prevalent in many sports, and are often insufficiently prevented. The existing technology for protecting against finger hyperextension either impedes the dexterity of the user or is inefficient. This research sought to design a system to prevent such injuries while minimizing the dexterity impediment and maximizing reusability. This research was conducted through the use of a surrogate hand model. The first design iteration was constructed and applied to the surrogate hand. After failing basic manual flexion, its attributes and disadvantages were recorded and utilized in constructing a second iteration. This iteration proved to be successful, as it encouraged the natural flexion of the finger to redirect the force applied to the pad of the fingertip to the stronger joint at the base of the finger. The prototype of this iteration, using only one strand of line, withstood a maximum of 10.5 pounds of force before extending and the force gauge slipping off the finger. This strength can be increased through the use of stronger material and more strands. The finger flexion this encouraged demonstrates that this design will be effective in preventing injuries to the second finger joint, where the majority of finger injuries occur. The line mechanism was then implemented into a leather glove as a prototype of the final version. Leather gloves were chosen for their material strength and ability to hold the line stable under high loads.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EE ME AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

178

Fair Category

PS

Project Number

6077

Title: Synthesis and Improvement of Mechanical Robustness Within Photonic Crystals

Student Name(s): V. Li

## Abstract:

Photonic crystals are periodic optical nanostructures capable of affecting electromagnetic wave propagation by defining allowed and forbidden bands of wavelengths, allowing them to easily control light. They can be used, in theory, wherever light must be manipulated. Current uses include thin-film optics, such as coating on lenses and paints, and photonic crystal fibers, which is applied in many areas, including fiber optics communications. In addition, they are expected to find future use in solar panels and within computers. However, practical application would greatly increase if photonic crystals of selective dimensions could be synthesized with more elasticity, rather than their inherent brittle state, thereby increasing its robustness. This was accomplished through use of self-assembled ABA bottlebrush block copolymers. The A block was polystyrene, which serves as a hard domain, while the B block was polydimethylsiloxane, which is softer. The block copolymers will be synthesized via ring opening metathesis polymerization. After synthesizing the photonic crystal, it was tested for elasticity, which we expected to see present in the photonic crystal. After synthesis we did indeed find increased flexibility present.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6078

**Title:** Evaluation of Bulk Metallic Glass via tensile strength and hardness after exposure to saline conditions

**Student Name(s):** K. Tsutsumi

**Abstract:**

Bulk Metallic Glass (BMG), also known as amorphous metals, are metals that lack a crystalline structure. This gives BMG special properties that metals normally do not have, such as its extreme malleability when heated to the correct temperature. The current environmental exposure limits of BMG are unknown; this project is testing for potential impacts on the hardness and tensile strength of the metal and determine whether or not it can be applied to marine environments. If BMG can be applied to marine environments it would open up a wide range of industries where BMG could provide an improvement over currently used materials and have potential for new applications other materials could not be used for. Samples of BMG were placed in capsules mirroring salinities of different environments, 0ppt, 26ppt, and 36ppt. The test was performed in triplicate with sets containing one sample from each salinity removed at set intervals; a control group using samples of carbon steel in place of BMG was also set up. Data show that the tensile strength of steel was reduced after 2 and 3 weeks of exposure to all conditions tested whereas BMG showed no change. These data are consistent with visual inspection under scanning electron microscope showing corrosion on steel but not BMG. Preliminary assessment of data from hardness test showed no significant changes in either BMG or carbon steel. Additional samples were placed out into the Black Rock harbor reach area to test for actual environmental conditions. These samples are currently under assessment.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

AT EN EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

236

Fair Category

PS

Project Number

6079

**Title:** Novel method to determine the total lasting albedo effect of aerosol-seeded clouds based on aerosol particle type

**Student Name(s):** J. Lam

**Abstract:**

Cloud albedo (reflectivity) is a natural phenomenon that has recently gained much interest because of its potential to initiate rapid global cooling that can reverse anthropogenic warming effects. Cooper et al. (2013) and Crutzen (2006) have proposed multiple methods to artificially seek the skies with aerosol to create clouds and an albedo effect. There has been research on the reflectivity of particles dependent on size by various studies such as Salter et al. (2008), but there has been no definitive research on the effect of cloud duration and the overall albedo of particles over the lifetime of a cloud. This experiment attempts to create a model that simulates a cloud with an aerosol suspension to quantify the overall effects of different common aerosols by measuring the total percentage of light that is reflected before the aerosol deposits for a fixed amount of each solution, aiming to discover trends and deriving formulas based on the results if they are consistent. The model created in this experiment is novel but aims to give realistic values and be scalable to larger cloud volumes. The data collected from three aerosols of interest — a sulfate, carbonaceous, and sea-salt based aerosols — provide little evidence to prove that differences in aerosol type significantly affect albedo, which suggests either that this low-volume design may not be sensitive enough to the changes in albedo is not a major factor in determining albedo effect.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6080

**Title:** Comparing the efficiency of various water-filtering materials and determining the optimal material for a filter for the developing world

**Student Name(s):** J. Todeasa

**Abstract:**

Lack of access to clean water is a major concern in the developing world, where bodies of water are used as sewers. A big problem today is that water collected from clean sources can get contaminated very easily before it is used. One solution to this problem would be an affordable water filter that provides a fast and reliable way to decontaminate water. This project sought to contribute to the development of such a filter by determining the optimal material to construct the filter out of between zeolite, activated carbon, graphene, and graphene oxide. To test their efficiencies, a filter was constructed out of each material and three types of contaminated water were run through the filters: muddy water, food dye, and iron (III) chloride. The pH and color were measured before and after each filtration, and the flow rate was timed during filtration. Also, sediments in the muddy water were examined under a microscope. Based on previous studies, it was hypothesized that graphene oxide would be the optimal material. The best filter was the one that produced the clearest, most neutral water from each type of contaminated water in the shortest amount of time. Thus, upon analyzing the results, graphene oxide was the best, which agreed with our hypothesis. However, because the sources of error were too numerous, the results were not accurate enough to provide a solid conclusion. This project should be repeated with multiple trials and more controlled variables in order to determine the optimal filter material.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN EM AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

238

Fair Category

PS

Project  
Number

6081

Title: Wine Glasses and What Affects Their Resonant Frequency

Student Name(s): N. Vail

## Abstract:

My project identifies how the density of liquid, amount of liquid, and shape of glass affects the resonant frequency of wine glasses. I hypothesized that a denser liquid, a greater amount of liquid, and a wider glass would produce lower resonant frequencies. To measure resonant frequency, I used an iPhone app called "Audio Kit". To complete the volume of water experiment, I put 25ml of water in a standard white wine glass (glass B) and ran a wet finger around the rim to produce sound resonance, I recorded this frequency at intervals of 25ml of water up to 250ml. Next I tested liquid density's effect on sound resonance using isopropyl alcohol, vegetable oil, and water. I tested density with a constant volume of 100ml of liquid in glass B and ran a wet finger around the rim of the glass and recorded the resonant frequencies of each. My final experiment was glass shape. To collect this data, I put 100ml of water into 10 glasses of varying shapes and recorded the resonant frequency produced by each. My data supported my original hypothesis- a denser liquid, a greater amount of liquid, and a wider glass produced lower resonant frequencies. This is due to absorption and slowing of sound waves within each system. As more surface area of the glass was covered, the resonant frequency decreased. Denser liquids slowed oscillations more than thin liquids did. Thus, resonant frequency was lower.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PS

Project Number

6082

**Title:** Testing the Substitution of Plastic and Various Household Materials for Insulation in a Home or Garage

**Student Name(s):** K. Baker

**Abstract:**

The purpose of this experiment was to determine how the quality of plastic product insulation compared to store-bought insulation. In order to determine this, I built a 50 cm<sup>3</sup> plywood outer cube. I also built a smaller, 30 cm<sup>3</sup> sheetrock cube meant to be placed within the other one. Both of these cubes had removable tops in order to place our temperature measuring device inside the smaller cube and surround that cube with our various tested materials. Within the larger box, the smaller box was elevated by small blocks of wood in order to ensure that the bottom is also insulated. The types of insulation that were tested were no insulation, store-bought insulation, densely packed plastic bags, softly packed plastic bags, and clothing material. For each trial, I placed the testing material within the large box, around the smaller box. I used a wireless thermometer to determine the initial and final temperatures of the space within the sheetrock box. The device has a wireless sensor that we placed inside the inner box whose temperature was read to an external monitor. I used an outdoor thermometer to determine how the outdoor temperature fluctuated. After conducting the experiments, I concluded that plastic insulation and clothing insulation was significantly better than no insulation at all. However, neither worked as well as standard insulation. By using plastic bags as insulation in homes instead of standard insulation, the estimated 1 trillion plastic bags consumed each year could be recycled and reused.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EE EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

231

Fair Category

PS

Project  
Number

6083

**Title:** Flow Rate vs. Hydroelectric Kilowatts Produced: A novel approach using Pelton wheels and land-based turbines in an effort to preserve surrounding ecosystems.

**Student Name(s):** E. Camel

**Abstract:**

The objective of this investigation was to calculate and create a standard for the amount of energy produced by varying, simulated flow rates using a Pelton-wheel connected to a hydroelectric turbine. Published flow rates for existing water sources were then used to calculate and design a submersible, Pelton-wheel “field” to be potentially used as a hydroelectric energy source. To set and control water flow rate, a flowmeter was installed between the water source and the Pelton Wheel. Water was pushed through the flowmeter, then through the Pelton wheel. A turbine connected to the shaft of the Pelton wheel was connected to a Vernier Voltage Meter and voltage was recorded over set time intervals. Subsequent trials included various flow rates and a standard curve established. Next, a plan for a Pelton-wheel field was created using published flow rate data of various water sources and potential kilowatts produced calculated. Upon conclusion of this investigation, analyzed data indicates that submerged Pelton-wheel fields are a viable source of hydroelectric power that will preserve most of the surrounding ecosystems as compared to the instillation of a dam. Future studies may include maximizing the electricity produced by the turbine system in order to supply power to areas with slow moving water and allowing the turbine to be raised and lowered along a vertical axle to account for the seasonal differences in water level.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EE EM ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6084

**Title:** The Effect of Different Textures of Coconut-Based Activated Carbon on the Adsorption of Dyes

**Student Name(s):** K. Tenerowicz

**Abstract:**

Azo dyes in public waterways are causing environmental pollution that leads to diseases affecting people worldwide. However, activated carbon has been shown to adsorb pollutants in water. In this experiment, the texture of coconut-based activated carbon that would adsorb more azo dye in an aqueous dye sample was determined. This study is unique because these carbons and dyes were not previously combined for research. The independent variable is the texture of carbon, and the dependent variable is adsorption. The time of exposure, carbon per container, and concentrations of each dye were constants. There was a control for each dye. The powdered carbon was hypothesized to adsorb more dye. 0.5g of Procion and 1.5g of Dylon were dissolved separate samples of 500mL of water. Three Procion and three Dylon samples, each 50mL, were put into containers. 0.5g of powdered carbon were stirred into each sample. When the samples reached equilibrium after one week, the concentrations of dye were measured using Logger Pro 3® and Beer-Lambert Law Plots. These were subtracted from the initial concentrations. This was repeated with the granular carbon. The powdered samples were centrifuged after they reached equilibrium. Results found that the powdered carbon adsorbed significantly more dye through statistical tests. This may help industries choose a more effective texture of carbon to clean polluted water. Research was conducted at Amity Regional High School and at a house under the supervision of a teacher or parent. Dr. Penny Snetsinger aided in providing materials and interpreting the data.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

209

Fair Category

PS

Project  
Number

6085

**Title:** Functionalization of Gold Nanoparticles with various Amino Acids under Different pH Environment

**Student Name(s):** D. Cai

**Abstract:**

Gold nanoparticles (AuNPs) functionalized with organic compounds containing various functional groups have attracted a great deal of interest due to their unique size-dependent optical properties. These properties can be chemically designed with specific organic compounds to promote highly selective and sensitive target-detection and target-binding properties. The unique properties of the functionalized AuNPs together with their small size, large surface area-to-volume ratio and low toxicity have made AuNPs an excellent choice in biomedical applications such as bio-imaging, gene delivery and drug delivery. In this research, the functionalization of AuNPs with amino acids containing different functional groups are studied systematically under different pH environment. Three amino acids were selected: L-cysteine containing a thiol group, L-Lysine containing an additional amino group and L-Glutamic Acid containing an additional carboxyl group. The interaction between the AuNP solution and the amino acids with different concentrations and mixing ratios, under different pH environment, were monitored using UV-Vis spectra as well as by means of colorimetry. The results showed that, both the AuNP functionalization and the AuNP aggregation rate are dependent on the ligand concentration and the pH environment, which can be designed for desired repulsive forces between the negatively charged AuNP surfaces to control AuNP aggregation.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

246

Fair Category

PS

Project Number

6086

Title: Synthetic Turf Infill Engineering

Student Name(s): R. Salvador

## Abstract:

Artificial turf has become popular for sports fields as it provides an alternative option to expensive field maintenance. One of the key elements of artificial turf is the infill which is placed within the turf mimicking soil. Historically this infill has been made of crumb rubber, but this has posed a serious ecological and health threat. In order to solve this issue, new infill was created in this experiment by combining cork and natural fibers. These fibers include coconut, banana, bamboo, and fique. The purpose of this experiment is determine the best type of fiber to use in the infill based on heat exposure, friction in dry and wet environments, biodegradability, and water absorption. Heat exposure was tested by exposing a turf sample with each infill under a heat lamp for 10 minutes and friction by moving a mass across a turf sample once wet and once dry with each infill. Each fiber was left in a sealed contained filled with water for 28 days to measure biodegradation. In order to test water absorption, fibers were left in water for 5 days. Overall, bamboo performed the best in the heat, biodegradation, and had the second lowest water absorption, however bamboo had the second lowest friction. The coconut fibers had the highest heat, biodegradation, and water absorption, but had the highest friction with banana being a close second. Although fique performed well, bamboo outperformed it in most tests making it the best alternative for crumb rubber infill.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6087

**Title:** Determining Salient Control Decisions of the Actuated Spring Loaded Inverted Pendulum Traversing Slippery Terrain Using a Sliding Mass Model

**Student Name(s):** S. Pfrommer

**Abstract:**

Legged robot running has long been modeled using a Spring Loaded Inverted Pendulum (SLIP). While the SLIP model has been found to accurately match important dynamic running characteristics such as ground reaction force profiles, it is also highly nonlinear and has no closed-form solution. This study proposes an analytically solvable sliding mass model for predicting energy-optimal key control decisions for a SLIP on low-friction terrain. To evaluate sliding mass model predictions, a series of test scenarios are generated. Each scenario consists of a randomly sized slippery patch with the SLIP positioned randomly over the patch, analogous to a legged running robot stepping on an unforeseen ice patch. Two possibilities are then considered for traversing the patch: stepping back onto firm ground first and then launching over the patch (three stance phases) or stepping directly from the patch to the goal (two stance phases). In order to determine the true energy-optimal solution, both situations are transcribed as numerical trajectory optimization problems using direct collocation. The optimal step sequence from the optimizer is then compared with the output of the simplified sliding mass model, which was found to determine the best sequence in 88% of cases. These results suggest that sliding mass models can be used to traverse unexpected terrain features in real time, whereas true trajectory optimization often takes prohibitively long to converge. Embracing similar control techniques could lead to the use of legged robots in previously inaccessible terrain, such as a disaster scene or complex natural environment.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PH CS AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

PS

Project Number

6088

**Title:** The Effect of Center of Mass and Center of Pressure Locations on Model Rocket Performance

**Student Name(s):** S. Jain

**Abstract:**

The purpose of this research was to determine if the location of the center of pressure and center of mass had an effect on model rocket performance. The three points of measurement to determining model rocket performance were altitude, distance rocket lands from the launcher and drag in a wind tunnel.

Five identical rockets were built using a Pitsco solid fuel rocket kit. Mass was added to the nose cones using hardware nuts of each rocket maintaining radial symmetry. These rockets were launched and the angles of elevation were recorded to measure altitude.

The average altitude at the apogee for the rocket with no additional mass in the nose cone was 111.8 feet and it landed the furthest from the launch pad, averaging 15.28 feet away. The rocket with the most mass in the nose cone had an average altitude at the apogee of 41.63 feet and landed at an average of 4.97 feet away. In the wind tunnel, both the rocket with little mass in the nose cone and the most mass in the nose cone had the least drag at 0.0107 N and 0.0100N. Rocket 4, the rocket with the second heaviest nose cone had a drag of 0.0133N.

Overall, the rocket with the most mass in the nose cone performed the best. The altitude wasn't high, but there was little drag and little displacement after landing. Future studies include observing the effect of alternate fin designs and alternate body designs.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PH AT EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

235

Fair Category

PS

Project Number

6089

Title: Study of Size Separation of Sub-Millimeter Granular Material Using Vibro-Fluidization

Student Name(s): J. Gowda

## Abstract:

Granular materials have many industrial and research uses and the need for narrow size distributions is important. Granular convection is a phenomenon whereby larger particles rise to the top of a vertically shaken container. Many observations have been made on the effects of a single large particle (~1 mm) within a bath of smaller granules. This work focuses on the separation of comparably sized sub-millimeter diameter particles under the influence of vertical shaking to better understand the dynamics involved in granular separation at sub-millimeter sizes. We mixed volumetric ratios of 4:8 and 6:6 mL of 70  $\mu\text{m}$  tungsten carbide and 50  $\mu\text{m}$  yttria stabilized zirconia milling media and placed the mixtures in 1'' dia. glass tubes to undergo vibro-fluidization (60 Hz with amplitudes 0.02-0.07 cm). We imaged the vibration of media in real-time and analyzed the time to separate for several shaking amplitudes. We find that the separation process follows a simple exponential decay function with parameters that can be used to gauge the physical separation process. In addition to measuring the dynamics of separation, we measured the purity of the resultant materials by iteratively vibrating and removing the separated powder. Purity was quantified by x-ray diffraction and scanning electron microscopy imaging of the separated media. We find that after separation the resulting material is 95% pure. This high-purity is remarkable considering the closeness of the particle sizes involved.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

236

Fair Category

PS

Project  
Number

6092

Title: Methane Production in Reservoirs

Student Name(s): P. Makarla

## Abstract:

The unprecedented release of methane from man-made reservoirs is currently being identified as a major source of contribution towards global warming. Though reservoirs were initially not considered a producer of methane, the EPA is increasingly becoming aware of its existence. Through the process of modeling a man-made reservoir and tampering with its state prior to flooding, one can affect the amount of CH<sub>4</sub> produced. In this manner, identifying a solution to inhibit further production of methane will be significantly accelerated. In the experiment, six biochamber reservoirs were filled with soil and grass. Prior to flooding the chambers, each set of chambers were treated differently to see if it would reduce the amount of methane produced: two chambers were treated with an NaCl solution, two chambers contained soil with the grass cut off, and the last two chambers acted as the control. The biochambers were brought to the West Lake Water Plant where gas samples were extracted directly from the models and measured in the Landtec Gem 2000 gas detector. Data collection occurred over the span of a week, with two day intervals between each collection. The results indicate that cutting the grass prior to flooding decreases the methane levels more than treating the chambers with a salt solution did. Through further research, environmentalists can apply this concept to a larger scale situation and prevent the production of CH<sub>4</sub> before the reservoir is even created.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PS

Project Number

6093

Title: Designing a Protective Cap to Reduce Impact Force and Head Trauma

Student Name(s): Q. Burke

## Abstract:

Football is a historic game in the United States that has existed for over a century. Recently, research has uncovered unforeseen health risks associated with Football. Specifically, that of concussions. Concussions have been linked to degenerative brain disorders such as CTE (Chronic Traumatic Encephalopathy) and Alzheimer's. Innovations in safety are needed to help preserve this American pastime. A padded skull cap worn underneath the helmet is a safe, comfortable, and inexpensive way to significantly improve protection from head trauma. It was hypothesized that a padded skull cap worn in conjunction with a football helmet would significantly improve protection from traumatic brain injury. The skull cap itself consisted of memory foam sections to offer protective qualities. The idea behind the skull cap was that it would offer superior protection to similar products, while also remaining relatively inexpensive and comfortable. Testing of the skull cap took place at the CT Science Center. Data was collected using the Crash Test Machine, and measured in g force. The data was then analyzed statistically using a paired t-test and a one way ANOVA test. I designed, helped build, and tested the prototypes. The data from this project showed that these skull caps significantly improve head protection. The ultimate goal is to patent the design, produce, and sell these skull caps. These caps have the potential to keep athletes of all skill levels and age groups safe, and preserve the sport of football, as well as a variety of other contact sports and occupations.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE EN AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

Yes  No



# CSEF Official Abstract and Certification

Word Count

161

Fair Category

PS

Project Number

6095

Title: The Fabrication and Testing of a Personal Air Quality Monitoring System

Student Name(s): C. Taniguchi

## Abstract:

Nowadays air pollution has been a serious problem in China, and breathing it into the lungs causes terrible health problem as much as smoking 40 cigarettes a day. It would be beneficial for people to know the air pollution's levels of their living environments, so that they could have a sense about their living environments and decide whether or not to continue living in those cities. The design goal of this project is to build an air monitor, and then collect the data of air quality from each type of sensors by connecting Bluetooth between the air monitor and the AirCasting app. The project was completed in three major parts: building an air monitor, programming on computer, and connecting the air monitor to the phone. The results showed that the NO2 sensor and the humidity sensor did not display on the app, and the only sensor displayed was the phone's microphone's voice sensor, so it did not meet the design goal.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EE CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6096

**Title:** Determining Orbital Properties of Eclipsing Binary Stars Through Visual Observations of Variable Brightness

**Student Name(s):** J. Bove

**Abstract:**

In this project, orbital properties of an eclipsing binary star system are discerned through observation of variable brightness. The system studied is OO Aql, in the constellation Aquila. OO Aql undergoes periodic dips in apparent brightness as the stars pass in front of each other relative to the point of view of an observer on Earth. The observations are done visually (with the aid of a telescope) by comparing the brightness of OO Aql to other nearby stars of fixed brightness. The data collected shows that the minimum apparent magnitude of OO Aql is approximately 9.4, with the maximum being 10.2. The orbital period of the system can be discerned by measuring the amount of time it takes for the same star to pass in front of the other star, as described by Filippenko (2007). This was measured to be approximately 12 hours. The inclination of the system's orbit is not perfectly edge-on relative to Earth, based on the fact that the point of minimum brightness during any given eclipse is a single point, instead of a continuous period. The level of contact between the stars in the system appears to be "detached," as described by Kafka and Waagen (2016). The luminosities (and hence, masses) of the stars in the system appear to be the same, based on the lack of significant differences between their respective eclipses of each other. The eccentricity of the orbits of the stars in the system also appears to be low for the same reason.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

262

Fair Category

PS

Project Number

6097

**Title:** Design and Synthesis of a Durable and Flexible Energy Harvesting System, via MOS<sub>2</sub> Paint-On Fabrication Techniques and use of Cement Based Composite Electrodes/Electrolyte: A Dual Process

**Student Name(s):** A. Bairat

## Abstract:

Currently, HAWT's require at least 5-11m/s winds to generate useable power. Additionally, conventional ultracapacitors when conformed to substrates of varying curvatures results to subsequent performance loss. This study seeks to engineer a hybrid energy harvesting system using ultra-barrier solar film (USF) and PVDF in parallel circuit, including a flexible, and durable ultracapacitor (UC) incorporating the use of new paint-on fabrication techniques with Molybdenum Disulfide (MOS<sub>2</sub>), and composite electrodes (via cement glue (CG))/electrolyte (Phosphoric Acid(H<sub>3</sub>PO<sub>4</sub>)) that would retain optimal capacitance even after the architecture is damaged.

Experiments involved investigating variables affecting capacitance and damage resistance, through testing substrate combinations, ratios of electrode/electrolyte: CG, and the optimal loading per unit area. Synthesis of the final UC regarded fabrication of copper substrates, and development of a non-composite and composite capacitor to measure variation in performance after damaged.

Characterization of electrodes was accomplished (SEM), while capacitance was recorded via cyclic voltammetry (CV.)

Methodologies concerned soldering the USF-PVDF energy source in a parallel circuit.

Additionally, the MOS<sub>2</sub>:H<sub>2</sub>O paint was synthesized with ratio of 1:2 respectively, and the optimal ratio of MOS<sub>2</sub>:CG resulted in 1:2 respectively. H<sub>3</sub>PO<sub>4</sub>:CG was quantitatively synthesized with optimal ratio of 10:1. The hybrid USF-PVDF system resulted in 650 mW of power. The composite capacitor measured capacitance of 10.41 mF before damaged, and was 23.75 % more efficient in comparison to the non-composite capacitor.

Potential applications of this device could be damage resistant energy harvesting systems on wind turbine applications, harvesting more vibrational energy at low costs, higher energy densities, and greater cycles.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET ET CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

PS

Project Number

6098

**Title:** Effects of Concentration and Cooling Rate on Microstructural and Macroscopic Properties of Tin-Zinc Binary Alloys

**Student Name(s):** J. Aindow

**Abstract:**

Zinc and tin have relatively low melting points as elements (419.5 and 231.9 °C, respectively), and they form a eutectic mixture at 198.5 °C for an alloy with 8.8 wt.% Zn. This alloy is an excellent candidate for lead-free solders, but there are concerns about the effects of the pro-eutectic phases. In this study commercial purity zinc and tin were used to form three alloys with Zn:Sn ratios (by weight) of 50:50, 30:70 and 9:91. For each composition, molten samples were cooled to room temperature at different rates: melter cooling by simply switching off the heater, air cooling, and water cooling. The samples were then ground, polished and inspected using reflected light microscopy. The 50:50 samples contain coarse primary Zn dendrites with eutectic Zn+Sn in the inter-dendritic regions. The dendrite arms are very coarse in the heater-cooled sample, finer in the air-cooled sample, and much finer in the water-cooled sample. The water-cooled 30:70 sample exhibits a similar structure, but for the melter- and air-cooled samples the Zn phase morphology is more angular. This unexpected morphology was also present in the 9:91 samples because the composition is not exactly equal to that of the eutectic. Here the Zn appears as dark needles, and the width and length of these needles decreases with increasing cooling rate. The Zn phase will have different electrical properties than the eutectic, and should be avoided in a solder material.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6099

Title: Residential Oil Spill Risk Prediction

Student Name(s): H. Ding

## Abstract:

Fuel tank leaks are an environmental and economic issue. From fires to explosions to pollution, oil spills can bring dangerous consequences with high cleanup costs. With a lack of general public recognition, consumers may be unaware of the danger and risk of leaking oil tanks and may not realize until it has spilled. This study aimed to predict the expected life span of residential oil tanks by inputting oil tank information collected locally from homeowners adults. This was accomplished using TypeForm where survey data is ported to a spreadsheet along with photos that were analyzed to find the condition of the tanks. A risk prediction model was created using the survival package of the statistical programming language R. This model can increase the amount of public awareness and hopefully reduce the amount of spills that occur due to the recognition of the potential replacement time of a tank. It was found that a typical residential tank should be replaced around the 30 year mark due to the age of it, but not due to the potential for leaks. The tanks that have already leaked to provide risk factors were not used, contributing to the rawness of this method of analysis at this stage. This data can be used for public awareness on the risk of all oil tanks, whether managed well or not. It can also be used as a model for larger scale studies involving more specific data with more data points to provide better insight into this issue.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EV MA CS

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

Yes  No

# CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6100

Title: A Closer Look At Petroleum: Our World's Energy

Student Name(s): G. Ortiz

## Abstract:

This study investigates a possible relationship between gasoline octane and carbon emissions that result from gasoline combustion. The results of this experiment could provide valuable insight into strategies for environmentally conscious operation within the transportation sector. To this end, the ultimate goal of this study was to identify methods of carbon savings and to suggest steps to take action against carbon emissions.

Carbon output was measured using a CO<sub>2</sub> Gas Sensor while a low compression internal combustion engine was run on full power idle for 120 seconds. This method was repeated for each of five trials per octane rating of gasoline. A non-experimental control was conducted that did not involve combustion of any fuel, and simply surveyed that baseline CO<sub>2</sub> concentration in parts per million present in the air naturally for 120 seconds per trial. Using analytical statistics, through a T-test method, a table of p-values were generated. These values established scientific grounds to identify differences in data beyond what could be reasonably attributed to random variation.

Findings suggested that the highest octane gasoline emitted the least carbon of all fuels tested. It is possible however that this is simply a result of the additional detergents and octane enhancers present in the more expensive gasoline rather than a direct result of the fuel's octane rating. Trials of more octanes of gasoline and molecular analysis of different additives would be steps looking forward, however a preliminary recommendation to lean towards higher octane gasolines to avert carbon emissions may be appropriate.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

ET EV EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

253

Fair Category

PST

Project Number

6501

Title: Magnetic Levitation

Student Name(s): Z. Rossignol, D. Reilly

## Abstract:

The purpose of this project was to determine if objects can levitate and move using magnets. magnets. We traced a shoe onto foamboard and cut that out. Then we placed five magnets on the foamboard evenly spaced out and the north poles facing away from the foam board and taped them. Next we drew a runway 17 inches long and 6 inches wide onto the foam board and placed the remaining 12 magnets evenly spaced from each other and the North poles facing away from the Foam Board and then Taped those into place. The purpose of having all of the magnetic north poles facing away from the foamboard is the north poles repel each other, which with the right tools means levitation. When we placed the foam board cut-out on the runway with the north poles facing each other, we discovered that the space between the magnets created a south pole which attracted the north poles and in-turn did the opposite of what we intended. To combat this we placed the magnets on the cut-out and the runway closer together, but the small gap between the magnets created a south pole and attracted the north poles. We came to the conclusion that we needed the runway to be comprised of a magnet that was powerful and at least 8 inches wide by 16 inches long so the gap between the magnets would be eliminated. We were unable to find that magnet and have had to stop testing the experiment.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

AT EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

236

Fair Category

PST

Project Number

6502

**Title:** An Investigation of Conductive Graphene Dispersion: optimizing heat retention, water resistance, strength and durability of fabrics

**Student Name(s):** M. Jacobson, N. Saah

## Abstract:

The purpose of this project was to investigate if graphene-coated fabrics are more heat retentive, water resistant, and more durable than uncoated fabrics. It was hypothesized that coating cotton, cotton flannel, polyester, and wool fabric samples with a graphene dispersion, the fabrics will exhibit an increase in heat retention, water resistance, and strength as compared to their non-coated fabric counterparts. Squares of equal dimensions were cut from samples of cotton, cotton flannel, polyester, and wool. The squares were coated with a conductive graphene dispersion solution that was premixed by the Graphene Supermarket. Each fabric sample, coated and uncoated, was tested as follows: heat retention was tested by covering a beaker filled with 100mL of water at 95°C and measuring the time interval required to cool the water to 90°C, 85°C, 80°C, and 75°C. Water resistance was tested by wetting each cloth with 50mL of water and massing each cloth before and after application. The strength of the different fabrics was tested using a Vernier materials tester that measured the force (in Newtons) required to compromise the fabric sample. After several rounds of testing, the fabrics coated with graphene demonstrated greater heat retention, water resistance, and strength than the control fabrics. Future studies may include an investigation of graphene's use in optimizing heat retention, water resistance, and strength of other substances such as nylon, canvas, or a variety of plastics.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EN AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

247

Fair Category

PST

Project Number

6503

Title: bamboo brick

Student Name(s): M. Rodriguez, j. montalvo

## Abstract:

Our project was inspired by environmental projects. We came up with the concept of putting bamboo poles within a brick there for getting the name bamboo brick. We wanted to test if putting bamboo within the brick, would make the brick bond stronger and more sturdy.

For our procedure we first found the bricks we would be using. We then used 1/2 inch diameter poles, which was inexpensive, and we bought 10. With that we stack bonded 6 bricks. One with the poles and another separate project without the poles and only mortar. We placed both projects on a table and shook the table to see which one would last longest and which would fall and break. Resembling an earthquake, we did this to see which would provide more safety and protection

The project without the bamboo did break when it had contact with the ground and the project with the bamboo did not break which proved our hypothesis correct and shows that the bamboo can improve a structure and could even provide insulation since bamboo is also a good insulator.

In conclusion, the bamboo brick project did not crack under pressure and proved that bamboo can be a good reinforcement agent to brick work. When we first were assigned the project we were told to make a project that had to do with masonry and is eco friendly. Bamboo is an eco friendly material that could be the future of all masonry projects in the future.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM EM

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

244

Fair Category

PST

Project Number

6504

**Title:** How does the radioactive threat of radon vary depending on the geographical and geological factors of sea level, proximity to bodies of water, and the age of the house?

**Student Name(s):** A. Cloud, A. Argulian

**Abstract:**

High levels of radon gas within houses is the second leading cause of lung cancer in the United States. Connecticut is classified by the NRD (National Radon Defense) to have a high potential for excessive levels of radon. The tested characteristics that contribute to higher risk levels of developing lung cancer when exposed to radon gases are a residence at a higher sea level, at a closer proximity to water, and of a greater age. Our study classified residences based on the number of these risk factors present from extremely low risk (zero factors present) to high (all three factors present). The EPA (Environmental Protection Agency) classifies any levels of residential concentration of radon above 4.0 pCi/L to have a significant health risk upon continuous exposure. Our results show that the average levels of radon within the basements of residences with extremely low risk (zero risk factors) were 1.39 pCi/L; those of low risk (one risk factor) were 2.15 pCi/L; those with a medium risk (two risk factors) were 2.94 pCi/L; and those with the highest risk factors (all three risk factors) were 4.12 pCi/L. These results show a direct correlation between levels of radon and the geographical and geological factors of sea level, proximity to bodies of water, and the age of the house. These results can assist those looking to buy a home to make informed decisions regarding the risk factors of certain geographical and geological factors.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EA EV CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

234

Fair Category

PST

Project Number

6505

**Title:** Piezoelectric Application: The use of mechanical stress to create and mobilize an electrical field in a novel device.

**Student Name(s):** H. Barringer, T. Foley

**Abstract:**

The objective of this project was to design and create a piezoelectric device that will convert mechanical energy (everyday foot traffic) into electrical energy that can be used to power the tread lighting on a small staircase. It was hypothesized that if a working piezoelectric circuit is built, then the potential electric charge produced when placed under stress, could be harnessed into a battery, stored, and used at a later time. First, a simple circuit was created, consisting of just piezoelectric discs and LED's. Then, the circuit was advanced using switches, a diode rectifier bridge, and capacitors. An oscilloscope and a multimeter were used to test and analyze the design. Data collected was folded back into the project to improve all aspects of the circuit until maximum piezoelectric efficiency was reached. The optimized circuit was expanded to include more piezoelectric discs used to charge a central battery that would in turn illuminate an LED light strip. The final prototype was installed into a "pad" and step trials conducted. The results proved harvesting energy via piezoelectric elements was possible but inefficient with current piezo-technology. The piezoelectric disks used did not produce a substantial amount of electrical charge, making it difficult to harvest the energy. Future studies may include creation of a larger piezo disk used in combination with a diode bridge in order to amplify the electrical output of the larger surface area.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EE AT ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

207

Fair Category

PST

Project  
Number

6506

Title: Producing bioethanol from cellulose

Student Name(s): H. Kummamuru

## Abstract:

With fast eroding supply of fossil fuels, the need for producing renewable bio fuels is greater now. Today ethanol is produced from corn, and the mass cultivation of corn for ethanol production is impacting the food prices. This project looks at producing bio ethanol from everyday house waste like paper and fruit skins to determine which type gives more yield. A sample of each kind of waste (paper, orange skin, banana peel ) was mixed with water and enzyme cellulase, which is a catalyst, and heated to produce a syrup solution. The syrup solution is glucose in water. The presence of glucose was tested using Benedict's solution. The glucose thus produced was fermented using yeast, at anaerobic condition, in a distillation flask at temperature between 77-82 Celsius, to produce ethanol.

My hypothesis was that the fruit skin which was natural plant matter would yield more ethanol than paper. The experimental results supported my hypothesis by showing the orange skin producing more ethanol.

This experiment concludes that everyday waste can be used to create renewable bio fuels, using a fairly inexpensive procedure and help reduce dependence on fossil fuels. Also by using waste materials, this method does not impact food prices and puts the waste materials to good use.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

244

Fair Category

PST

Project Number

6507

Title: Tail-Pipe Turbine

Student Name(s): C. Gavilano, K. Jonke

## Abstract:

The tail-pipe turbine development was decided upon the identification of the lack of a universal charging device in the old motorcycle market. Different websites were used to find information about the design of vehicles. When the problem was first defined, the scope was open to any motorized vehicle with an exhaust pipe. Research showed that motorized vehicles were highly inefficient, using only up to 30% of fuel energy to carry out its basic functions. Based on this information, the group decided to create an exhaust driven power supply to charge devices, specifically on a motorcycle. The goal of the project is to develop a device to create an electrical current which will be used to charge devices on a vehicle.

To determine the actual importance and relevance of the project, the team met with two experts; Bob Lambert, a retired mechanical engineering currently working as volunteer at the observatory; and Sergio Liguori, a mechanical engineer currently working at Harley-Davidson. Both experts gave valuable insight on the different considerations that should be taken, temperature of the exhaust gas, aesthetic consideration, and life cycle considerations. Further researched followed, ranging from identifying prior solutions and identifying design requirements. The group then designed a three-dimensional model of the product using AutoDesk Inventor. Information about the design's performance with an applied force was simulated using the same software. Based on the result from the simulation, a turbine with more blades is expected to be more beneficial.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

233

Fair Category

PST

Project  
Number

6508

**Title:** Role of Ambient Environmental Chemical Composition in the Creation of Precursors to Life

**Student Name(s):** T. Statchen, Z. Skrabacz

**Abstract:**

The origin of life is a subject that has puzzled researchers for centuries, particularly in light of new theories proposed in the past decades that re-evaluate the true origins of biological life. This research aims to verify current theories on the origin of life by recreating tests done by leading researchers in the field as well as creating new tests to evaluate whether these processes could drive bioformation in the environment theorized to be present on Jupiter's moon, Europa. Experiments done at JPL NASA show that there is potential to generate up to 0.929 V, enough to run the processes needed (Barge et al, 2015). More complex experiments that introduce heat and pressure show that organic carbon molecules that are key factors in creating life like formaldehyde can also be formed (Herschy et al, 2014). The theory for this research is that life started in deep sea hydrothermal vents known as Lost City or White Smoker vents. These vents were formed from alkaline liquids seeping into the early earth's acidic ocean and forming a pH and voltage gradient that will drive reactions to life. Replicated chemical gardens of both Earth and Europa's conditions are being created and monitored. Preliminary results from this study are showing that voltages can be created to verify the current theories of biomolecule formation thereby giving evidence that these are the processes that are the origin of life.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

BI

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

225

Fair Category

PST

Project Number

6509

Title: Cooking Oil Splatter Guard

Student Name(s): J. Kane, M. D'Ambosio

## Abstract:

Our science fair project is an innovation to existing cooking oil splatter guards. We are trying to design a product that can block cooking oil from escaping household pans at all angles. We discovered to achieve complete coverage we have to design a system that still blocks the sides while the user manipulate the lid. We created the full coverage by making accordion style collapsible mesh sides, this adds the intended protection and the collapsible sides keep it ergonomic. We are currently in our test phase. We are testing by using the following procedure.

Hypothesis: If we use our Oil splatter guard, then it will be more effective than the existing designs, because of the advantage and innovation of complete coverage.

Independent Variable: The presence of our prototype

Dependent Variable: The amount of oil on the test paper

Control: Pans without any form of protection

Experiment: To test the usability of our design we will use rollable construction paper to determine how much cooking oil/fat is escaping the pan. We will put this into action by cooking bacon in a pan that will be exposed or unexposed, the paper will show how much oil is escaping for both exposed and unexposed. If the guard blocks 70% more oil than the unexposed pan, then our design will have been effective.

Our prototype is being finalized.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

234

Fair Category

PST

Project Number

6510

**Title:** Analysis and Proving of “Cycloid” Universe Using Friedmann Equations and Torsion Cosmology

**Student Name(s):** K. McCormack, H. Dharani

## Abstract:

The current theory for the conception of the universe is that it expanded from a single point in an event known as the Big Bang. Due to mechanics like cosmic torsion, the universe should not have been in this singularity before a big bang, which may suggest it has cyclically expanded and contracted. Therefore, the size of the universe should appear as cycloid if graphed, but with each curve getting larger as more mass is created. Additionally, the universe experiences different expansion epochs. The particle conundrum and mathematical relationships of torsion cosmology in the Friedmann equations suggests that the universe may have a fourth, inflationary period at the very beginning. The purpose of our study is to prove that the equation for the scale factor of the universe is the parametric function of a cycloid and to model the expansion of the universe in one overarching equation in terms of scale factor. Using the Friedmann equations, torsion cosmology, various previous publications, and various lectures with a professional in the field, we were able to derive the equations based upon assumptions about the different epochs and the relationships between them. The results of this study proved that the universe’s expansions and contractions can be accurately represented by a cycloid. Additionally, the inflationary period portion of the overarching expansion equation mimics a quadratic function at small values and gives way to the other three expansion epochs.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

PH MA

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

107

Fair Category

PST

Project  
Number

6511

**Title:** Will the Type of Acidic Liquid Mixed With Milk Change the Durability of Plastic?

**Student Name(s):** C. Merlo, P. Sundararajan

**Abstract:**

The purpose of our experiment is to see if changing the acidic liquid that is used to mix with milk to make plastic. And if it will change the durability of the plastic product. We first measure out exact amounts of milk, and acidic liquid (vinegar, lime, lemon). Then the milk was heated and both liquids were mixed in till the milk turned into curds. We strained the liquid out and were left with the milk curds that later turns into plastic. While doing this project the one thing we noticed most was the aroma. But in conclusion the strongest plastic came from lime mixed with milk.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CH EV

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

188

Fair Category

PST

Project Number

6512

Title: The U-Desk

Student Name(s): M. Adamou, T. Schneider

## Abstract:

The U-Desk will be an universal school desk that gives both left and right handed students the comfort they need to stay seated and focused during class time. This new innovative design allows all the students the option of using the left sided surface, the right sided surface, or both surfaces attached. It's unique in that in its closed position, it is very efficient to maneuver around a classroom. This development was decided upon the identification of left handed students being uncomfortable while sitting in a typical school desk for a duration of time. The group encountered multiple problems with the common desk that schools use today.

To determine the actual importance and relevance of the project, the group conducted additional primary and secondary research that made the problem justifiable. This includes, online research, patent research, and an expert in the material/manufacturing field. All of this research gave valuable insight on different considerations that should be taken, the overall ergonomics, the aesthetics, and the amount of surface area it takes up.

Testing will be done on the final design including a stress analysis on the parts.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

239

Fair Category

PST

Project  
Number

6513

**Title:** The Effect of Adding a Second Polymer to Bombyx mori Silk Fibroin on the Mechanical Properties of the Polymer Blend Systems

**Student Name(s):** C. Patel, J. Albert

## Abstract:

Bombyx Mori silk, or silkworm silk as it is commonly known, is a fibrous protein that is known for various mechanical properties such as toughness. When put into different forms such as gels and films, the silkworm silk can have biomedical applications that have the ability to improve the health of an individual. The silk fibroin can be modified to be used in wound healing and engineering in different tissues such as bone, cartilage, ligament, and tendon tissues.

This study focuses on using PEO to improve the mechanical properties of the silkworm silk. Initial work concentrated on obtaining and purifying the silk fibroin from the cocoons found in nature. Blends of silk fibroin with 5% PEO, 10% PEO, and 20% PEO were made in solution and silk films were cast to dry at room temperature. Samples were cut from these films and were tensile tested using the PASCO Materials Testing Machine. Mechanical properties, such as Young's modulus, was obtained from the initial slope of the stress-strain curve. Additionally, the ultimate tensile strength was recorded and the toughness was calculated from the area under the stress-strain curve.

Limited results show that as the percentage of PEO increased, the modulus and ultimate strength of the blended systems decreased. However, information concerning the toughness of these blended materials was inconclusive. Difficulty in "cutting" samples from the brittle films made testing problematic and further studies will need to address this challenge.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

EN EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

241

Fair Category

PST

Project  
Number

6514

**Title:** Charge Your Devices Using a Portable Thermoelectric Generator Harnessing Wasted Heat Energy

**Student Name(s):** A. ElSherbini, A. Mohammed

## Abstract:

Thermal energy is wasted when common appliances are used around the house. Even when food is heated, the thermal energy generated from the pot is wasted. The objective of this project is to design and construct a portable thermoelectric generator (TEG) box that attaches to various appliances to harness wasted thermal energy and convert it to electric energy that can be stored in a power bank or rechargeable batteries via a USB port, and later utilized to charge other USB-chargeable devices.

A series of experiments were conducted to evaluate various box designs and appliances. The experiments focused on three major appliances: hot pot, oven, and heating pipe. A total of five different configurations, each containing 4 TEGs, were designed and tested. A portable TEG box sturdy and big enough to withhold a pot filled with food generated 4.72V, although it dropped to 0.67V after 30 minutes. A portable TEG box that magnetically attaches to the oven and heating pipe generated 1.08V and 1.15V, respectively, with no cold side. With an ice pack, 3.75V were achieved with the oven. The final box design was constructed with dimensions of 7x1.5 inches.

The voltage generated from the portable TEG can be boosted to charge a power bank via a USB port. In this experiment, we have demonstrated that a portable TEG box can be designed to recover waste energy from household heat sources, and use that free energy later for charging electrical devices.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

211

Fair Category

PST

Project Number

6515

Title: The Power Pack

Student Name(s): D. Baker, M. Carroll

## Abstract:

The Power Pack

Our idea for the Power Pack was inspired by current battery packs that use only one or two forms of renewable power. We could not find a product capable of charging a device with solar power, wind power, and a hand crank. Our proposed device would be completely independent of conventional electricity-capturing means, and would be easy to operate, store, and maintain. So far, we have analyzed current products to find where their strengths and weaknesses lie, such as charging ability, durability, and sustainability. We then used our data to develop a number of potential designs. These designs were again analyzed via the same criteria to determine which of them would perform to the highest ability in all categories. The design that scored the highest according to our ranking utilizes a storable wind turbine, a hand crank, and external solar panels on the device's casing, all three means of electricity wired into battery packs used to charge various electronics. As of March 1st, we have designed and 3D printed several custom parts for our prototype and begun designing the circuitry of our device. We plan on working further on this prototype to be as close a replica of the intended device within the best of our abilities.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE ET

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PST

Project Number

6516

Title: Converting Grass into Cellulosic Ethanol to Generate Energy as a Heating System

Student Name(s): R. Ahmed, J. Choudhury

## Abstract:

The U.S. economy wastes about 61 to 86 percent of plant source biofuels that can be generated from corn, wood, and sugar crops. However, various researches mention that grass is a more efficient energy source. Farmers in Nebraska and the Dakotas claimed grass can produce about 13.1 megajoules of energy as ethanol. Based on this research, four consecutive experiments were conducted which proved outdoor picked grass can be a considerable source of biofuel. For the experiments, both the outdoor and indoor grown grass solutions were prepared with yeast solutions. The concentration of the grass-yeast solution, fermentation time, and filtration process were changed in each experiment to yield more ethanol and for better filtration. Most of the ethanol was produced from outdoor grass that was left to ferment for 48 hours. The fermented solution was frozen and the bottle was tilted to separate liquid ethanol from ice layers. Store-bought ethanol was used in comparison with indoor and outdoor grass produced ethanol. To test the efficiency, wooden sticks were soaked in each type of ethanol and ignited to compare the size of the flame and burning time. Water was heated by the ignited wooden sticks to measure the increasing temperature. It had about 40% longer burning time and 20% higher temperature than the control (ignited plain wooden sticks). Therefore, ethanol produced from outdoor grass can be used for an energy saving heating system and to operate motor engines since it is readily available, easy to make, and inexpensive.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

243

Fair Category

PST

Project  
Number

6517

**Title:** A Novel High Performance Liquid Chromatography Protocol to Investigate the Analgesic Role of Salicylic Acid and Other Bioactive Components found in Traditional Chinese Medicine

**Student Name(s):** R. Roca, J. Lawlor

**Abstract:**

Herbal medicine accounts for a large portion of traditional medicine, and is a health care method globally utilized. Despite the widespread and varied use of medicinal herbs, little is known about how or why they work. Information on the separation and analysis of the active components in these herbs are varied, unclear, largely inaccessible or do not exist. Decocted and freeze-dried Ren Shen, Gan Cao, and Bai Zhu Chinese herb samples were utilized for developing an investigative protocol to determine the analgesic role of salicylic acid and other bioactive components. High Performance Liquid Chromatography (HPLC) allows for the identification of specific analgesic components (such as salicylic acid). Comparing the overall peaks of each chromatographic scan can indicate commonalities found within the herbs and differentiate the bioactive components. Extensive analysis of a multitude of different mobile phases indicates that 10% methanol and 90% dH<sub>2</sub>O, provides adequate separation of the herb's components and a relatively short run time. All three herbs shared distinctive peaks at a retention time of approximately 2.50 minutes and 7.70 minutes. Ren Shen and Gan Cao demonstrate a unique peak at 4.10 and 3.44 minutes respectively. Bai Zhu and Gan Cao also share characteristic peaks at 3.92 and 5.77 minutes. Each significant peak represents a separate bioactive component found within the herbs. These peaks can be identified based on the novel protocol, indicating the analgesic compounds found within these herbs, and provides an explanation of the efficacy of herbal medicine.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ME BI CH

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

203

Fair Category

PST

Project Number

6518

Title: Auto Sorter

Student Name(s): C. Holick, D. Collentine

## Abstract:

The Auto Sorter was created due to the problem we assessed in the beginning of the year. Coins around your car that are unsorted, as well as uncounted, result in a dangerous driving situation. 430,000 injuries were reported in 2014 that were directly related to distracted driving. We concluded by researching multiple articles that a product that sorts and dispenses coins could both lower distracted driver injuries and supply a useful function to everyday drivers. Our project is based around the idea of minimizing the hassle and distraction of gathering and counting coins around the car. So far we have conceptualized the basis of our design, and we are entering our testing phase now. We have also done market research to assess the need of our product in the marketplace, as we could not find a product that utilizes digital electronics, sorted coins, and could be used at ease in a motor vehicle. We plan to test the final prototype on varied areas of performance, such as coin sorting speed, coin distribution speed, and tensile strength analysis test, etc. Along with testing these properties, we also wish to conduct a personal performance analysis test to allow for real world situations to be observed.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EE

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

217

Fair Category

PST

Project Number

6519

**Title:** The Optimization of a Polycrystalline and Monocrystalline Solar Cell through Effective Cooling in the Form of a Heatsink Transfer System

**Student Name(s):** J. Burnett, A. Huang

**Abstract:**

Photovoltaic cells have been the solution to many environmentally hazardous energy resources. The greatest issue has been the cost effectiveness of the cells, and that many homeowners would not get their money back in the terms of energy produced. In this study, the voltage production of both a monocrystalline and polycrystalline photovoltaic were analyzed. UV lights were concentrated on a photovoltaic cell that was connected to a heat sink which ran water through its tubings from a fish tank that is a part of an hydroponic system to transfer thermal energy. The voltage produced throughout a period of 7 hours was measured as well as the temperature of the two systems with and without the heatsink. As a result, solar cells mounted with the heat sink produced a higher voltage. Upon closer observation, the monocrystalline solar cell had the highest voltage production and a higher efficiency percentage. With the implementation of the heatsink, on the monocrystalline solar cells there was a 4.72% efficiency. On the polycrystalline solar cell there was a 2.42% increase. This data paralleled our data from our previous experiment where with the heatsink in small scale trials, which had a 3.13% increase in efficiency. With the potential of increasing the efficiency of solar panels, affordable photovoltaic systems could be implemented on the residential level.

**Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)**

ET EE AT

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PST

Project  
Number

6520

Title: The Effect of Bio-inspired Textures on Friction

Student Name(s): R. Du, C. Greifenberger

## Abstract:

Humans often look to nature for inspiration in solving technological problems through biomimicry. A research study analyzing organisms' adhesion mechanisms motivated the research question: How do bio-inspired patterns on a large scale impact friction? The independent variable is the surface design/pattern. The dependent variable is the amount of friction (Newtons). Designs (small mushroom shaped pillars mimicking gecko setae, indentations like wet human hands, hooks mimicking galium aparine, cone structures like canine paws) were modeled in CAD and printed onto rubber coated silicone panels (110x60x4mm). The control has a flat surface and same dimensions and material as other designs. Each design was tested by dragging against different surfaces using a piezoelectric force sensor to measure frictional resistance. It was hypothesized that change in surface design would result in a rise of friction. Results supported the hypothesis. The designs which increase friction the most were the pillars mimicking gecko setae and human hand indentations. Results showed friction for the control and designs was considerably higher when on the dry surface. All trials displayed the magnitude of static friction being greater than kinetic friction. Because the designs were large scale, data showed that bio-inspired designs impacted friction greatly. The p-values between each design and the control were both less than .001. There are many implications to increasing and decreasing friction, including increasing the resistance of a tire tread, or optimizing efficiency on a conveyer belts' durability. These designs could be implemented in hiking boots to optimize durability.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EN

1. As a part of this research project, the student directly handled, manipulated, or interacted with (check all that apply):

- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

183

Fair Category

PST

Project Number

6521

Title: Eco Friendly Batteries

Student Name(s): M. Olivares, R. Tran

## Abstract:

The purpose of our study is to develop a working battery that is biodegradable unlike conventional batteries, which contain dangerous elements such as mercury, and lead. These can take hundreds of years before they can decompose and be recycled once they are drained. Our approach to this issue was done by the creation of our own batteries, made of copper, zinc, and an electrolyte solution composed of store gelatin and seaweed. The seaweed provides the semi-permeable membrane; this and our copper and zinc as our metals are biodegradable. One unit of our battery produced .600 volts. We've constructed two portable designs, one of which is a voltaic pile, which consists of metals linked in series, all while being in our seaweed gelatine. The other is what we call the "durich" design, which consists of two long metals linked parallel to each other, also being enveloped in our seaweed gelatine. Our plans for improving are working on sustainability on our batteries, as in the past the gelatine has melted. We also plan on working on our measurement to better plan out our designs.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CH PH

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- human subjects       potentially hazardous biological agents  
 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

214

Fair Category

PST

Project Number

6522

Title: Project W- Water Reuse System

Student Name(s): C. Haupt, C. Ramos

## Abstract:

In 2016 Connecticut experienced extreme drought conditions which resulted in water use restriction in households. According to the United States Geological Survey, the average person uses 80-100 gallons of water per day. Our project aims to create a filtration system that can effectively re-purpose cleaned water for secondary household uses and help reduce household water demand in our state. Have you ever wondered what you could do with all that water you use? Well, we have come to solve this question.

Currently, there are systems that redirect and reuse water but they are limited to piped irrigation lawn applications only. We plan on further improving these types of systems and increasing their uses by filtering and cleaning the water. We will use a Ultraviolet Germicidal Irradiation (UV-GI) light and a pool sand filter to purify and filter greywater. These two filters will provide more opportunities for re-purposing grey water in-house uses. This project will take greywater from household sources such as sinks, dishwashers, and showers, and attempt to process the water and (1) reintroduce it into the household for lawn irrigation and the waste system and (2) pipe it back into the potable water system and resell it to the city system. This will eliminate over 50% of water waste.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

EM

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

249

Fair Category

PST

Project  
Number

6523

**Title:** The Effect of Aerodynamic Leaf Design on Electrical Power Generation via a Network of Vertically Aligned Micro Wind Turbines

**Student Name(s):** C. Rinaldi, V. Talanki, J. Pasato

## Abstract:

Wind energy is identified as an efficient source of renewable energy. Typical turbines require large investments in infrastructure and are not optimized for light winds such as those experienced in residential settings. This project seeks to develop a design for a small vertical axis wind turbine which can be part of a larger network that generates power from wind energy. The vertical axis wind turbines are designed to mimic the appearance of an actual tree, where the network of micro-turbines act as leaves on a tree to generate electricity.

The initial focus was to model three distinct Leaf Designs using CAD (Computer Aided Design), which were based on principles of aerodynamics. They were evaluated using CFD (Computational Fluid Dynamics) and manufactured using a 3D printer. These three designs were validated using a wind tunnel. The leaf designs were tested outdoors, and subject to environmental variability. Field studies took place to evaluate turbine performance under varying environmental conditions.

Predictions using CFD, which were verified in the wind tunnel, revealed a dead zone in which the turbine could not start without assistance. The new leaf design features six blades to increase symmetry and improve starting reliability. Combined with smaller mass and larger curved area to capture wind more reliably, this redesign improves the conversion of wind energy to electrical energy at low wind speeds. Additional investigations will work to redesign the fourth leaf to determine the optimal number of blades for peak performance. Field studies are ongoing at this time.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

EE ET AT

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 vertebrate animals       controlled substances

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3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No

# CSEF Official Abstract and Certification

Word Count

220

Fair Category

PST

Project Number

6525

Title: Environment-Friendly Street light

Student Name(s): H. He, S. Guo, M. Lin

## Abstract:

The name of our project is "Environment-Friendly Street light." Our goal is to produce electricity using as many ways as we could, so that we can save certain amount of electricity from the city electrical network. We want to power a special street light to solve this problem without giving city electrical network extra burden. In this project we want to use three ways: road-pressure, solar energy, and wind. For pressure we used two pieces of wood board--one on the top and one the bottom--between which there are magnets and copper coils. According to electromagnetic induction phenomenon, when someone steps on the board on the top causing two boards get closer, the coils we put on the top board will vertically cut through the magnetic induction line between the magnets on the bottom board. In this way it can produce induced electromotive force, and therefore the electricity. We also use wind generator with special fans, and simple solar panels, as the second and the third way. All of these device that we use to produce the electricity will all connect to a transformer and a storage battery in order to storage the energy and give the street light the exact device that the light needs. And we use LED bulbs in order to save more energy.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

ET EE EM

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

239

Fair Category

PST

Project Number

6526

Title: Using Programming to Solve Math Problems my Calculus Teacher Couldn't Solve

Student Name(s): K. Wright, J. Worthy

## Abstract:

All through our education career we have been taught how to solve different math problems by using mathematical equations. However, are there math problems that math teachers can't solve by using mathematical equations? In our AP computer science class, we started writing programs in Java to solve math problems that we didn't know how to solve using traditional mathematics. We were able to solve the math problems by using Monte Carlo strategies, brute force and recursion.

We decided to test whether our math teachers could solve these problems with equations. We asked seven teachers (all qualified to teach Calculus) to solve a series of problems we had written programs to find solutions for. We asked the teachers to see how long it took them to solve these problems or see how quickly it took them to notice the "insolvability" of the problem. We gave the teachers four moderate to challenging math problems.

After gathering and analyzing the data we observed, on average, 67.8% of the questions were solved incorrectly or given up on, and only 32.2% of the questions were solved correctly. One of the problems, none of the teachers were able to solve.

With this experiment, we demonstrated that high school students, just beginning to program, were able to solve complex mathematical problems that our calculus teachers couldn't solve with traditional mathematics perhaps pointing out that there may be a better way to teach mathematics and problem solving.

Technical Disciplines Selected by the Student  
(Listed in order of relevance to the project)

CS MA

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 vertebrate animals       controlled substances

2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No

# CSEF Official Abstract and Certification

Word Count

248

Fair Category

PST

Project  
Number

6527

Title: The Impacts of Ocean Acidification on Phytoplankton

Student Name(s): S. Schaaf, N. Sudhir

## Abstract:

Since the Industrial Revolution, the pH of surface ocean waters has decreased, a process known as ocean acidification. Seawater absorbs CO<sub>2</sub> released into the atmosphere, causing carbonate ion concentration, which may be killing many marine organisms as the pH of water drops below their tolerable range. In this experiment, the impacts ocean acidification on phytoplankton will be investigated. The independent variable is the CO<sub>2</sub> exposure. The dependent variable is the algal mass levels. It is hypothesized that if more CO<sub>2</sub> is introduced to Long Island Sound, more algal biomass will increase. The materials needed include water from LIS, spectrophotometer, and pH meter. Water will be divided into nine containers of equal size with three groups with different treatments. Zooplankton will be removed to avoid interference with the growth of phytoplankton. The results show that, in general, exposure to carbon dioxide leads to higher levels of algal biomass and the differences are statistically significant. With no exposure to carbon dioxide (T2), biomass levels were lower relative to both moderate (T1) and high (Control) exposure treatments (with  $p < 0.05$  in both conditions). However, there was no significant difference between the moderate (T1) and high (Control) exposure treatments ( $p = 0.62$ ). The confirmation of the hypothesis that if more CO<sub>2</sub> is introduced to the Long Island Sound water, there will be more algal biomass, indicating an increase in phytoplankton populations, so this information can be used worldwide in investigating the consequences of ocean acidification and in finding ways to counteract its effects.

## Technical Disciplines Selected by the Student (Listed in order of relevance to the project)

EA EV

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2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

5. My display board includes photographs/visual depictions of humans (other than myself or my family):

- Yes  No



# CSEF Official Abstract and Certification

Word Count

226

Fair Category

PST

Project Number

6529

**Title:** Virtual Forensics Chemical Lab Simulation App (for Liquids, Metals, and Nonmetal Solids)

**Student Name(s):** J. Hari, D. Hari

**Abstract:**

Currently students have to go to a lab to perform chemical lab experiments with glass lab equipment and substances however some of the substances are hazardous and it is difficult to set up all the lab equipment necessary. The purpose of this project is to simulate a forensics lab that allows students to perform virtual forensics lab experiments without going to a lab to do it. Related research showed that no software tools found met our project objective. This verified the fact that students are unable to do the lab experiments in anyplace but the lab environment. The unique aspects of this project include the design and development of an app using MIT App Inventor, that simulates a forensic lab environment in an easy to use interface with the following key features: Chemical reactions, pH level and physical properties of Metals, Non-Metals Solids and Liquids. This app allows students to understand how different substances react with other substances, prevents the need to buy certain expensive lab equipment/chemicals, and eliminates the necessity of having to take any safety precautions, as this is a virtual lab. students with a smart device can take the app anywhere and use it. Potential applications for this app include educational use in middle/high school and Science related Competitive events such as the Science Olympiad Crime Busters and Forensics events.

**Technical Disciplines Selected by the Student**  
(Listed in order of relevance to the project)

CS CH AT

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2. Student independently performed all procedures as outlined in this abstract.  Yes  No

3. This project was conducted at a Registered Research Institution.  Yes  No

4. Is this project a continuation?  Yes  No

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- Yes  No