

68th Anniversary



**Connecticut
Science &
Engineering
Fair**

March 15 - 19, 2016

Student Abstracts

Fair Categories

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

Technical Disciplines

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

Technical Discipline Composites

Biotechnology	AS, BI, CB, EN, ME, MI, PS
Environmental Sciences	EV, EM
Engineering	EN, EE
Sustainability	EA, EN, EE, ET, EV, EM

CSEF Official Abstract and Certification

Word Count

106

Fair Category

LT

Project Number

1001

Title: Growing mustard seeds with fertilizer

Student Name(s): z. pinker, a. fogel

Abstract:

Our science fair project was growing mustard seeds in fertilizer. We were testing the most efficient amount of fertilizer to use when growing mustard seeds. We chose mustard seeds because based on our research they don't need very precise conditions in order to grow and they grow very quickly. During our experiment we found that using 1/8 of a teaspoon to one quart of water, watering every other day with an eight of a cup of the solution, was the most efficient concentration. Using this method with a much larger sample size, scientists can find the cheapest and fastest way to grow mustard 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

250

Fair Category

LT

Project Number

1002

Title: Feeding plants different waters

Student Name(s): A. Szabados, M. Garcia

Abstract:

The purpose of investigating the topic of our project was to find out if feeding plants different chemicals affect their growth. Our hypothesis that we studied was if feeding plants salt and sugar water affected their growth.

The procedures we conducted to find the result of our hypothesis was we planted four plants and fed them equal amounts of each plants waters which were salt, sugar, tap, and filtered. Every time at the end of the week we recorded data on how many peppers each plant had produced and their height.

Our data was: salt and sugar plants did not grow and didn't produce peppers. Tap and filtered did grow And produced peppers. Our filtered plant produced 13 peppers and our tap plant produced 8 peppers, salt and sugar did not produce any at all. For their heights the salt plant grew 2 inches, Sugar 3 inches, tap 5 inches and filtered 6 inches. Our observations were that if you feed salt to a plant it will make your plant smell really bad. Lastly we noticed that tap and filtered water are the best waters because, in our case we got peppers and the plants grew tall and healthy.

Our conclusion is that tap and filtered water are the best because from both plants we had a total of 21 peppers and the plants grew tall. The salt and sugar produced 0 peppers and barely grew. Our process was to plant and feed them daily to see the final results.

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

PS PS 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

191

Fair Category

LT

Project Number

1003

Title: What Genre of Music Makes You Run the Fastest?

Student Name(s): E. Halas, A. Doherty

Abstract:

The main purpose of this experiment was to discover if there is a questionless genre of music that makes the average person run faster. The question we asked was, “What genre of music makes the average person run the fastest?” Our hypothesis stated that we think that running to hip-hop will make you run most efficiently because of its fast, upbeat sound. This project is particularly helpful to people who run listening to music. Many people listen to music when they are running. Together we figured out that the majority of people listen to their favorite songs rather than the most efficient songs. To explore this question we had multiple people run four hundred meters to various genres of music and timed their run so we could accurately discover if there is a genre of music that makes the average person run the most efficiently. We concluded that the genres of music, our independent variable, affect how fast you run. The runners all ran consistently, besides when they ran without music. Their times shorten considerably running without music. Overall it was a successful experiment to help people looking forward to better running times.

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

ME BE

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 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

186

Fair Category

LT

Project
Number

1005

Title: The Effect of Different Types of Fruit on the Amount of DNA Extracted

Student Name(s): E. Glover, A. Ippolito

Abstract:

This experiment tested whether different fruits would yield different amounts of DNA because of the number of chromosomes they possess. Various fruits have different concentrations of water, which means that they will be more juicy or less juicy. We used the juice to extract DNA from the fruit, so if a fruit had more to use, theoretically, we expected to extract more DNA.

The mashed particles of the fruit were combined with an extraction liquid that helped break down the cells. This combination was filtered into a glass jar through a coffee filter, which helped us to obtain only the juices. Next, an alcohol layer was added to the top of this combination causing the DNA to float up into the top layer as a solid. From there, we extracted and weighed the resulting DNA.

The kiwi yielded the most DNA, with an average of 0.019%. The second most amount of DNA extracted was from the strawberry. The strawberries averaged 0.008 per extraction. The bananas averaged a bit less, with 0.007 for extraction. The kiwi, as the juiciest fruit, had the most DNA extracted from it.

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

CB

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- Yes No

CSEF Official Abstract and Certification

Word Count

242

Fair Category

LT

Project Number

1006

Title: Enjoy It Now... Or Enjoy It Later? Understanding Delayed Gratification

Student Name(s): D. Scudder, S. Crawley

Abstract:

We are doing this project because we wanted to test the age-old theory that girls mature faster than boys. We saw online that scientists tested the patience skills of children aged 3-4. We wondered if the tests would yield the same results if we used older subjects & Kit Kats, instead of marshmallows. We believed that delay of gratification, or patience, would be fully developed within the female subjects & partially developed among the male subjects.

In this experiment, we had the Kit Kats visible to Group A. The Kit Kats were not visible to Group B. We timed how long the students in each group would wait before asking for a Kit Kat. There were 4 subjects in each group (2 boys & 2 girls in each.) We used 2 large bags of Kit Kats, a timer, and a notebook to record data.

Our hypothesis was correct. The skill of delayed gratification, or patience skills, were fully developed within the females and partially among the males. This means that the majority of female subjects waited the given amount of time, & that the males either waited for a shorter period of time or did not wait at all.

There was a significant difference between our results & those of the study done by scientists in the '60s. This shows that delay of gratification develops as you get older. If we could have done anything different we would've used slightly younger kids (ages 7 or 8.)

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

BE ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

144

Fair Category

LT

Project Number

1007

Title: Colorful vs Black & White Powerpoints

Student Name(s): D. Wildman, S. Leifer

Abstract:

The question is "Does a colorful Powerpoint with pictures affect how a student learns?" This led us to test the hypothesis, "If a black and white Powerpoint and a colorful Powerpoint contain the same contents, then the colorful Powerpoint will help students learn the topic better because students will focus more on the colorful Powerpoint." The materials used were test subjects (between the ages of 11-14), a Chromebook, a projector, an extension cord, a power source, a patch cable, a quiet isolated space, the two Powerpoints; one with color & pictures; the other black & white and the quiz questions. Groups of four test subjects watched the Powerpoints, alternating from colorful to black & white. After the test subjects watched the Powerpoint, they completed a quiz based on the contents from the Powerpoint. Our hypothesis was proven correct after we had completed twenty trials for each Powerpoint.

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

BE

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- Yes No

CSEF Official Abstract and Certification

Word Count

214

Fair Category

LT

Project
Number

1008

Title: Exploring The Chemistry of Red Flower Pigments

Student Name(s): K. Leduc, M. Eckel

Abstract:

Abstract

For our project we used paper chromatography to determine if red flowers have the same or different pigments. There are about four major classes of pigments. Two common ones are carotenoids that produce red, orange and yellow flowers. And flavonoids that produce red magenta, and blue colors. The flowers we used were a poinsettia, a red rose, and a carnation. We made a solvent to do the process. The solvent consisted of solvent isopropyl alcohol and 1/4 cup of water. We transferred the pigments on the strip of chromatography paper using a coin and rubbing it onto the origin line. All of the pigments for each flower were purple. Then we put the stripes into the solvent and waited for it to dry. The strips took about 45 minutes to dry. When they were done, the results for the pointsettia were that the pigments were are pinkish red color, and you could see them clearly. The carnation started to fade, and after about 15 minutes you could barely see them, but the color was a faded pink. The roses results were the most surprising, they were purple, then at the top they turned blue! They were completely different from the carnation which means the rose had different pigments, so our hypothesis was incorrect!

Technical Disciplines Selected by the Student
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PS

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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

111

Fair Category

LT

Project Number

1009

Title: Wormaculture

Student Name(s): D. Lombardo, W. Carroll, M. Santos

Abstract:

For our science fair project we experimented the effects of worm juice when added to different types of soil. We gathered our own worm juice through a worm farm we built. It started with 500 worms, but now it might have 1,000. We tested the soil before, right after, and a day after adding worm juice. The worm juice improved the nitrogen, potash, and phosphorus by two on the testers ratings and improved the Ph by .5 on the garden soil, but didn't improve the Ph on the Cactus Soil. We came to the conclusion that worm juice significantly improves the fertility of soil, and that our hypothesis was almost correct.

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

EA

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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

211

Fair Category

LT

Project Number

1010

Title: Bye-Bye Bacteria: The Effect of Different Disinfectants on the Growth of E.coli

Student Name(s): I. Piazza, J. Beaulieu

Abstract:

In our project, we tested which household disinfectants could kill a harmless strain of Escherichia coli K12(E.coli). E.coli is a bacterium found in the intestines of warm-blooded organisms. This project is important because in our world, bacteria surround us and we need to know which disinfectants work to properly protect us from getting sick. We tested four different disinfectants to see which one would kill the most bacteria in 48 hours. We chose to use Scrubbing Bubbles, Clorox Bleach, Lysol Spray Cleaner, and Green Works. Scrubbing Bubbles breaks down dirt and deposits, removes soap scum and soils, and adjusts the PH. Clorox Bleach whitens and kills bacteria, removes grease, alcohol, stains and soils. Green Works is 97% all natural and it breaks down dirt, inhibits the growth of microorganisms, and removes stains and soils. Lysol spray cleaner acts like a sanitizer, removes odor, and acts as an antiseptic. Through our results we discovered that all natural cleaners like Green Works worked just as well as a basic cleaner, yet Clorox Bleach did the best. All of the E.coli cleared. We think the Clorox Bleach, cleaning all of the E.coli. We hypothesized that Scrubbing Bubbles would do the best but it did the worst with only three centimeters of clearing!

Technical Disciplines Selected by the Student
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MI

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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

189

Fair Category

LT

Project Number

1011

Title: Energy Bars: True or False

Student Name(s): I. Lopez, P. Tilus

Abstract:

We conducted this experiment to see how the nutritional value in the homemade energy bar compares to the nutritional value in retail energy bars. Our hypothesis was that the homemade energy bars nutritional value would be greater than the retailed energy bars nutritional values. The way we conducted this experiment was by making the energy bar and then we found the nutritional values of the bar using a database. After that, we found the mass of the each ingredient in the homemade energy bar using a scale. Next, we found the nutritional values in the store bought bars and we compared that to the nutritional values in the homemade bar. Our results were that the homemade bar contains more carbohydrates and fats than the retailed bars. It also included more protein. From our results we can conclude that the homemade energy bar had more nutritional values than the store bought bars. This means that the homemade energy bar can help improve an athlete's performance in sports, such as track, soccer, and football. This also means that the homemade energy bar can be used by people looking to build muscles.

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

BE ME 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

229

Fair Category

LT

Project Number

1012

Title: Delicious or Dangerous

Student Name(s): M. Khan, C. Reynolds

Abstract:

In our experiment, we tested to see if different foods affected the pH of your saliva. pH is a scale used to rate the acidity or alkalinity of a substance and ranges from 1 (most acidic) to 14 (most alkaline), with 7 being neutral. Your body's pH is important as a 1-2 point change in it can alter your body's chemistry. Even small changes in pH can affect overall health. To test this, we used 3 different foods: Ice cubes as our control group, cucumbers as alkaline, and lemons as acidic. We took a starting pH of our saliva. We then ate each food, and then measured the pH at 5 minute intervals over 20 minutes to search for any trends. We believed that lemons would cause the most change in our pH as they are strongly acidic. We were correct, and found that lemons immediately dropped our pHs from the normal 7-8 to 3-5. As expected, ice cubes did not affect the pH since they have neutral pH. Cucumbers were rated weakly alkaline with a pH very close to neutral and therefore hardly affected our pH. We also found that the pHs changed for only a short amount of time, and returned to normal after about 5 minutes. In conclusion, foods do affect your saliva's pH, but this change is brief, and should not cause damage to body.

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

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

246

Fair Category

LT

Project Number

1013

Title: Growing Algae

Student Name(s): K. Keegan, D. Sandow

Abstract:

Our original idea was formed after learning about the Three Gorges Dam in China. The dam is creating major algae blooms, causing the riverbanks to deteriorate. We had the impression that most of this growth was due to the buildup of silt the dam has spawned, but after research we found that the main contributor to the growth is pollution.

Our project's purpose is to see if algae's growth rate is sped up by supplemental CO₂, we "made" CO₂ by creating a chemical in a water bottle. The components were sugar, baker's yeast, and of course water. The reaction sent bubbles to the surface and through the tube connecting the CO₂ bottle to the algae bottle. Though it eventually worked out, our first CO₂ blew up, literally. We researched farther, after creating the CO₂ bottle, leaving it pressurized. When we took the cap to thread the airline tubing it exploded on Kailey and I.

Our algae specimen was found in Rec Park, a park near where Kailey lives. We chose this site because we studied the amount of bacteria in water from lakes at different parks around Southington. We got what we wanted, murky water with something living in it. Though we do not believe in Spontaneous Generation, Kailey discovered that there was a small creature in the water. We then separated the murky water between 4 bottles. We found after all that algae given more CO₂ will in fact have a more impressive growth rate.

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

EA PS

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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

176

Fair Category

LT

Project
Number

1014

Title: Which Beverage Stains Teeth The Most

Student Name(s): K. Tran, G. Dearborn

Abstract:

Abstract: There are many advertisements telling viewers how to prevent stains but are they really telling you how they get there in the first place? This experiment was conducted to find out which common beverages (coffee, tea, and Coca-Cola) stain teeth the most. To represent the teeth, hollowed-out eggshells were used to test the drinks. This experiment is very important because it shows how your teeth can get stained by the drinks people consume most often. It may influence them to think about the amount of the beverage they take in and how it can affect their teeth. At the end of our procedure, it was concluded that Coca-Cola stains the enamel (the outer layer of your teeth) the most which is a beverage that is consumed all around the country. Yet, coffee did stain the dentin (the inner layer of your teeth) the most, which is a liquid drank often as well. The objectives were met when it was discovered that all the liquids could affect the teeth, both inside and out.

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

ME BI

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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

248

Fair Category

LT

Project Number

1015

Title: Does X-Ray Radiation effect Reproduction in Fruit Flies

Student Name(s): P. Iannetta, J. 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. Our experiment attempts to discover if x-ray radiation has an effect on the reproduction of fruit flies. Our experiment was completed by x-raying four vials of fruit flies with different amounts of x-ray radiation. Two vials of fruit flies were not exposed to x-ray radiation this was our control group.

In our experiment the other controlled variables were environmental constants like light, temperature, food and storage these were kept the same for all vials of fruit flies. Due to constant movement, the fruit flies were difficult to count, we decided to count the pupa which were on the sides of the vials. Each group of pupa were counted weekly. The independent variable was the amount of x-ray radiation delivered to the fruit flies. The dependent variable was the amount of pupa reproduced.

Ours results indicate that the fruit flies that received higher doses of x-ray radiation reproduced more fruit flies. We also observed that the fruit flies that received greater amounts of x-ray radiation appeared to be smaller and moved much faster than the fruit flies that received little or no x-ray radiation

Our conclusion is that the more radiation that was received, the more the fruit flies reproduced and the radiation may have changed their reproductive characteristics.

Technical Disciplines Selected by the Student
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AS

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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

LT

Project
Number

1016

Title: Do You C The Vitamins?

Student Name(s): M. Suarez, A. Gleissner

Abstract:

Have you ever wondered what the healthiest way to cook broccoli is? Our project was testing to see which cooking method most greatly decreased the level of Vitamin C in broccoli. We thought that steaming would lose the most vitamins. To test our hypothesis we boiled, steamed and microwaved the broccoli separately and then strained all of the juice out. Then, we made an iodine solution and mixed it with the broccoli juice to create a bluish color. We observed the colors to determine how much Vitamin C had been lost. After we conducted the experiment, we found that boiling lost the most Vitamin C, followed by microwaving, and then steaming which lost the least. Our hypothesis was not supported, because we thought steaming would lose the most, but boiling did instead. This showed that the best way to cook broccoli, and receive the most Vitamin C is steaming and the worst way to receive Vitamin C is boiling.

Technical Disciplines Selected by the Student
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ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

252

Fair Category

LT

Project Number

1017

Title: How does the brand of Yogurt affect the amount of bacteria

Student Name(s): G. Vazquez, V. Rodriguez, G. Perez

Abstract:

In the study of nutrition and diet, which covers a lot of topics like dietary guidelines, advertisements wanting people to buy foods, and discussions of healthy verse unhealthy foods for kids, it has been long understood that each person's diet is different and that fad foods are always popping up. Recently, yogurt has become one of those fad foods advertising bacteria and live cultures to make people want to buy it, due to the benefits thought to be caused by the bacteria. But, no known general knowledge for the public exists about the number of bacteria in a serving of yogurt and how much bacteria a person actually needs for the body to benefit from the bacteria. The literature describes yogurt as a popular food containing good bacteria clinically proven to strengthen the body's defense system and regulate digestion. In this science project, a commonly used method was used to wet mount and stain samples yogurt allowing bacteria to be visible under the microscope, pictures taken, and bacteria counted. The following estimated average bacteria count in 8 ounces of each type of yogurt were obtained: store brand 3,911,591.6, Activia= 1,924,408.4 bacteria, Stonyfield=2,019,043.7 bacteria, Oikos=1,072,690.90 bacteria, Yoplait= 1,987,340.88 bacteria. In conclusion, reporting the number of bacteria in yogurt may help people become better consumers and research how the number of bacteria that is actually good for their digestive system. Next steps include testing more types of yogurt and asking people if reporting the number of bacteria in yogurt would change eating habits.

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

MI

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CSEF Official Abstract and Certification

Word Count

111

Fair Category

LT

Project
Number

1018

Title: How Sweet Is It: Flucos Levels In Your Favorite Drinks

Student Name(s): R. Nunn, A. Izzo

Abstract:

You do it all the time, you take a sip of a drink without even considering its' ingredients or how much unhealthy substance is in your beverage. This project looks into the glucose content (dependant variable) of three very popular drinks (independant variable) ; Sunny D, Coca-Cola, and Red Bull. Our hypothesis was, "If we test these beverages by adding invertase enzyme to isolate the glucose, then the Red Bull will show results containing the highest levels of concentrated glucose because it contains a higher amount of sugar than any of the other drinks". Our results supported our hypothesis by showing us that Red Bull contained 1,700 mg/dL of glucose.

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

CH BI ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

190

Fair Category

LT

Project
Number

1019

Title: Sugar Uncovered: A study on how the enzyme Invertase simulates the hydrolysis of sucrose, revealing hidden sugars

Student Name(s): N. Sciallo, K. DeRosa

Abstract:

The enzyme sucrase is known to break down complex sugars into simpler forms through the process of hydrolysis. The purpose of our experiment was to use the enzyme Invertase as a replacement for the enzyme sucrase in common drinks, thus changing the amount of glucose we think we are digesting. Our hypothesis indicated that the Invertase would not have a threatening effect in the breaking down of complex sugars. After testing our glucose test strips and our Invertase enzyme, we began our experiment. We diluted six drinks, Gatorade, Orange Juice, sweet tea, Monster Energy, Coca Cola, and a 7/11 Slurpee, and measured their glucose concentrations with a glucose test strip. Then, we added ten drops of Invertase to the drinks and measured how their glucose concentrations changed over time due to the Invertase. By using the glucose test strips, we were able to analyze the effect that Invertase had in drinks. Our results proved that Monster Energy and Slurpee had the highest glucose concentrations after the conversion. Our conclusion proved our hypothesis wrong, for the Invertase did break down complex sugars and added to the glucose concentrations of our drinks.

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

BI 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

173

Fair Category

LT

Project Number

1021

Title: Burning Calories

Student Name(s): N. Saha, B. Harris

Abstract:

This experiment demonstrates how the food in our bodies breaks down into energy. Our experiment mimics the chemical reactions happening inside of us when we digest food using a calorie (energy) measuring device. The goal was to find out if marshmallows contained the most energy since they're a carbohydrate and carbs gives us a lot of energy. We built a calorimeter, a device that measures energy, and used it to measure how much chemical energy is in the different types of food groups. Our homemade calorimeter burned up the food items and captured the energy by heating up the water. We then used an equation that converted our data into the amount calories in each gram for each particular food items. Our results show that the peanuts from the fats group actually had the most calories per gram. With peanuts at the top, our marshmallows were second to last. From pictures we took, we were able to tell that the natural oil found around the peanuts was what gives the peanuts its energy.

Technical Disciplines Selected by the Student
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ET 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

254

Fair Category

LT

Project
Number

1023

Title: Mutagenesis in Bacteriophage Lambda to Induce a Target Host of Escherichia Vulneris via Natural Selection

Student Name(s): S. Johnson, A. Joseph

Abstract:

Antibiotics resistance is a critical health concern that is gradually undermining the efficacy of antibiotics. One such solution to the problem is the bacteriophage. The primary setback on phage therapy is the host range, which is limited to harmless or easily treatable bacterial infections. Therefore, the phage will have no clinical value. We responded with an innovative method to expand and limit the host range to bacteria without carcinogenic mutagens or Bessel beam. The method used was rapid natural selection. The lambda phage was first placed in a natural environment of E. coli K12. Gradually, levels of E. vulneris (our chosen target) were increased and the phage would adapt to its new host. The E. coli K12 and E. vulneris will then be killed using third-generation sulfamethoxazole-trimethoprim. The intent is to isolate the Lambda phage to study the changes in its genetic makeup. Thus far in our project, we have not obtained results. However, we are making progress and are, currently, steps away from a successful antibiotic. Furthermore, because we plan for a two-year project, we have many revisions planned for the future. Primarily, we must expand the host range further to target bacteria in need of a cure. Secondly, for scientific purposes, we must perform a high-resolution melt (HRM), as we intend to track mutation in bacteriophages. With this information, it may be possible to replicate our experiment rapidly using optical tweezers to directly manipulate the DNA. Ultimately, our project is a novel and practical solution to antibiotic resistance.

**Technical Disciplines Selected by the Student
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CB ME MI

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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

212

Fair Category

LT

Project Number

1024

Title: Let's Go Bananas! The Effect of Ripeness on Banana DNA Extraction

Student Name(s): Z. Meyerson, D. Smith

Abstract:

The objective of this project was to determine which stage of banana ripeness yields the most extractable DNA. Extracting DNA allows scientists to change the DNA by adding or removing various segments of the DNA. By doing this, new medicines, vaccines, and crops resistant to diseases are created. In preparing to extract the DNA, a buffer was created and added to mashed bananas, then strained to remove the pulp. The remaining liquid contains the DNA. Cold rubbing alcohol was poured down the side of the glass; when the two liquids met, three distinct layers formed. The hypothesis was proven correct and showed that ripe bananas have the most extractable DNA. The results showed that the underripe bananas had an average of 0.37 milliliters, (ml) the ripe bananas had an average of 0.43 ml, and the overripe bananas had an average of 0.25 ml. There was a difference of 0.18 ml between the ripe and overripe bananas, which is significant for our data analysis. Since DNA is stored in cells, the amount of extractable DNA in bananas will decrease as cells are destroyed in the ripening process. This information is important to help scientists isolate DNA to combat viruses, bacteria, and diseases (i.e. diabetes, autism, and cancer) that affect both humans and plants.

Technical Disciplines Selected by the Student
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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

LT

Project Number

1025

Title: Got Bugs? A research project on arthropod diversity and abundance.

Student Name(s): C. Rego, K. Miller

Abstract:

Our project focused on how plot treatment affected diversity and abundance of arthropods. The six plots around the Environmental Sciences Magnet School were planted with a mix of wildflowers in 2011. They were mostly untouched, except for being mowed once or twice a year. Three plots were renovated in the spring of 2014. The renovation consisted of the top 2 inches of soil being removed to get rid of seeds and plant species that might regrow. The bare plots were seeded with grasses, which are native, and were mowed sporadically. We wondered how this renovation affected arthropod diversity and abundance. We thought that renovated plots would have greater species diversity than plots that were not renovated, and this hypothesis was proved correct by our data. Renovated plots had a higher average diversity index of 1.787; unrenovated plots averaged 1.272. We also thought that the unrenovated plots would have a greater arthropod abundance, but this thought was proved wrong by our data. The renovated plots had 26 species and unrenovated had 16. The renovated plots had an average of 6.25 arthropods per trap, compared to 6.64 for the unrenovated plots (73 arthropods in 11 trap sets). Within our studies we found that the renovated plots are more diverse than the unrenovated. If the goal is to increase arthropod diversity, then renovation is a good approach. Future studies could yield better results with better preparations.

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

EV EM AS

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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

125

Fair Category

LT

Project Number

1026

Title: Effects that a microwave has on Brine shrimp egg hatching

Student Name(s): B. Marcus, G. Genger

Abstract:

Our project was to see the effects that a household microwave might have on Brine shrimp eggs. We ran three tests. The first (control group) was “untouched” Brine shrimp eggs and salt water. Our second group was the near microwave group which was the same setup as the control group, but it was near the microwave for 20 seconds, then, prepared to be hatched. Lastly the third group was the Microwave group which had the same setup as the other two, but it was in the microwave. Our results were very surprising, all the groups had almost the same results. We believe that this experiment was very effective, but next time we would like to use more groups to prevent the likelihood of unwanted variables.

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

AS EA 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

230

Fair Category

LT

Project Number

1027

Title: The Effect of Added Nutrients to Hydroponic-Grown Plants VS Soil-Grown Plants on Lactuca Sativa

Student Name(s): R. Paine, R. Hossain

Abstract:

In this experiment, two different methods of growing plants were examined in order to determine which was the more efficient method. The use of hydroponics was tested against the use of soil in plant production. In addition, nutrient use was tested on the growth of the lettuce plant. Soil farming is traditional and has been used for thousands of years, there is no doubt that this method works, however, Hydroponics is a more advanced type of farming that has recently sprung up. In this method, soil is replaced by water. Materials such as clay pebbles are also added at times. It is stated in the hypothesis that the hydroponic grown plants with added nutrients will grow the plants the most efficiently due to both the novel method as well as the added nutrients.

The results thus far have shown that the hypothesis was completely wrong. Out of the hydroponic plants, the group without added nutrients has grown the most. It is believed that the plants were not able to absorb enough water. In addition the water was observably foamy when the nutrients were added. It is believed that there was a mechanical error made in setting up the project that may have affected the growth of the lettuce plants. Out of the soil grown plants, they have both been growing at an equal pace and so far are very healthy.

**Technical Disciplines Selected by the Student
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PS EA EV

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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

249

Fair Category

LT

Project Number

1028

Title: Terrific Tardigrades!

Student Name(s): J. McCann, S. Robichaux

Abstract:

Our discovery of tardigrades began when we saw a picture of an unusual creature on the back of Scope magazine. We researched the tardigrades and thought they were incredible! We wanted some of our own to study. When we learned about how to find tardigrades, it seemed remarkably easy. We followed the procedures we had researched, located some moss and cut some to use in our experiments. We let the moss samples soak in distilled water. Next, we squeezed the water that the moss had absorbed into the petri dish. We examined the contents of the petri dish under the microscope and finally found a tardigrade! We were so excited! In our research, we learned that the tardigrade is reportedly the most resilient creature on earth. We decided to test this ourselves. We ran five tests on the tardigrades. The only test the tardigrades did not pass was the Vinegar test, likely because the vinegar is acidic. We wanted to learn why the tardigrade is so tough. While doing research, we discovered startling information: the tardigrade is not one full DNA, but it is actually a group of multiple types of DNA. We believe this grouping contributes to its resiliency. We made a pie graph showing the DNA of the tardigrade, and constructed models showing a tardigrade and its habitat. In conclusion, we discovered just how resilient the tardigrade is. We would like to research ways in which the resiliency of the tardigrades can be applied to human use.

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

AS MI

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- Yes No

CSEF Official Abstract and Certification

Word Count

214

Fair Category

LT

Project Number

1029

Title: Backyard Biofuel (Which biomass briquettes burn the best?)

Student Name(s): A. Auzina, C. Corriveau

Abstract:

Biomass briquettes can important for survival, and can be used for cooking food, heating homes, and making electricity. Many people rely on biomass briquettes to live. For our experiment we were trying to find the most effective plant to make biomass briquettes out of. Our hypothesis was "If we use radish seeds to make biomass briquettes then it will burn better than other other briquettes".

We blended our independent variables with water in a blender. We Compressed, and formed our briquettes in a homemade biomass briquette maker made out of pvc pipe and a caulking gun. Then we let them dry before trying to light them on fire. Finally we timed the burning time and the temperature of the flame.

Not all of our biomass briquettes successfully burned. The coconut briquettes burned the best. They burned the longest out of all of our briquettes. Briquettes made out of radish seeds burned the hottest but not the best. With this experiment we found that the best plant to make briquettes out of are coconuts. Our hypothesis was partially wrong because briquettes made out of radish seeds didn't burn the best but burned the hottest. Our results could be passed on to people who rely on briquettes to live or scientists to further test more plants

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

EN PS 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

240

Fair Category

LT

Project Number

1030

Title: Effect of Technology Use On Deep Sleep Percentage

Student Name(s): S. Schlagheck, R. Corbett

Abstract:

The purpose of this experiment was to understand whether or not children should use technology before going to sleep. The experiment specifically focused on the use of technology one hour prior to bedtime. The results would help people comprehend the impact of technology use before bed and whether or not they should be using it then, based on deep sleep percentage.

To begin the test, the test subject either would or wouldn't use technology for one hour before getting in bed. Then, in order to correctly use Sleep As Android, an app on phones that can track stages of sleep, movement, etcetera, they would set the phone down near them on their bed and turn on the app. This app was useful for this project because when one wakes up, it reports their deep sleep percentage.

Several observations were made during the testing periods. First, after nights of being on technology for one hour before bed, the test subject noticed they were experiencing lower alertness and focus, while when off electronics, they felt more focused and well rested. Second, the average deep sleep percentage when off electronics was 12.4% higher than when on.

The results of the experiment suggest that, ultimately, children should be off electronics for at least one hour before bed. When not on the computer before bed, the test subject felt better physically, mentally, and behaviorally during the daytime and statistically, had significantly higher deep sleep time.

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

ME BE

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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

264

Fair Category

LT

Project Number

1031

Title: Are eco K-cups better for the Earth?

Student Name(s): T. Karasinski, S. Borrelli

Abstract:

PROJECT ABSTRACT:

Experiment purpose:

We are testing to see if bio K-cups actually decompose faster than their original counterpart.

Our results may help to solve the environmental crisis.

Hypothesis:

If we crush each decomposed K-cup than the biodegradable ones would crush without a great amount of pressure being applied.

Procedure:

1. Gather a fish tank, three bio K-cups, three non-bio K-cups, a light source, plastic wrap, dirt and other natural items, water and a dial scale.

2. Fill the tank with the dirt and other natural items and bury two bio K-cups and two non-bio K-cups inside. Seal the tank with plastic wrap and leave an opening for water to be poured in. Then hang the light over the tank.

3. Leave the tank alone for four months and pour one cup of water in every week.

4. After four months dig up the K-cups and measure the pressure it takes to crush each one.

Also crush the non-decomposed K-cups to use as controls.

5. Compare results and draw conclusions.

Results (kgs):

After our experiment concluded and we analyzed the data, we could see that the bio K-cups had an average crush pressure that was 4.08kg less than the average crush pressure of the non-bio K-cups.

Conclusion:

Our hypothesis is confirmed. The bio K-cups do decompose faster than the originals. You can see this because if they had decomposed longer they would require less pressure to crush.

Therefore, the bio K-cups are better for the environment as stated.

Technical Disciplines Selected by the Student
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EA EM EV

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- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

LT

Project Number

1032

Title: Preventing Bacteria Growth in Food

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

Abstract:

Abstract:

Many foods are manufactured with harmful biocides. The purpose of the experiment is to prove that a food grade biocide could be as effective as an industrial biocide. We chose this topic because many people have spoken to us about what additives are in food we eat. In addition, a team member has food allergies and as a result he needs to look at labels before food is purchased. Our hypothesis is that non-harmful food grade biocides will be as effective as some of the harmful industrial grade biocides in preventing bacteria growth.

The investigation was conducted by preparing four different types of food to test industrial and food-grade biocides. The level of bacteria growth was measured using a bacteria test kit used in the chemical industry. Within three days of testing, bacteria growth was detected. We decided to test for ten days to see if any additional growth would occur.

The key results supported our hypothesis that food grade biocides are equal to or better than industrial grade biocides in preventing bacteria growth in food. The food grade biocide and the paraben biocide performed equal to or better than the industrial grade biocide in 75% of the food groups.

The conclusion that we can draw is that it is not necessary for food manufacturers to use harmful biocides to prevent bacteria growth in food. The FDA (Food and Drug Administration) should change the rules and not allow harmful biocides to be used in the U.S food industry.

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

BI EN

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- Yes No

CSEF Official Abstract and Certification

Word Count

209

Fair Category

L7

Project
Number

2001

Title: How does soil pH affect bean plants?

Student Name(s): T. Schloss

Abstract:

Plants rely on soil pH for proper nutrient balance and availability. In my project, I investigated how adjusting soil pH affected bean pod growth and yield. This type of data is crucial to growers in areas where soil pH is unfavorable. Growers need to be aware of preferred plant specific soil pH in order to increase their crop yield. I raised soil pH to 9.0 by pouring reverse osmosis water mixed with sodium bicarbonate on my high pH test group. I lowered soil pH in my low pH test group to 3.0 by using reverse osmosis water mixed with phosphoric acid. My control test group was watered with reverse osmosis water, which had a pH of 7.0. My results showed that plants grown in high pH soil grew approximately 33% more beans than the beans grown in low pH, they grew approximately 11% longer and weighed 4.7% more. Compared to the control, plants grown in high pH grew 1% heavier, 1% longer and 5% more beans than my control. The plants grown in low pH soil grew 25% less bean pods, which were 10% shorter and weighed 1% less. From this data, we can form the conclusion that growing plants in a higher pH soil does have positive effects.

Technical Disciplines Selected by the Student
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PS BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

L7

Project Number

2002

Title: Fruity Finds

Student Name(s): E. Meehan

Abstract:

It is well known that fruits have many natural health benefits but it is a struggle to keep them ripe without spoiling. If people knew how to store fruits, their ability to maximize the consumption time would improve. My experiment sought to find the optimum storage method for 4 types of fruit: bananas, strawberries, raspberries and apples, in both organic and non-organic form. My hypothesis was that all fruits would stay ripe longest when left in a freezer, in much the same way as it lengthens the life of fresh meats, breads, and convenience foods. To complete my experiment I put one of each type of fruit into designated locations: countertop, paper bag, refrigerator, and freezer. Second, I recorded the behavior of the fruit over one week. My hypothesis was different from the results because each of the fruits required something different to stay fresh. The results showed that the fruits needed different climates to stay fresh. Some fruits, like strawberries and raspberries were better kept in the refrigerator, but others, like bananas, turned brown faster this way. Another good example is that on the second day, the bananas in the freezer were browning and the organic strawberries on the countertop were growing mold. My project is important for those who need assistance in proper food storage. Many people wonder why their fruit looks like a science experiment, and by doing exactly that, I showed them how the fruit is affected by storage. Proper storage keeps fresh fruit edible longer.

Technical Disciplines Selected by the Student
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PS

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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

248

Fair Category

L7

Project Number

2003

Title: Si High, Low, or No: Algae Where Do You Want to Grow?

Student Name(s): S. Rougeot

Abstract:

I have always been interested in why and how algae grows on ponds. The purpose of my project was to determine whether freshwater Navicula diatoms would grow in larger numbers in a high silicate, low silicate, or no silicate environment. My hypothesis states: If the Navicula are put in different flasks with high silicate, low silicate, or no silicate they will grow better in the flask with the high silicate.

I setup nine flasks with 3 high silicates, 3 low silicates, and 3 no silicate treatments. I conducted 5 cell counts over three weeks on the nine treatments. For my experiment, three replicates were prepared. I maintained the proper temperature and lighting and aerated the treatments manually by vigorously shaking them daily.

Over a period of three weeks five cell counts were taken of each treatment. The average amount of cells per ml in the high silicate is: 49,916, the low silicate is: 46,499 and the no silicate is: 32, 082. These results prove that you can control or manipulate the growth of algae by knowing what factors affect its growth.

I was sure that the treatments with the high silicate would do the best because in researching Navicula diatoms I learned that they use silicate to make their cell walls. I felt that providing them with more of this nutrient it would help them grow faster and in larger numbers. This information would be helpful to anyone that wanted to control or manipulate the growth of algae.

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

CB MI

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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

230

Fair Category

L7

Project Number

2004

Title: Substrate and Vegetation Preference in Zebra Danio Spawning: A Study Of Breeding Triggers

Student Name(s): N. Reeves

Abstract:

People are always looking for the most efficient way to breed fish, both for conservation and commercial purposes. Most fish are triggered to begin the breeding process by an abiotic factor, such as temperature, or precipitation. I wanted to find if terrain or vegetation type could be a trigger for zebra danio fish. I was curious to find out if zebra danios preferred one type of substrate or vegetation over another.

During my experiment I set-up different areas of the tank with different substrate or vegetation types. I checked the tanks daily for the amount of eggs in each section of substrate or vegetation (grassy, leafy, rocky, and nothing). I thought that the zebra danios would prefer to lay their eggs in the leafy area of the tank, but I was wrong. I found that the fish preferred to lay eggs in the grassy area of the tank. I found 4 eggs in the grassy area, which was more than the other areas eggs combined.

Overall, I learned that if you want to breed zebra danio fishes (*Danio rerio*) then you should give them a grassy habitat. They preferred to breed in this area, and when I looked in the tank, they were mostly in that area. I think this area reminds them of home and is most like the rice paddies they live in, in their natural habitat.

**Technical Disciplines Selected by the Student
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AS BE EM

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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

63

Fair Category

L7

Project Number

2005

Title: Study of Various Starch-based Biopolymers

Student Name(s): L. Josyula

Abstract:

In this experiment, I created three different bioplastics and conducted tests on each of them to conclude which bioplastic is the best in terms of strength, biodegradability, weight, and pH.

The three different bioplastics were created from three different biomasses: Corn, Tapioca, and Potato.

The potato starch-based bioplastic passed 3 tests with flying colors, therefore, the potato plastic was the best bioplastic.

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

BI EN

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

- Yes No

CSEF Official Abstract and Certification

Word Count

224

Fair Category

L7

Project
Number

2006

Title: The effect of fertilizer quantity on algae growth

Student Name(s): T. Kearney

Abstract:

The purpose of this experiment was to determine how much fertilizer would make algae grow the most. It was predicted that the 2x recommended amount of fertilizer would have made the algae grow the most. The procedure was to make an algae growth medium, combine the growth medium with the algae, pour the algae into the jars, let the jars sit in the sunlight for 8 days, run the samples through a spectrophotometer, and then measure the data from the spectrophotometer. At a spectrophotometer wavelength of 680nm (nanometers), the 2x recommended amount had the least algae growth, the recommended amount of fertilizer grew the algae the most, and the non-fertilized algae grew in between the range. It was predicted that the 2x recommended amount of fertilizer would make the algae grow the most. The data showed that the recommended amount of fertilizer grew the algae the most, at .1884, thus proving the hypothesis completely wrong. The non fertilized algae grew at .1446, and the 2x fertilized algae grew at .0929. It is concluded that the recommended amount of fertilizer makes algae grow the most. This experiment could have been better if there were more precise and equal measurements of the spectrophotometer samples, if all the days were sunny instead of having a few rainy days, and if fungus didn't grow with the algae.

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

245

Fair Category

L7

Project Number

2007

Title: Plant Growth Using Different Kinds of Fluids

Student Name(s): K. Caguitla

Abstract:

Abstract: Plant Growth Using Different Kinds of Fluids

This project is about using different kinds of fluids in plant growth. The purpose was to find out which fluids help plants to grow. In this experiment I used bean seeds, six containers and soil. The fluids that I used were tap water, whole milk, orange juice, soda (coke), gatorade and black coffee. I planted two bean seeds on each container with soil. Then I labeled the containers and watered each of them with different fluids. I watered the plants with different kinds of fluids every two days until day twenty. I made sure that they were in the room with good ventilation and enough sunlight. This experiment started on January 10, 2015. Nothing grow on the first six days. On day seven, I already threw away the whole milk container because it smelled horrible and it accumulated a lot of molds. On the same day, seeds being watered with black coffee started to sprout. On day fifteen, seeds being watered with water also started to sprout but on day sixteen I threw away the orange juice container because of its bad smell and it also accumulated some molds. Until my last day of experiment, no seeds sprouted from soda and gatorade container. Based on my experiment, my hypothesis was wrong that only water helps plants to grow. Black coffee also helps plants to grow. Seeds that were watered with black coffee actually sprouted first than tap water.

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

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

239

Fair Category

L7

Project Number

2008

Title: The Effect of Alternative Fertilizers (Eggshells and Coffee Grounds) on the Growth of Radishes

Student Name(s): J. Young

Abstract:

The purpose of this project is to find the effect of alternative fertilizers on the growth of radishes. Eggshells and coffee grounds are a free, natural source of nutrients which are helpful for plant growth. Eggshells provide calcium and coffee grounds offer acidity to the soil. The hypothesis is if these different fertilizers are added to planting soil, then the radishes in the soil will have enhanced growth as compared to the radishes in plain soil.

Soil was placed into 15 small peat cups and in addition to soil, 5 cups received crushed eggshells, and 5 cups received coffee grounds. Two radish seeds were placed in each pot to ensure at least one would grow. The radishes were watered daily and all pots received the same amount of water and sunlight for 19 days. The smaller radishes were pulled after 9 days to make room for the larger plants to grow. On day 19, all the radishes were pulled. All the plants were pulled before bulb growth began.

The results showed that the radishes grown in eggshells and coffee grounds had larger length averages than the radishes grown in soil alone. The conclusions that can be drawn from this experiment are that though plants can thrive with simple ingredients of soil, water and sunlight, added nutrients that come from recycled and nature-safe fertilizers help plants grow and develop to be larger and more healthy than with minimal ingredients.

**Technical Disciplines Selected by the Student
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PS

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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

234

Fair Category

L7

Project
Number

2009

Title: Ground Level Ozone in Danbury

Student Name(s): N. Raslavsky

Abstract:

The purpose of my experiment was to collect and publish new ground level ozone data that is not currently in the global data set. The hypothesis being studied was that different parts of Danbury, Connecticut would have different amounts of ground level ozone and that by adding this to the global data set, it may reveal the sources of ozone. I used two different sets of test strips for experimentation. I left both sets for different periods of time outside to conduct the experiment. The locations were outside my house which is in a low traffic area, Main Street, the Danbury Fair Mall, and near Exit Five. I observed that the Standard gas station near Exit Five had the highest amount of ground level ozone in Danbury. My house, which is in a low traffic area, had the least amount of ground level ozone. For this area, the data from the test strips showed a very subtle color that was hard to see. From my data, I have concluded that high traffic areas have more ground level ozone than low traffic areas. This is because of the nitrous oxide emissions in these areas from cars. What makes me believe this is that nitrous oxides are part of the creation of ozone, along with VOCs. While both sets of data were a little bit different in some areas, the results still point to my conclusion.

Technical Disciplines Selected by the Student
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EV

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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

179

Fair Category

L7

Project Number

2010

Title: The Effect of Caffeine on Plant Growth

Student Name(s): K. DeVito

Abstract:

Caffeine is a substance that stimulates the central nervous system. It is found in many everyday beverages such as tea, coffee, and more.

In my experiment, I tested growing pea plants with different concentrations of caffeine. I predicted that the 0.25% caffeine concentration would help the plants grow better than the control and the other concentrations of 0.05%, 0.50%, 0.75%, and 1.00%. The purpose of my experiment was to find what concentration helped grow peas the best in health and height. To make these concentrations, I diluted from a 1.00% stock I made from 25 200mg caffeine caplets in 500mL of tap water. In the end, my hypothesis was incorrect. The caffeine concentration that enhanced plant growth the best was the 0.05%. I discovered that the lower concentrations of caffeine, including the 0.05% and 0.25%, enhanced plant growth. The higher concentrations of caffeine of 0.50%, 0.75%, and 1.00% harmed the plants' growth and overall health. In conclusion, my original hypothesis was proven incorrect, but my new hypothesis would be that the 0.05% caffeine concentration enhanced plant growth the best.

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

PS

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- Yes No

CSEF Official Abstract and Certification

Word Count

237

Fair Category

L7

Project
Number

2011

Title: Flour Power!

Student Name(s): C. Baldini

Abstract:

The purpose of my experiment was to evaluate the amount of gluten contained in four types of flour. I chose this experiment after a family member was advised to limit the amount of gluten in her diet. Although not allergic to gluten, this person was told to reduce her intake of foods such as bagels, muffins, bread and pizza. I decided to test the kinds of flours that are used to make these foods to see which foods contained the most amount of gluten. I also wanted to see if a commercially marketed "gluten free" flour was, in fact, as it was represented.

I suspected that the wheat flour that was closest to its natural form would contain the most gluten. I also suspected that the gluten-free flour which was not derived from wheat would not contain gluten. To test these hypotheses, I analyzed four types of flour, one gluten-free flour and three types of wheat flour.

My results showed that of the wheat flours, the 100 % wheat flour contained the most amount of gluten and the all-purpose bleached flour had the least amount of gluten. The gluten free flour was, in fact, gluten free. Knowing the amount of gluten contained in wheat flour enables people to know which kinds of wheat flour are appropriate for making certain kinds of foods. It also provides valuable data to persons who are gluten sensitive or intolerant.

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

ME 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

250

Fair Category

L7

Project Number

2012

Title: Torso Length vs Lung Capacity

Student Name(s): B. Reyes

Abstract:

Torso Length vs Lung Capacity

By Brianna Reyes
(Black Rock School, Bridgeport)

This project is based on comparing torso length and lung capacity. Your torso starts at the prominent bone in your neck, usually called the "C7" and ends at your iliac crests, located at the top of your hip bones. The purpose of the lungs is to bring oxygen into the body and eliminate carbon dioxide. Lung capacity is defined as the volume of air contained in the lungs. Some people's lung capacity can be weakened by health conditions.

A spirometer is an instrument used to measure the air capacity of lungs. Spirometers are mostly used in hospitals for patients after surgery so they can exercise their lungs. They are also used to gauge how effective a lung treatment is working for asthmatics and those with other lung conditions.

I come from a tall family and wonder if someone has an especially long torso, if their lung capacity might be greater than the average lung. By conducting this experiment, I tried to find out how torso length affects lung capacity. To find out I measured the torsos of four people and compared them with the lung capacities that I measured for each person (using the spirometer).

After analyzing the data, my hypothesis (that the greater the torso length, the greater the lung capacity) was supported. As predicted, as torso length increased, lung capacity increased as well. If I could add to the data, I would have used more participants.

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

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

250

Fair Category

L7

Project Number

2013

Title: the effects of different fertilizers on grass

Student Name(s): m. simms, N. N/A, N. N/A

Abstract:

The purpose of this experiment is to test, which is the best fertilizer for grass, and how well it grows in a set amount of time. The fertilizers are Jonathan Green winter survival fall fertilizer (10-0-20), chicken waste, sheep waste, or none at all. It was predicted that the sheep waste would be the best fertilizer, second best would be the chicken's waste, the store bought fertilizer would be third, and the soil would be last. The procedure consists of; putting on gloves, labeling the 3 trial pots for each fertilizer, putting in the grass seeds and fertilizer, waiting three weeks, and gathering the data and results.

This study showed the effect of different fertilizers on grass growth, as assessed by grass height and growth rate, (height / time) in comparison to no fertilizer as a control. The results demonstrated that the sheep waste clearly grew the fastest but only for the first 12 days, eventually the chicken, sheep, and control were all about the same height by day 16 and stayed the same height for the rest of the experiment. The data also shows that store bought fertilizer treated soil delayed growth and produced grass that was less than half the height. It is noted that, the faster the grass grew the weaker the grass stem seemed as observed by the bending and drooping stems. In conclusion the natural organic waste produced the same results as the untreated fertile soil, while the man-made fertilizer appeared to be less effective.

Technical Disciplines Selected by the Student
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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

250

Fair Category

L7

Project Number

2014

Title: Do Graphic Organizer Affect The Way Students Write?

Student Name(s): B. Pham

Abstract:

Bush Pham

Do Graphic Organizers Affect The Way Students Write?

A graphic organizer is a visual organizer that helps students to see relationships between facts, concepts and ideas. My question is can a graphic organizer really help and affect our writing if we use one versus when we don't use a graphic organizer for our writing? When I was exploring my topic, I found out that students who used a graphic organizer in their writing scored better on their writing assignment. My experiment has few basic materials, that you can find in a classroom or your home. What I needed was a pencil, paper, a writing prompt, graphic organizer and students. I gave my group of students a writing prompt based on animals with their teacher's help. But, I didn't give my group a graphic organizer. After the prompts were all written, I graded the papers out of 1 points by using a rubric. After all paper were graded the score was 53% below mastery on their writing. The next thing I did was give the students the same prompt, but this time they used a graphic organizer. After the prompts were done, I graded them the same way I did with the first prompts. They increased to 89% mastery with the graphic organizer. I learned that students will elaborate more in their writing. Writing is use in a daily base, you can use writing while writing a book, a script, or a play. Writing is going to affect us.

**Technical Disciplines Selected by the Student
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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

176

Fair Category

L7

Project Number

2015

Title: How Will Vitamins Impact Plants?

Student Name(s): P. Castellano

Abstract:

The main idea of this project was to see how the following seven vitamins would impact plant growth: vitamins A, B1, B2, C, D, D3, E, and water used as the control. The plants were fed every other day and measured every four days. The hypothesis was "If I add vitamins to the scallions, then there will be an increase in growth." It was also believed that vitamin B1 would do best because it was recommended by several sources saying it improved plant metabolism.

After three weeks of growth and measurements, the results were not what was expected. Vitamins B1, D3, and E had similar results, but each had a different reason for succeeding. For B1, it was because the vitamin improved the metabolism of the plant, while for D3, it was due to it helping with germination. This caused the scallion plant to sprout many small plants, instead of one or two big plants. On the other hand, vitamin E had immunity to colder temperatures, a trait no other plants had, which made it successful.

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

PS BI

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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

250

Fair Category

L7

Project Number

2016

Title: Family Fingers

Student Name(s): T. McBride

Abstract:

My family and I share an iPad. The device has the option for fingerprint security. If one family member sets the security as his or her fingerprint nobody else can unlock the iPad. This problem hatched my problem statement "Are fingerprints inherited?" By discovering if fingerprints are inherited, I can find if everyone in my family could unlock the iPad with their own fingerprint. In my research, I learned that there are three types of fingerprints.

I tested five families; one set of grandparents, parents, and children. I cleaned the person's right thumb with a moist towel and dried it with another towel. Then I put the person's right thumb onto an inkpad for about ten seconds. After that I lifted the finger off the inkpad on a blank index card. When the fingerprint isn't able to smudge, I labeled below the fingerprint of what family it belongs to. I also wrote either the print was a grandparent, parent, or child.

According to my data, four out the eight children had a fingerprint one their parents have. In family C, 80% of the family has the whorl type of fingerprint. In the other four families it is very equal. Families usually have about the same amount of members in types of fingerprint.

This experiment has lead to be inconclusive. The experiment says there is a 50% of getting a finger from your parents, but I know that can't be correct and I will continue to work to answer my problem.

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

AT CS 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

222

Fair Category

L7

Project Number

2017

Title: The Stroop Effect

Student Name(s): N. Yastremski

Abstract:

Abstract: The Stroop Effect

Can you pat your head and rub your tummy? This is one example of how the Stroop Effect Works. I investigated the Stroop Effect to see if naming the color of a word is harder if the word differs from the color ink in which it is printed. My hypothesis was that if I tested my participants on the Stroop Effect, then it will take them longer when to say the color of the word that does not match its name. To conduct my experiment, first, I timed the participants on how long it took them to say the color of the word that matches its name. Next, I did the same-only with the word printed in ink that does not match its name. I did this in two groups: children and adults. Each group had five participants. I calculated the average for each set of words. This gave me the time difference delay Then, I subtracted the average time of the non-matching colors from the matching colors. The children and adult's time difference delay both rounded to about nine seconds. So, being a child or adult did not affect the time delay. My hypothesis was correct because it took the participants longer to say the color of the word that does not match its name.

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

BE

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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

135

Fair Category

L7

Project Number

2018

Title: Does the Color of Light Effect Plant Growth?

Student Name(s): S. Signore

Abstract:

The purpose of this experiment was to find out what colored light bulb would increase the growth rate of string bean plants the most after fourteen days of growing under a colored light bulb.

My hypothesis was that the red light bulb would increase the growth rate of string bean plants more than the clear, blue, and yellow light bulbs will. I base my hypothesis on the fact that red light gives off the longest wavelength. According to the University of Hawaii, "Plants get most of their energy from the red and blue parts of the light spectrum."

The information gained by this experiment will help local farmers. If farmers that grow beans indoors want to speed up the growth rate; they can see which color of light bulb will make beans grow the fastest.

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

PS

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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

235

Fair Category

L7

Project Number

2019

Title: How does difficulty of a video game affect emotion.

Student Name(s): T. Mahon

Abstract:

In the study of how video games affect emotions, which means how people's moods and attitudes are affected while playing video games, it's long been understood that video games can have positive and negative affects on the human body. But, there is no known general knowledge about how the difficulty setting of the game affects a person's mood. The literature describes video games as affecting human moods and attitudes in a negative direction, meaning the more difficult a game, the angrier a person gets. In this science project, a common procedure is used to measure a person's emotions after playing a video game however instead of having people rate their emotions through a self report survey, a pictorial chart showing human emotion is used. During this experiment data is collected from anonymous participants playing video games at different difficulty settings and rating their emotions with a emotions chart. The following results were obtained: as the difficulty increased the participant's moods degraded from happy and ok to angry in 80% of participants. In conclusion video games difficulty and human emotion as a result of video game playing may be linked to increased anger which could result in uncontrollable outbursts, physical aggression, and maybe even gun violence or death. Next steps include trying different video games and a larger sample size while keeping the use of the pictorial emotion chart due to its successful use among participants.

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

AT BE

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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

249

Fair Category

L7

Project Number

2020

Title: Mud Power

Student Name(s): L. Millott

Abstract:

I did my project on getting power from a microbial fuel cell (MFC). My main question is: "how can you increase the power output from an MFC"? My other questions were: what happens if you add salt, urine or coffee grounds to the mud in an MFC? My hypothesis was that adding salt, urine or coffee grounds will increase the power output of an MFC. First I ordered an MFC kit online containing 3 MFCs. I assembled the MFCs using the instructions and using mud from my front yard. I took voltage measurements using a multimeter to get power measurements each day. Once the bacteria started to grow and make electricity I waited until the power output stabilized. MFC #1 and MFC #3 stabilized first and I added salt to each. The power output increased after adding salt. When MFC #2 power stabilized my Father collected his urine in a glass jar while wearing nitrile gloves, and using an eyedropper, he added urine to MFC #2. The power output of MFC #2 decreased after adding urine; I believe my Father collected the urine incorrectly so it was not sterile, or the glass jar was not sterile. Adding coffee grounds to MFC #3 did not help to increase the power output; it harmed the bacteria inside the MFC. That part of my hypothesis was incorrect; coffee grounds are food for plants but not bacteria. My other hypothesis that adding salt would increase the power output of an MFC was correct.

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

EN ET 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

187

Fair Category

L7

Project Number

2021

Title: How Light Affects Plant Transpiration

Student Name(s): A. Masthay

Abstract:

Allison Masthay's Connecticut Science Fair Abstract

This year, I chose to study whether or not light affects plant transpiration. Plant transpiration is when water, in the form of water vapor, escapes through the leaves of a plant. I decided to test which of three different light sources (sunlight, a household lamp, and a fluorescent lamp) causes the most plant transpiration. I hypothesized that the sunlight would cause the most transpiration, and I was correct. I conducted my experiment by making several small greenhouses and putting them under the three different light sources. There were a few cloudy days, so on those days the amount of transpiration from sunlight was only a few drops. However, when there was a lot of sunlight, the transpiration measured up to one teaspoon! The household lamp produced more transpiration than the fluorescent lamp, but not by much. Both lamps didn't produce a lot of transpiration; only one or two drops. During my experiment, I found out that, not only does light affect plant transpiration, but temperature does also. The sunlight is both bright and warm, so naturally, it produced the most transpiration.

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

239

Fair Category

L7

Project Number

2022

Title: What is the perfect absorbent for used cooking oil?

Student Name(s): S. Lee

Abstract:

Inappropriate disposal of used cooking oil has been causing drain damages, water pollution, pipe blockages, and harming marine life. The purpose for this investigation was to discover an easy, eco-friendly, accessible, good quality and economical absorbent for used cooking oil. Peels of bulk orange, grapefruit, tangerine, eggplant, Bella mushroom and mushroom were evaluated for the absorbing capacity of both used cooking oil and new oil by 20 minutes. This procedure was repeated with 24 hour dried materials and 48 hour dried materials (Experiment A). Also, the different decomposition rates between absorbents with oil and without oil (Experiment B) was tested. Time to absorb oil (Experiment C) and temperature of the oil (Experiment D) were different independent variables and experimented. In addition, the structures of the superior absorbents (bulk orange peels, grapefruit peels, and tangerine peels) were observed using a dissecting microscope and a microscope (Experiment E). It was shown by data that fresh Grapefruit peels have the most absorbability, and after soaking 10 minutes to 20 minutes was the most efficient and effective at absorbing the oil. As a result, the absorbents with oil decomposed less than absorbents without oil; this means that burying the absorbent is not an effective method. The images under microscope showed that grapefruit peel has larger empty spaces between fibers than other citrus fruits and it makes the difference. In conclusion, easily accessible and cost effective grapefruit peels could be a useful biosorbent.

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

BI EM 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

L7

Project
Number

2023

Title: Death of Bouquets

Student Name(s): T. Jargalan

Abstract:

The reasoning for my experiment was to find out if different types of liquids increase the lifespan of flowers. I tested this by putting yellow carnations flowers in water, water with alcohol and water with bleach. I picked these liquids by researching the different types of liquids that help flowers survive. My hypothesis was that the alcohol will make the flower last longer and the bleach will not help at all. I found multiple sources that state adding alcohol to the flowers will make it live longer. On one of the sources, it said liquid bleach will make it live longer. I was surprised at this statement but I was interested to find the outcome of it. My hypothesis was the alcohol would make the flower live longer because I found multiple sources for it. I found only a few sources stating that liquid bleach helps flowers, so I was not sure it would help at all. But, I was interested in the outcome of it. After conducting the experiment, the results disproves my hypothesis. The plants that was put in alcohol only survived for 8 days and the flowers in the liquid bleach survived for 10 days, as compared to the water flower, which survived 18 days. In conclusion to this experiment, adding alcohol and bleach to your plants will not increase the lifespan of the plant.

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

163

Fair Category

L7

Project Number

2024

Title: The Stroop Effect

Student Name(s): L. Greenfield

Abstract:

The purpose of my experiment was to see if the Stroop effect could be negated by changing the types of words used in the experiment. I achieved this by creating a booklet with the two original Stroop tests (both with color words) and three Stroop test variations (one with emotional words, one with nonsense words, and one with random nouns). I gave each of eleven volunteers one test from the booklet at a time in this order: Test 1, Test 2, V1, V2, and V3 (the Vs stand for "variation"). I timed each test one by one and recorded the results. Aside from Test 1, in which the color words corresponded with the font color of the word, V2 had the fastest results. V2 is the test that uses nonsense words in replace of color words. Its average time was 23.42 seconds (rounded to the nearest hundredth). All of the other tests (excluding Test 1), had averages of at least 1 second longer.

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

222

Fair Category

L7

Project Number

2025

Title: The Effect of Different Substances on Plant Growth

Student Name(s): P. Hijeck

Abstract:

I wanted to find the most efficient way to grow plants because people and animals use them every day for food, oxygen, shelter and recycling.

In this experiment, I grew four green bean plants using different watering fluids: aspirin, coffee, grey water and water. I aimed to determine which fluid would result in the tallest length and biggest plant. I thought coffee water would grow the tallest and largest leaves because the caffeine in it is a stimulant. The grey water plant had the largest leaves, largest new growth and grew a 13.25 inch stalk. I learned grey water contains chemicals from soap (phosphorous and nitrogen) which are essential nutrients for plant growth. Grey water can be substituted for fertilizer and provide phosphorus and nitrogen to plants, gardens and lawns.

The potential ecological benefits of grey water recycling include:

- Reducing freshwater taken from rivers, streams and wells
- There is less impact on sewage treatment plant size because grey water is the majority of water used in a home and goes directly to the treatment plant after use
- It replenishes groundwater
- It replenishes soil nutrients

In the future new homes can be designed to have grey water storage and use features.

In conclusion, not only is grey water the most efficient way to grow plants, but it has many benefits for our environment.

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

EA EM 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

137

Fair Category

L7

Project
Number

2026

Title: The Effect of Liquid Medicines on Plant Growth

Student Name(s): M. Ciambra

Abstract:

It was predicted that the Pepto-Bismol would kill, or stop the grass seed from growing, and the Tylenol and Mucinex would help it grow taller faster. The results were the Tylenol killed the grass seed completely, and the Pepto-Bismol slowed down the growth. The Mucinex grew at the same time the control plant did. This experiment could be improved by more accurate ways of measuring the plants growth. Also, by using stronger medicines and watering them into the plants more often for better results. There was only one effective problem and that was measuring the grass accurately because it was difficult to do that when almost every blade of grass is a different height. Also finding the tallest grass blade was complicated, too. It was concluded that medicine does have an effect on plant growth.

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

178

Fair Category

L7

Project Number

2027

Title: Tap, Fizz and Vitamin

Student Name(s): J. Hussey

Abstract:

Abstract

My project tests to see if the type of water you give a plant affects its growth. I decided to do this investigation because I like nature and wanted to create a project that involved growing plants. I tested three different types of water -- Tap, carbonated, and vitamin water -- on nine basil plants and observed which plant grew the most. In my hypothesis I thought that the plants given tap water would grow the most.

Over the course of four weeks I watered the plants and left them side by side in light 24 hours a day. I measured the plants in the beginning, middle, and end of my experiment.

The experiment showed that my hypothesis was correct and the tap water plants did grow the most. However, the plants getting fed carbonated water may have produced larger leaves than the plants getting fed tap water. I didn't measure the leaves at the beginning so I can not be sure. Next Project: an experiment testing if carbonated water really does produce larger leaves might be very interesting.

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

93

Fair Category

L7

Project Number

2028

Title: Stressed Out

Student Name(s): M. Banach

Abstract:

The purpose of my experiment was to see if blood pressure and temperature increase during a stressful situation. Based on personal experience and the information I gathered, my hypothesis was that a person's blood pressure and body temperature increase with stress. To test this, I had eleven subjects take a multiplication test in both a non-stressful and a stressful environment. I measured each test subject's blood pressure and temperature before and after every test. The result of my data shows that most people's temperature and blood pressure did increase during stressful situations.

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

220

Fair Category

L7

Project Number

2030

Title: Is Peanut Present? The Effects of Cleaning Agents on the Peanut Protein

Student Name(s): B. Rose

Abstract:

Scientists estimate that up to 15 million people have food allergies in the United States. Allergies are becoming more prevalent in young children across the country and the developed world, with allergy researchers still unsure what the reason is for this growth. This increase has led to more students with allergies in the classroom. A direct result of this change is that tables need to be cleaned thoroughly to make sure that no allergen is present for a child with allergies to come in contact with. But a question remains: Which wipe should you use to make sure all the allergen residue is gone? The purpose of my experiment was to find out which wipe was the best at removing peanut residue. I had human volunteers eat one of three peanut foods over a table, then I cleaned the table with one of the four wipes, then I swabbed the table with a protein tester, and it told me how much peanut protein there was. Surprisingly, I found out that the eco-friendly brand Seventh Generation and the Pampers baby wipe brand were the most effective at removing peanut residue. I believe that the reason for this is the fact that they were the thickest wipes, and thus were able to pick up more crumbs and residue from the table.

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

L7

Project Number

2031

Title: From Dirty to Clean

Student Name(s): L. hickey

Abstract:

I wanted to study how daphnia would suffer as the result of an oil spill. My experiment involves studying the effects on the daphnia in an oil spill I created (275 mL water and 4 mL motor oil in a beaker).

My experiment was divided into three parts. In the first part, I established our controls. I used a 400 mL beaker as my fish tank. I first tested to see if the daphnia would survive in 275 mL of tap water. I chose to study 10 daphnia with each experiment so I could see the effects on a small group and get a good read. I then tested to see if the daphnia would survive in 275 mL of tap water with 4 mL of oil added. In the second part of the experiment, I took ten different household items that were known to absorb water or oil and measured the relative amount of oil left in my beaker after trying to clean up the oil spill (275 mL water plus 4 mL oil). I chose the best three to clean up the oil in the presence of the daphnia to see if they would live longer. The third part of my project was to find out which of my three methods was the best to keep the daphnia alive.

Through my research I found that wood, cotton, and a diaper were my best sorbents. The diaper was the best because it kept the daphnia alive and didn't affect them.

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

EM 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

251

Fair Category

L7

Project
Number

2032

Title: Does different liquids effect plant growth?

Student Name(s): S. Misra

Abstract:

The purpose of my experiment was to discover if water is the only type of liquid that will help increase plant growth and keep it healthy. My problem statement was how does water, 2% milk and orange juice effect plant growth? My hypothesis was if water increases plant growth then what will orange juice and 2% milk do to the plant's growth because both of these liquids include a good source of nutrients. This is how I conducted my experiment, first I bought 3 plants and 3 appropriate sized vases. Next, I planted one plant into each of the vases and labeled each one of them either water, 2% milk or orange juice. Then, for every two days I would pour 1/2 a cup of liquid to each of the plants accordingly to what liquid the vase was labeled to. Lastly, I would record the data and take pictures weekly. In this experiment my independent variable was the liquids {water, 2% milk and orange juice}. My dependent variable was the plants. However during the experiment I noticed that the 2% milk formed a small piece of hard layer on the top of the soil. Later on, in the experiment it started to turn into a slime like material, until it finally it turned into fungus. I also noticed that the orange juice also formed a thin layer of fungus on the top of the soil. Subsequently to the experiment my hypothesis was wrong. Water is the best liquid to use for plant growth. Although, I definitely had a great time conducting this experiment.

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):

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

5. 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

L7

Project Number

2035

Title: Do Algorithms Dream of Electric Trees?

Student Name(s): A. Pourkavoos

Abstract:

Evolution is a complex natural process, involving an organism's entire genome, trillions of chemical reactions, crossover, mutation, selection, and more. However, what if it were possible to boil everything down to the key ideas at the core of evolution? It would become a valuable optimization process, allowing us to design things that are extremely well suited to a certain task. In fact, the only things that are important to evolution are mutation and selection. With just these two elements, evolution can be simulated on a computer. In fact, it has been used to design antennae that fit a certain radiation pattern, such as the one shown. This project concerns the morphology of trees in particular, and whether evolutionary algorithms can produce trees that look similar to living species. These evolved trees could be used to create highly efficient arrays of collectors, such as solar panels or water wheels.

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

CS 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

247

Fair Category

L7

Project Number

2037

Title: FOGPONICS

Student Name(s): R. Abirached

Abstract:

The purpose of my experiment was to prove that if I use a system that creates fog containing a mist enriched with nutrients to grow green bean plants without a growing medium, then the plants will grow healthy and efficiently. Fogponics is an advanced form of aeroponics, which uses water in a vaporized form to transfer nutrients and oxygen to enclosed suspended roots. Fogponics uses an electronic mist- maker that creates fine droplets that are absorbed immediately through the plant roots. The reasons to consider fogponic gardening systems are: Easy to build, easy to maintain, silent, automated convenience, maximizes space and output, and uses less water and energy. The data collected indicated that my 4 bean plants are growing efficiently and steadily. The average growth rate for “Plant A” was 1.84 cm/ day, “Plant B” was 1.72 cm/ day, “Plant C” was 1.48 cm/ day, and “Plant D” was 1.18 cm/ day. After 25 days, the abundance of leaves and buds on “Plant A” was 10 leaves and 3 buds, “Plant B” had 8 leaves and 3 buds, “Plant C” had 8 leaves and 2 buds, and “Plant D” had 11 leaves and 3 buds. In conclusion, my hypothesis was supported. I proved that it is possible to grow plants without a growing medium by using a fogponic system. As our global population increases, the concern over water and soil quality continues to grow and I hope fogponics will be considered as a solution and will develop.

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

PS PS 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

2038

Title: Building A Prosthetic Hand

Student Name(s): N. Zwolinski

Abstract:

Individuals among us have lost limbs due to war, accidents, or birth defects. Imagine being able to help these individuals by giving them back their lost limb. This project set out to create a device to take the place of a human hand that could grasp, lift, and release. Different designs were researched and I decided to make the fingers based on a design from sciencetoy maker.org. This design used cardboard, straws, silicone, and twine. I decided to enhance the design by attaching the fingers to a funnel which was then attached to PVC pipes. The device was operated by pulling on a key ring causing the fingers to contract and release. The whole device can be operated by a simple pull on the key ring.

Bones, muscles, and tendons work together to make the hand move. Tendons are tissues that connect muscles to bones. When muscles contract, tendons pull on bones. This causes the hand to close. In a human hand the muscles that bend the fingers are located in the forearm. The key ring represents this muscle. Pulling on the key ring pulls the strings that will act as the tendons on the inside of your hand causing your fingers to bend. Silicone was used to make the hand snap back once the key ring was released.

The hand was tested on ten different items and eighty percent of the items were successfully grasped. In conclusion, it's possible to construct a device that can grasp, lift, and release.

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

234

Fair Category

L7

Project Number

2039

Title: Snuggly Cuddly Puppies: Puppies Keeping Warm

Student Name(s): J. O'Brochta

Abstract:

Title: Snuggly Cuddly Puppies: Puppies Keeping Warm

Personal Interest: I started researching ideas for a science experiment on www.sciencebuddies.com. I was drawn to this subject of puppies because I have always wanted a puppy. This project also had a lot to do with heat transfer, which was the topic we were studying in science at the time.

Purpose: To determine how much huddling and cuddling from puppies reduces heat loss.

Research: Why do puppies huddle together? How do puppies use energy to stay warm?

Hypothesis: If I group jars touching of the same temperature, then as a group, the jars should retain more heat.

Overview: In this experiment, I used bottles to represent my puppies. My bottles had to reach 190 degrees Fahrenheit. Once the set temperature was reached, I took the bottles out, dried them, and then took note of their temperature for every two minutes up to ten minutes. I did this three times for each group. (One model alone, two models touching, two models 3cm apart, three models touching, and 3cm apart)

Summary: As a result, I can conclude that the closer together the puppy models were, and the more models there were, the more heat was retained. The heat transfer property of conduction helped to keep my models warm. Puppies huddle together to retain heat and keep warm. The more puppies that are huddled together, the more heat will be retained.

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

AS 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

224

Fair Category

L7

Project Number

2040

Title: The Effect of pH Levels on Bacterial Growth from Teeth

Student Name(s): V. Zimmer

Abstract:

This experiment was conducted to determine if the acidity of a liquid would affect the amount of bacterial growth in teeth. In this experiment, three different acidic substances were tested. Assorted liquids have different contrasting pH levels, which can drastically affect the amount of bacteria that grow from our teeth. This experiment was also conducted to possibly define if acidic liquids can help to cleanse our teeth, instead of using high energy consuming products such as UV Light Modern Teeth Cleaners.

This experiment took place in an evolutionary microbiology lab at Yale. To perform this experiment it was necessary to have five people brush their teeth. The 3 substances were drizzled onto the toothbrushes, which were then wiped onto 15 separate petri dishes and placed in a 37 degree incubator. Bacteria grew for 24 hours, and was taken out to be recorded.

This experiment proved that substances with the lowest pH levels promote the least amount of bacteria growth. Vinegar, with the most acidity, had an average growth of 31.6 colonies in 24 hours. Lemon juice, with the second lowest pH level, had an average of 103.2 colonies. Water, with the least amount of acidity, failed in the prevention of bacterial growth, whom of which ended with an average of 362.4 colonies. This proves higher pH level substances promote the growth of more bacteria.

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

209

Fair Category

L7

Project
Number

2041

Title: How pesticide affect water hardness

Student Name(s): S. Gudlavalleti

Abstract:

My problem statement is how pesticides used in farming affects hardness of water. I did this because I am curious to how pesticide affect our water. My hypothesis was that, If I add pesticides in fresh water, then it will change the quality of the water, because of what the pesticides contain in them. My conclusion was that pesticide does affect water in a very negative way. This is because after 2 weeks has passed my pesticide water sample grew a fungus in them this harmful to our environment as well because farmers use pesticide and if is it stays in the water it will affect our health. Also the water hardness in the pesticide was much higher than the regular water. The higher the hardness the worst the water is for drinking. My hypothesis was right because I did say it would change the water quality and it did change but it was changed in a negative way. I think my next experiment will be to test the ph or the chlorine because hardness of water is just one part of water quality there is so much more to it. Also because the hardness of the water did not change during the 2 weeks I was observing it.

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

119

Fair Category

L7

Project Number

2042

Title: Garden Trouble

Student Name(s): S. Hurlbert

Abstract:

I am doing this project to find a more effective material for garden boxes. This is because there is a concern that alternate materials may harm the soil. I need to prove that these alternative materials would not tamper with the nutrients present in the soil. I did this by creating a set of boxes from each material. Then I watered them for 3 weeks. Lastly, I tested the soil from before and after for key nutrition components needed for a healthy plant. The results showed that the before and after soil have the same amount of nutrients. This means that we can now consider whether these materials would be more cost-effective to use as a garden box.

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

207

Fair Category

L7

Project
Number

2043

Title: Hydroponic vs Soil

Student Name(s): M. Silano

Abstract:

The problem in my experiment is how does the method of growing plants (hydroponically or in a soil medium) affect how tall the plants grow? I wanted to do this experiment because I am interested in plants and I want to see which method makes them grow taller so I can use it for growing my own plants more efficiently. I originally thought that if I grow two plants one hydroponically and the other in a soil medium than the plant grown hydroponically will grow taller because there is more oxygen in the hydroponic system which will make the plant grow taller. In my procedure I planted both sets of plants and built the hydroponic system to set up for the experiment. In the end the soil plants grew taller than the hydroponic plants. The final average of the hydroponic plants was 1.83 cm and the final average of the soil plants was 17.42 cm. I concluded that the soil medium was more effective than the hydroponic system, contradicting my original hypothesis. To further extend this experiment in the future I could test the plants for a longer period of time to see if the hydroponic plants were ever able to catch up to the soil plants.

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

PS 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

250

Fair Category

L7

Project Number

2044

Title: TESTING THE EFFECTS OF WATER PERMEABILITY IN LOCATIONS WITH DIFFERENT SOIL TYPES

Student Name(s): L. Wolson

Abstract:

The purpose of this experiment is to compare the rate as water permeates in locations with different soil types. It is predicted that Sand will permeate the fastest, made with small grains of sand. Woods will be next as it is made up of a mix of soil and rocks. Dirt Road is third as it is made up of a compacted mix of soil and rock. Grass comes in forth to absorb the water. Clay comes in fifth place to absorb the water. In the procedure, a coffee can was pushed into the ground, about 3 centimeters in. Then, one liter of water is poured into the can, as the timer starts. Then left undisturbed until the water permeates, stop the clock. It was predicted that the soil Sand would permeate the fastest, as it is made up of sand. The hypothesis was correct, as the average time was 4:10, beating all other times. The mixture of rocks and soil would not be the second fastest, with an average time of 25 minutes. It came in second to last, before clay. The grass was third, and the woods were second. It would be best for you to bring three cans to make the experiment go faster as you cannot predict the weather and it took several hours to complete the various trials. It is also a good idea to bring multiple liters of water, or two or three liter bottles and to have a water source to refill them.

**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

246

Fair Category

L7

Project
Number

2045

Title: Prosthetics Making the Disabled Able

Student Name(s): S. Gerst

Abstract:

Abstract

The purpose of this project is to design, build, and test a hand prosthesis that is able to grasp, lift, and release an object and be activated by a pull cord.

If a prosthetic hand is made using twine as tendons then with the correct placement when the twine/tendon is pulled it should cause that individual finger to bend.

The hand prosthesis was built out of wood using twine to represent the tendons which will allow the motion of grabbing and releasing an object. The twine comes down the inside of the palm and when it is pulled it causes the fingers to bend.

According to my experiments, when a stronger string is used as tendons it makes the fingers sturdier and allows the hand to pick up an object with less difficulty. My first prototype was able to pick up an object for the first couple of times but once the strings loosened up then I was not able to pick up anything because the fingers were too flimsy. For my final prototype I used a stronger string and springs to pull the fingers back which made it much easier to pick up objects.

My hypothesis was that if a prosthetic hand is made using twine as tendons then with the correct placement when the twine/tendon is pulled it should cause that individual finger to bend. My results do support my hypothesis and I was able to build a functional hand prosthesis.

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

252

Fair Category

L7

Project Number

2046

Title: Bovine Emissions Capturing Device

Student Name(s): C. Morris

Abstract:

Methane is a naturally occurring greenhouse gas. Too much methane is harmful to the environment. Bovines produce methane that gets into the atmosphere. Diet affects the amount of methane bovines produce. My purpose is to find a diet for bovines that eliminates negative health problems, as well as to design a device to capture bovine methane before it goes into the atmosphere.

I researched and compared different diets, such as grass or corn to determine how much methane is created, as well as how each type of diet affects lifespan.

I designed and constructed a model of a methane-capturing device that could be attached to the back of a bovine. Methane would be captured by inserting a tube into the stomach of the cow, which would then go into a low-pressure holding tank on the device, and then be compressed within a high-pressure holding tank, also on the device.

I developed a model, taking ideas from previous "methane backpacks". My prototype offers a simple display to understand how the device works and shows the improvements to the previous versions, such as a high-pressure tank and solar panels that are used to power the compressor.

Ultimately, a goal for this project would be to find a way to use the methane that has been captured in the tank, as renewable energy source. Creating a user-friendly version of a "methane backpack" someday could be used worldwide, not only to improve lives of bovines, but also to help the environment.

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

AS BI 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

173

Fair Category

L7

Project
Number

2047

Title: The decay of organic matter

Student Name(s): M. Cardenas

Abstract:

The purpose of my project was to inform others about the places of where your organic items may be placed in order for it not to 'brown' so much. It was expected that the banana in the plastic container would ripen the slowest. The experiment was performed in the kitchen at home using the plastic container, a paper bag, a plastic Ziplock® bag, And 3 bananas. Each banana was separately placed in one of the selected items. They were tested by duration of how long the process was going to ripen. Based on data collected, The banana in the plastic container did not ripen the slowest- But in between. In fact, The banana that ripened the fastest was the banana in the paper bag. Lastly the banana in the Ziplock bag ripened the slowest. The hypothesis of whether the banana in the plastic container would ripen the slowest was not strongly supported by the results. If this experiment was to be repeated, different types of areas would be used and other organic items would be tested.

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

242

Fair Category

L7

Project Number

2048

Title: Do different types of music affect the rate at which domesticated cats eat?

Student Name(s): P. Wiliarty

Abstract:

The purpose was to test if music affects how cats eat. My hypothesis was: If I play music for cats, rock, and classical music while my cats are eating, they will eat slowest while music for cats is playing because cats are exposed while they eat and if cats are tense they will try to get it over with as fast as possible, but music for cats will calm them down so that they eat slower. To test this I recorded how much and how long cats ate for. I divided the amount eaten (grams) by time eating (minutes) to get a rate (grams/minute). I did this twice for both cats for each song. I used rock, music for cats, classical music, and no music (control). The average between both cats was slowest with no music (3.905grams/minute), faster with cat music (5.265g/m), slightly faster than that with classical (5.96g/m), and very slightly faster than that with rock (5.995g/m). I can conclude that cats are affected by music. My hypothesis was incorrect - the cats ate faster with all types of music than with no music. However, cat music was the slowest type of music. I also conclude that different cats are affected differently by music. One cat ate an average of 7.54 g/m with rock, and the other ate an average of 4.54g/m with rock, leading to an overall average of 5.995 g/m for rock.

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

AS 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

248

Fair Category

L7

Project Number

2049

Title: Effect of Watering Bean Plants with Chlorophyll Solutions To Increase Chlorophyll Content

Student Name(s): B. Laham, N. N/A, N. N/A

Abstract:

Chlorophyll has been proven to have many health benefits for humans. In order to grow more chlorophyll-rich plants, I propose that watering two different types of bean plants (kidney and bush) with different concentrations of chlorophyll water will increase the amount of chlorophyll in the plant as compared to plants watered with only water. This experiment involves six different plants watered with three different liquids. The first two kidney and bush bean plants are being watered with 30 ml of water and serve as the control plants. The second two kidney and bush bean plants are being watered with 30 ml of solution one (2.5 oz of chlorophyll in 1200 ml of water). The third two kidney and bush bean plants are being watered with 30 ml of solution two (5 oz of chlorophyll in 1200 ml of water). All of the plants are being grown in a makeshift greenhouse made from two fish tanks, an ultraviolet light and a clear plastic tarp. The plants are being watered daily with their respective solutions and are continuing to grow. After ten days, I will take two leaves from each plant and chemically extract the chlorophyll with 70% isopropyl alcohol, ending up with eighteen different solutions in total from all three trials. I will spectrophotometrically measure the absorbance of each solution at 440 nanometers (the peak absorption of chlorophyll) in order to determine the relative chlorophyll content of each solution and to determine which watering solution is most effective.

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

195

Fair Category

L7

Project
Number

2050

Title: How do microbeads affect plants?

Student Name(s): M. Cheela

Abstract:

I am investigating, how do microbeads affect plants? Microbeads are little microscopic plastic beads that are mainly used in body washes and scrubs. The problem with these beads is that when we use the body washes and scrubs, they aren't getting caught in the filters in the drainage systems and making their way into the oceans. These little beads act like little sponges and absorb all of the toxic chemicals around them and when animals eat them it could harm their health. Since I know that they beads affect ocean life in a negative way, I wanted to know how they could affect plant life. I thought that the microbeads would kill the plants. I saw that they microbeads did not affect the plants in the way that I thought they would. Although they didn't kill the plants, the plant with the microbeads, grew much slower than the plants without. I noticed this when I looked at the data and saw that the plant without the microbeads had grown a couple inches within a few months, while the plant with the microbeads had grown half an inch or two in the same amount of time.

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

PS 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

194

Fair Category

L7

Project Number

2051

Title: Got Milk?

Student Name(s): M. Coyle

Abstract:

The purpose of this project is to find out if different kinds of milk take different amounts of time to spoil. My hypothesis stated that If I test which milk will take the least and most amount of time to spoil then I believe that the result will be the that the whole milk will take the least time to spoil and the fat free will take the most because of the fat content. This experiment included leaving out three different kinds of milk (whole, fat free, 2%) in same sized jars at room temperature. Next I smelled the milk twice a day at 9am and 9pm to determine if it had spoiled and the data. After four days I examined my data and then repeated three more trials. As a result I found that all my data supported my hypothesis which stated the whole milk would take the least time to spoil and that fat free would take the most. The data demonstrated the whole milk took the least amount of time to spoil with 84 hours and the 2% was second with 96 hours and lastly the fat free took 108 hours.

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

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

157

Fair Category

L7

Project Number

2052

Title: The Power of Fruits and Veggies! How Much Electrical Power Do They Produce?

Student Name(s): M. Emerson

Abstract:

Abstract

My project involved comparing apples, oranges, and potatoes as batteries in a simple circuit. My experiment is interesting because many people make batteries out of food, but people usually do not compare them to see which is better. I predicted that the potatoes would generate the most power because they were starchy and people often use them when doing potato clock experiments. To find out which type of food could generate the most power, I set up three replicate pairs of each type of food in a simple circuit. I then attached a multimeter to measure the voltage and current. Then I calculated the power. Out of the three types of batteries, the apples did the best, with an average power of 153.15 micro watts, beating the potatoes (119.58) and oranges (63.63). My project surprised me when it showed which food batteries did better, and I would like to research more about that in the future.

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

BI 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

210

Fair Category

L7

Project Number

2053

Title: Caffeine and Plant Growth

Student Name(s): J. Bushka

Abstract:

For my science fair experiment, I will be testing the effect of caffeine on plant growth. The purpose of this experiment is to see which solution would make plants grow the most, water, caffeine, or coffee grounds. To complete this procedure, I will have to plant 10 to 12 mung beans in a pot. Then, I will give the plants water for approximately five days. After the first five days, I will mix one 20 milligram caffeine tablet with water and then pour it into one pot. In another pot, I will sprinkle about a teaspoon of coffee grounds where the plant is growing. I will have the plants stay like this for about 3 days. Then, I will feed the plants water for about a week. After one week of the plants being fed water, I found that the plant with the coffee grounds in it grew the most. This happened because coffee grounds have organic nutrients in it like phosphorous and potassium, which are known to help plants grow. It is also a common practice for farmers to sprinkle coffee grounds in their plants with the water that they feed them to make their plants to grow healthier, and faster. This is how I conducted my science experiment.

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

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

220

Fair Category

L7

Project Number

2054

Title: An Energy bar That Sticks Best

Student Name(s): G. Cooper

Abstract:

My goal was to make a nutritious energy bar that is best able to hold together its ingredients, without using an unhealthy sweetener to do so. I found that most of the commercial bars contain large amounts of unhealthy sweeteners, including high fructose corn syrup or cane sugar. These sweeteners digest quickly and enter the bloodstream quickly, which is bad because people have to have a steady blood sugar - you do not want it to spike! While these types of commercial bars can stick together, the ingredients used for this purpose contain a lot of sugar. My bars will be made with whole foods, instead of using processed or chemically-made ingredients.

I did research to compare different types of sweeteners that could be used to hold the bars together. I also compared the nutritional values, how the body digests these sweeteners, and the health benefits or concerns.

I made bars using the same ingredients for each bar, changing only the type of sweetener. The sweeteners used were sunbutter, coconut nectar, stevia, and honey. I then conducted three different tests to compare the bars: stickiness test, bendability test, hardness test.

I originally thought that the sunbutter was going to stick the best, but the stickiness test indicated that the coconut nectar and honey were the stickiest and held together best.

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

131

Fair Category

L7

Project Number

2055

Title: The Effects of 35, 65, and 85 Degree Water on the Spread of Oilspills

Student Name(s): M. Rader

Abstract:

The purpose of this experiment is to see which temperature of water cold (35 degree), warm (65 degree), and warm (85 degree) water. It was predicted that the 85 degree water will make the oil spill grow the largest in size. The hypothesis is true. The 85 degree water was the water temperature that made the oil spread the most. The 85 degree was always ahead of the other water temperatures with an average spread of 18.5 centimeters. The 35 degree water was the lowest just as predicted as well with an average spread of 13 centimeters. The 65 degree temperature water had an average spread of 15.8 centimeters spread. In conclusion, this experiments proves that hot water around 85 degrees in temperature spreads oil the fastest. As says the hypothesis.

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

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

246

Fair Category

L7

Project Number

2056

Title: Plants: Nature's Stabilizers

Student Name(s): S. Turner

Abstract:

The purpose of this experiment was to determine if plants help reduce erosion and help keep our waterways free from sediment. I tested 3 types of soil covering: wood chips, wood chips + plants and no covering. My hypothesis was if plants cover the land, then the water would not run over the land and cause erosion because the plants help slow the water down so it seeps down into the soil. I predicted that water running over land that has been planted will carry less soil than water running over soil that is bare. I filled three bottles with potting soil. One bottle had plants and wood chips and the second just wood chips. The third bottle was uncovered. The bottles were put on an incline and I poured 400 mL of water into the top end of each bottle. At the spout end of the bottles I placed beakers to catch the water and any eroded soil. On average, I found that the least amount of soil was lost from the plant bottle. The most soil lost was from the wood chip covered treatment. The standard errors show that in all the trials, the plant treatment always had the least amount of soil lost, but that the amount of soil lost from the other treatments was varied. My experiment supported my hypothesis and shows that the water running off of a planted landscape will carry less soil than water running off of a bare landscape.

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

PS PS 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

236

Fair Category

L7

Project Number

2057

Title: How does being related affect fingerprints?

Student Name(s): D. Amparo

Abstract:

In the study of forensic science, which means ‘the practical application of science for matters of the law and proving the guilt or innocence of the defendant’, its long than understood that fingerprints are commonly used as an identifier for human beings. But, there is no known general knowledge about how being related affects fingerprints. The literature describes that fingerprints are meant to be unique but no one has actually figured out if people who are related have similar fingerprints. In this science project fingerprints were collected in a similar fashion that local authorities and scientists use, however, a comparison was made amongst people who are related and not related. During this experiment fingerprints were collected by making a pencil lead pad and having people rub their pointer finger against it and then comparing the fingerprint characteristics (‘whorl, arch, loop, arch, right slant loop, and mixed’) amongst people who are related and not related. The following results were obtained : the two subjects that were related have similar fingerprint characteristics (both were arches), while unrelated people did not share any fingerprints characteristics . In conclusion, it was never known that people who are related have similar fingerprints, potentially creating mistakes in a criminal case if the police officer takes a partial fingerprint and it identifies an innocent family member. Next steps include getting a larger sample size to see if the relationships between fingerprints and relatedness holds true.

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

235

Fair Category

L7

Project
Number

2058

Title: Breeding in the Rain: A Study of Breeding Triggers in Danio rerio

Student Name(s): A. Cosme

Abstract:

People are constantly searching for the most efficient way to breed animals, especially fish, for many purposes, conservation and money being the most popular of reasons. Most animals - including fish - are triggered to breed by an abiotic factor. I wanted to know whether or not rain is one of these factors for zebra danios because zebra danios originate from areas that do have rainy seasons, and so I wanted to see how the rain affects them. I thought that the rain tank would yield more eggs than the other tank.

For this experiment I had two tanks, one tank with a rain stick to simulate a rainstorm and one without. I monitored both tanks to see which fish produced eggs first. I found that the tank with the rain had five eggs and the other tank yielded none, proving that my hypothesis was correct.

After the duration of this experiment, I learned that the rain can trigger zebra danios to breed faster and that without rain it could take more time for the fish to breed. I would be interested in continuing this experiment to see the difference in the time it took for the fish to breed.

This project is important because it can show what could happen if the rainy season got cut short or just didn't happen in an area where the Danio rerio reside, and how it would affect the fish.

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

AS BE 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

167

Fair Category

L7

Project
Number

2059

Title: The Difference in Osmotic Properties of Brown as Compared to White Eggs

Student Name(s): A. Harrari

Abstract:

The purpose of this experiment was to find out whether white as compared to brown shelled eggs had different osmotic properties. Four eggs of each color were put in a vinegar solution to dissolve the Calcium Carbonate shell, leaving a semipermeable membrane around the rest of the egg. The eggs were then weighed. Each egg was put into either water, a saturated hypertonic saline (NaCl) solution or saturated hypertonic glucose solution for 7 days. The eggs were then reweighed and changes documented. As expressed in percentage increase in mass as compared to pre-solution weight, the brown eggs weighed more in all cases except the ones that were in the sugar solution. The conclusion is that the molar concentration with in brown eggs is higher than in white eggs. Further research may be done in the future to determine what substances contribute to the osmotic gradient of white versus brown eggs and if the membrane of each egg type may have different properties affecting its osmotic permeability.

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

CB 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

243

Fair Category

L7

Project
Number

2060

Title: The Plant Problem: What Liquid Helps Plants Grow The Tallest?

Student Name(s): I. Lim

Abstract:

Why do people water their plants with H₂O? Is there another liquid that could be better than water? I tested this question with vinegar, vitamin water, diet coke, and milk as replacements to see which grew the tallest dill plant over 21 days. 10 dill seeds in cups were watered with each fluid regularly, including water plants as a control. I hypothesized that milk would help the dill become the tallest because of its content. Milk contains many of the 16 chemical elements required for a plant's survival, prompting my hypothesis. Yet milk plants grew mold and died, and the end results were not as expected. My hypothesis was incorrect. Diet coke's final average height came 1st, followed by water. From these results, I concluded that coke prompts plants to grow the tallest, possibly from extra sugar hastening the process of photosynthesis. Although this result may hold true to this experiment, I am still skeptical, as the only plant tested was dill. This may be the only plant that coke works on. Also, I had not let the plants reach their maximum maturity levels; different outcomes could have appeared if the time span had been longer. Even if this new hypothesis was 100% correct, buying coke for an entire garden is significantly more expensive than hosing down plants with tap water and the plastic bottles of coke are not as eco friendly. Therefore, this new "discovery" would not likely become popular throughout homes.

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

150

Fair Category

L7

Project Number

2061

Title: Which has a greater bacteria activity, refrigerated or non-refrigerated probiotics?

Student Name(s): M. Malloy

Abstract:

My experiment tested which type of probiotic had the most bacterial activity level, refrigerated or non-refrigerated. I choose this experiment because often people take probiotics for various reasons so, I wondered which one would benefit the most. My hypothesis was that the refrigerated probiotics would have the most active bacteria. The experiment consisted of two capsules each of two different refrigerated and non-refrigerated probiotic brands. Each capsule was opened and emptied into a separate cup of 100 milliliters of lukewarm milk and allowed to sit for 24 hours. Then, I measured the amount of solids versus milk remaining, more solids indicating more bacterial activity. I repeated the experiment a second time. Only one probiotic, non-refrigerated, appeared to repeat with larger amounts of solids consistently. The rest of the probiotics didn't repeat consistently and had various results. From these results, I could not prove or disprove my hypothesis.

**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

177

Fair Category

L7

Project Number

2062

Title: Running Heart Rate

Student Name(s): K. Casey

Abstract:

The two groups of people, people who exercise regularly and people who don't exercise regularly, will be made up of middle school aged children. Everybody will go through a series of exercises in which their heart rate will be measured before, to see what their normal heart rate is, during the exercise, and after, to see how long it takes for their heart rate to return back to normal. Definition of "Exercise regularly" is people who exercise 3-5 times a week for about one hour each session. The participants are volunteers and are not pressured to do the experiments. They are allowed to withdraw from the experiments at any time. The risk that is in this project is the risk of overexertion. The measures that will be used to minimize the risks of overexertion are that the participants will only do two or less exercises per day, and the exercises will be less than five minutes. Also, if the participants think that they are at risk of overexertion, they can say so and the experiment will stop.

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

253

Fair Category

L7

Project Number

2063

Title: Are Cell Phones Taking Over our Lives

Student Name(s): A. Zayas

Abstract:

In the study of cell phone technology and its affects on people, it's long been understood that cell phone usage has become an issue causing problems such as sleep loss, leading to other health problems especially in adolescents. But there is no known general knowledge about how cell phone use affects the amount of time sleep urban adolescents get. The literature describes the following health problems related to cell phones such as fuel memory loss, increase stroke risk,obesity,damage bones,increase cancer risk however no specifics in regards to adolescent teen usage exists specifically for urban area students. In this science project the quality time and moment apps are used to collect data over time on cell phone usage to compare it to the amount of sleep a person gets at night. During this experiment participants reported cell phone usage collected on the apps and self reported amount of sleep. The following results were obtained: participants spent an average 15.1% of their 24 hour day on their cell phone with an and average of 32.6% of their 24 hour day sleeping. In conclusion, this information can be used to further examine what participants are doing with the other 52.3%, when 33.33% is already allocated for school (=8 hours), leaving approximately 18.9% of the day left for other activities. Next steps include collecting data on how people feel throughout the day due to potential sleep deprivation, and tracking trends in data use and sleep and comparing adolescents in urban, suburban, and rural areas.

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

194

Fair Category

L7

Project Number

2064

Title: Shorty

Student Name(s): M. Lula

Abstract:

My main purpose for this experiment was to see if people are taller in the morning then when they go to bed. I thought that people would stay the same height. The growing would take place with age. To test my hypothesis, I first measured how tall my test subjects were as soon as they woke up. Then I measured how tall my test subjects were right before they went to bed. Next I recorded it. I repeated steps one through three for four days straight. Finally, I looked back at all the a.m. and p.m. heights. I found out that one of the older people, person 1 shrunk 0.84 inch. throughout each day. The other older people, person two shrunk 0.52 inch. throughout each day. One younger person, person 3 shrunk 0.34 inch. throughout each day. Finally, the youngest of them all, person 4 shrunk 0.63 inch. throughout each day. So in conclusion, everyone does shrink at least a small bit throughout each day but it is consistent. You are the same height every morning and even though that height may be smaller, you are the same size when you go to bed.

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

252

Fair Category

L7

Project
Number

2065

Title: Banana Peels: Second Life as a Water Purifier

Student Name(s): A. Bhagavatula

Abstract:

Improper disposal of industrial, mining and agricultural waste has led to excess amounts of heavy metals and agricultural runoff in local bodies of water. This contamination of water sources is particularly great in developing countries, but can also be seen in areas like Flint, MI.

Current solutions rely on the use of chemicals, which while effective, come with a high cost, limited availability and an adverse impact on the environment. I have investigated an alternative purification method with 'biosorption' using inexpensive, readily available biomass - banana peels.

I formulated and tested copper contaminated water and fertilizer contaminated water to see (1) Whether banana peels are capable of removing heavy metals and fertilizers (2) Which size of banana peels is most effective (3) How this method compares to alternative methods.

I prepared 3 different sized banana peels as well as dried-powdered banana peels to test. I passed the contaminated water through the different sized peels. Using Sensafe Heavy Metal testing strips, I tested the contamination at different time intervals. I observed that while all the banana peels were very effective in purifying water, the dried-powdered banana peel was fastest and most effective. I then conducted the same test using Activated Carbon and a Heavy Metal Neutralizer and observed that the powdered banana peel purifier was better than the other two methods.

In conclusion, dried-powdered banana peels are very effective in removing heavy metals and fertilizers from contaminated water. Banana peels can be used as an alternative environmentally friendly water purification solution.

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

EA EV 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

79

Fair Category

L7

Project Number

2066

Title: How Does Being Watered With Different Liquids Effect A Plants Growth?

Student Name(s): K. Egan

Abstract:

The purpose of this experiment was to see the effects on plant growth using different types of liquids. I used one tablespoon of tap water, seawater, Gatorade or Coke to water each plant. Every several days, I measured the height of the plants and recorded the data. My hypothesis was that Gatorade would be the most beneficial on plant growth. The results show that both Gatorade and tap water grew to the exact same height, thus supporting my hypothesis.

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

241

Fair Category

L7

Project Number

2067

Title: The Effect of pH Levels on Grass Growth and Germination Rate

Student Name(s): K. Marquis

Abstract:

This experiment was conducted to determine if soil pH levels affect the germination rate and growth of plants (grass). Soil samples were established with pH levels between 6.5 and 8. The seeds were planted along the edge of transparent cups in four locations to easily spot germination. Germination and growth were monitored daily, over the course of 3 weeks. On the final day a height measurement of the grass was also made. The germination counts were used to calculate the germination rate.

The grass grown in Sta Green brand soil (pH of 7.9) had the greatest average height and germination rate at 87% and 23.3 cm. The worst growth and germination rate of 23% appeared in grass grown in soil adjusted with rapid lime (pH of 8.2) and in soil adjusted with aluminum sulfate (pH of 7.0). The grass grown in soil adjusted with rapid lime had the lowest average height, as none of the seeds sprouted.

There is a relationship between the growth and germination of grass and the pH level of the soil. The samples grown in soil with a pH range of 7.8-8 had the greatest average height and germination rates. This was observed in the unadjusted soil (pH of 8) and the Sta Green brand soil (pH of 7.9) which had the greatest average height and germination rates. The pH between 7.8 and 8 may have affected the nutrient transport in the plants grown in these soils.

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

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

248

Fair Category

L8

Project Number

2501

Title: What is the most effective over the counter (OTC) antacid when it comes to neutralizing the pH level of stomach acid?

Student Name(s): S. Peglow

Abstract:

The purpose of this science project was to determine what is the most effective over the counter (OTC) antacid when it comes to neutralizing the pH level of stomach acid. After research I determined that the pH and volume of stomach acid in a typical adult is 1.5 and 50 mL. I then proceeded to make a homemade stomach acid solution with a pH level of 1.5, by adding 10 mL of concentrated Hydrochloric Acid (HCL) to 400 mL of water. Second, I measured 50 mL of the homemade stomach acid solution into a glass Mason jars. Next, I crushed up the recommended adult dosage of each antacid tablet, in a plastic bag. If the antacid was liquid, I measured the recommended adult dosage with a syringe. Then I added each antacid to the Mason jars and mixed. Lastly, I recorded the resulting pH of the stomach acid and antacid mixture, and added more antacid up to the recommended adult dosage if the pH was not yet neutralized. By testing the resulting pH, I have determined that Phillips' Milk of Magnesia liquid was the most effective and Pepcid Complete was the second and Equate Ultra Strength was the third most effective. The fourth through ninth most effective antacids were: Alka-Seltzer, Tums Ultra Strength, Equate Maximum Strength liquid, Rolaids Ultra Strength, Gaviscon Extra Strength, and CVS Homeopathic. I also determined that the most cost effective product is Equate Ultra Strength tablets at a cost of \$0.03 per tablet.

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):

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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

L8

Project Number

2502

Title: Heavy Metal Adsorption Capability Of Pumice

Student Name(s): B. Agirman

Abstract:

Unfortunately, pollution is all around us, from our contaminated waters to the air we breathe. One of the most fatal pollutants in the world is heavy metal pollution. Heavy metals such as arsenic can cause cancer at worst. Other types of heavy metals can also damage the circulatory system, neurons, and brain. There is a possible solution to this however. This study addresses this topic and presents a possible solution to heavy metal pollution. Pumice, a porous and igneous rock, can possibly act as an adsorbent to heavy metals such as copper nitrate. In this study, adsorption capability of pumice is tested. Copper nitrate and pumice is put into DEIonized water solutions, where different sets of solutions have different pH levels and different amounts of pumice. There are acidic pH and neutral pH. This helps uncover whether or not pumice can be an adsorbent to copper nitrate and if so, in what types of water and how much is necessary in water solutions. The solutions wait for about two hours (or more) so adsorption can occur. The results of the study show that pumice is an adsorbent to copper nitrate. By using an Ultraviolet Imaging Spectroscopy, it is discovered that in acidic pH, adsorption does occur. However, with neutral pH, adsorption levels are close to zero. There needs to be more research on pumice to see whether it can be an adsorbent. Future studies will hopefully explore basic pH and neutral pH with more range of pumice in the solutions.

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

CH EV 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

154

Fair Category

L8

Project Number

2503

Title: Utterly Sour Milk

Student Name(s): O. Peterson

Abstract:

Have you ever wondered what type of milk will last longest? This experiment was conducted to determine if the amount of fat in milk affects the spoiling rate. At the moment, not many professional studies have been done to find this out. This experiment took place over the course of six days. Eight ounces of whole milk, 2% milk, and fat free milk were poured into separate cups for a total of four cups each. Then all the cups were left out together at room temperature. The cups were observed every day and on the sixth day the cups were poured out on a sheet pan and observed further. The experiment resulted in the whole milk spoiling first by a day or so. The 2% milk and fat free milk followed relatively at the same rate. This experiment found that the amount of fat in milk does effect the rate in which it spoils.

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):

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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

L8

Project Number

2504

Title: Celling Power

Student Name(s): G. Hyland

Abstract:

The purpose of the experiment is to understand the phases of mitosis in an onion root tip, and to determine which phase will be the most prevalent. Each phase proceeds at different rates and the number of cells in each stage are counted to determine the relative rates of each phase. It is hypothesized that Interphase will be the most prevalent phase during cell regeneration. To grow onion roots, onions are submerged root side in water. After four days of regrowth, a scalpel is used to slice root samples and to remove the top and bottom of the tips. The root is cut into lengthwise strips. Using eye protection and latex gloves, root tips are soaked in Muriatic Acid for ten minutes and rinsed in distilled water. After being drained, roots are submerged in Toulidine Blue diluted equally with distilled water for five minutes, then dabbed with a paper towel to remove mixture. Slides are created with root tips topped with a cover slide and then viewed with a compound light microscope at various magnification levels to view cells replicating. The data obtained from thirty-one prepared onion root tips demonstrated the most prevalent phase at 48% likelihood was Interphase. Prophase at 15% was second most prevalent. Telophase, Metaphase, and Anaphase all measured 8% or below. In conclusion, from data observed, the most prevalent phase of mitosis in onion root tip cells is Interphase, supporting and proving the hypothesis as fewer cells were observed in all other phases of mitosis.

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

CB MI 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

137

Fair Category

L8

Project Number

2505

Title: How Does Music Affect Heart Rate?

Student Name(s): T. Haggerty

Abstract:

For my science fair project I asked the question: How does music affect heart rate? It seems as if the answer to the question may not be very important but on the contrary, it can help many people. If a person is very stressed and needs to lower their heart rate they might be able to listen to a certain type of music. In my experiment I tried to find what types of music would raise and lower heart rate. When performing the experiment I took four to five subject's into a room, took their heart rate and had them listen to a song from a category of music. The subject's listened to four different types of music: rock, pop, country, and classical. I found that rock will raise the heart rate, and classical will lower it.

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

125

Fair Category

L8

Project Number

2506

Title: Averaged Allure: How Composite Faces Compare to Singular Faces

Student Name(s): A. Mathias

Abstract:

What makes a person beautiful? Society has been trying to find that answer since the beginning of time. Many people believe that facial symmetry holds the key to beauty. In my experiment, I am testing this theory through composite faces. Composite faces, the faces of two or more people combined through computer software, are more symmetrical and less blemished than other faces. My hypothesis is that when asked to choose, test subjects will pick the composite face as more attractive than the non-composite face. After running my experiment, I have found that in most cases, subjects picked the composites as more attractive than the singular faces. In addition, when singular faces were chosen, it was likely because of the individual attractiveness of the people.

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

BE 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

245

Fair Category

L8

Project Number

2507

Title: Man vs Wild; A study of plant biodiversity in overgrown ecosystems

Student Name(s): A. Zemsta

Abstract:

In this project I set out to find if renovating some of my school's natural habitats had a positive or negative impact on their biodiversity. I predicted renovating a plot would result in higher biodiversity of plants, since getting rid of the dominant species would make room for colonizing ones. Increased biodiversity would result in a more stable ecosystem. If one species dies off, the remaining species would potentially support each other. More species creates less reliance on any one species. To find out I took samples from 6 plots that ranged 1,000 sq ft - 12,800 sq ft. 3 plots were renovated, 3 were not. The renovation took place in 2014, all of the topsoil was dug up removing all species, and new grasses were planted. To get samples I put a 63 x 46 cm quadrat in a random area inside the plot. I recorded all of the species inside the quadrat, I did this twice per plot. I then calculated species richness, evenness, and Shannon Wiener diversity index. Renovated plots clearly had higher diversity. The average diversity index for the renovated plots was 1.9 while the average for the un-renovated was 1.22. Renovated plots were also higher for evenness (0.856666667 vs 0.693333333) and richness (9.33 vs 5.66). I concluded that renovating these plots was beneficial to their biodiversity. I believe that this treatment should be considered for the other plots because increased biodiversity would result in a more stable and interesting ecosystem.

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

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

4. Is this project a continuation? Yes No

5. 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

L8

Project Number

2508

Title: The Effect of Magnesium, Calcium and Vitamin C On the Growth of Raphanus Sativa

Student Name(s): A. Nazir

Abstract:

The objective of this experiment is to observe the effects of adult vitamins on radish growth. Vitamins are often consumed to replenish needed supplements. The vitamins used on this experiment are Calcium, Vitamin C, and Magnesium. The hypothesis of this experiment is that the Magnesium would increase the growth of radishes because it is an essential vitamin to plants. The plants with Vitamin C were determined to be second in height in comparison to the plants supplemented with Magnesium, since Vitamin C is usually found in fruits and vegetables.

A total of 16 plants were divided equally into four groups. Three groups were given specific vitamins and one group was made the control. They were placed under a lamp and given $\frac{1}{4}$ cup of water every other day. The height and appearance of the plants were recorded every 48 hours.

The plants with the Magnesium grew the tallest because it aided the plants in photosynthesis and is essential to plants. The control plants grew the second tallest. The plants that were given Vitamin C grew the third tallest because it is often found in fruits and vegetables, however not essential to plants as the Magnesium is. The plants with the Calcium grew the least in height because Calcium helps a plant's cell wall structure, but does not affect the height. In conclusion the hypothesis was supported. The plants fortified with Magnesium grew the tallest.

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

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

248

Fair Category

L8

Project Number

2509

Title: Acidification of Oceans

Student Name(s): G. Grey

Abstract:

Pollution from human activities and machines is causing a rise in the amount of carbon dioxide (CO₂) in the atmosphere. The rise in CO₂ affects the oceans ecosystem by CO₂ being dissolved in the ocean as carbonic acid. The pH of the ocean in the past has been slightly basic at 8.2, but with the industrial revolution the pH has dropped to an average of 8.1. The ocean near populated areas might have more acidity than the ocean in less populated or remote areas. A visit to one of the most remote regions of the world provides the opportunity to test this hypothesis. My hypothesis is to test the pH of remote oceans away from populated areas to determine if CO₂ released into the atmosphere is affecting the oceans. The initial thought is that more populated areas tested will be more acidic than areas with fewer people. The research was conducted with pH strips in each of the following locations, Ushuaia, Argentina, The Falkland Islands, South Georgia Islands, Elephant Island, Deception Island and the Peninsula of the Antarctic Continent. A pH sample was taken in each location by dipping the pH strip into the ocean and reading it immediately according to the color scale on the pH strip container. Results were recorded on an Excel workbook sheet. The experiment was conducted over a three week period. The results were surprising and showed that even in very remote areas the pH of the ocean was more acidic at 7.0.

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

EV EA

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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

230

Fair Category

L8

Project Number

2510

Title: Utilizing Microbes And Chlorella Vulgaris Algae To Construct An Eco-Friendly Microbial Fuel Cell

Student Name(s): Y. Zaidi

Abstract:

Ever since our planet's atmosphere began changing rapidly due to CO2 emissions trapping heat, there has been an increasing demand for clean energy. Researchers have already constructed hydrogen fuel cells that use H2O to produce electricity through electrolysis. However, is it possible to utilize microbes (from marsh water or wastewater) in a Microbial Fuel Cell, in order to produce clean energy, while using Chlorella vulgaris as an oxidizing agent and CO2 scrubber? My quantitative goal is to produce 120 millivolts from a handmade MFC. The inspiration for this project comes from the Korea Institute of Science and Technology. Scientists at the Korea Institute of Science and Technology constructed a Microbial Fuel Cell that does not use a mediator and uses the metal reducing bacterium, Shewanella putrefacien. I hypothesized that the microbes will exchange enough electrons to produce 120 millivolts, but the Chlorella vulgaris will only produce a minor amount of oxygen since it is only 1 bottle. Most photobioreactors are meters in width and height. The total voltage produced was 132.1 mV, 11/10ths of the goal made. The energy produced after 30 seconds with no air pump was .032 mV, however after 30 seconds with the air pump, .078 mV were produced making it 243.75% more efficient. My conclusion is that it is possible to harness energy from microbes and that the use of an air pump increases the efficiency.

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

MI BI ET

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

246

Fair Category

L8

Project Number

2511

Title: What Happens To Eggs When They Are Exposed To Vinegar?

Student Name(s): B. Chavez

Abstract:

In this project I will hope to get all the correct results that are needed in this project. I would like to find out what happens with the hard-boiled egg and the raw egg when they are both exposed to vinegar for 24 hours. When an egg is soaked in vinegar, the shell will dissolve because the vinegar is acidic. The membrane will soak up the vinegar and get stronger. Strong enough to hold the yolk which makes it bounce. The first step to start is to need to measure the vinegar to 1 cup. When, finished measuring you pour 1 cup of vinegar in each cup. You put both raw and hard-boiled egg in the cups for 24 hours. It's good to document the changes that happen with eggs so that you can observe the results. In the first 4 hours I saw the raw egg started to rise up. I then noticed that there was a foam shaped layer surrounding the egg. Once the 24 hours ended I took out the eggs and noticed that the hard-boiled egg had not reacted as well as the raw egg. The raw egg was very bouncy but the hard-boiled egg didn't change at all. The hypothesis is correct I noticed that the egg shells dissolved but the hard-boiled egg didn't react well with the vinegar like the raw egg did. The hard-boiled egg in fact didn't react to it all. The raw egg did bounce; it did exactly what I hypothesized.

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

242

Fair Category

L8

Project Number

2512

Title: Plants to cool the planet

Student Name(s): M. Gupta

Abstract:

Temperature and humidity levels on Earth are constantly rising. Small changes in the average temperature of the planet can translate to large shifts in climate and weather, resulting in intense storms, droughts, floods, glacier melting, rise in sea water level, and ocean acidification. The rate and magnitude of predicted climate change require an urgent attention in order to avoid runaway climate change. Urbanization and deforestation is causing a dramatic decline in the number of trees. In this experiment, three different Bonsai plants (Broadleaf, Palm and Pine) with leaves and a control bonsai plant without leaves were grown in a micro environment to examine if plants affect temperature. Furthermore, whether diverse plant species have different effect on temperature and humidity levels is also evaluated. My research shows that all the plants reduced temperature as compared to the control. The Palm tree showed decrease in temperatures with rise in humidity levels. The Pine tree showed the highest temperatures and the lowest humidity levels. The Broadleaf tree showed an overall beneficial effect with the modest decrease in temperature without substantially rising humidity levels. Results indicate that the plants with more foliage have greater effect on temperature and humidity levels compare to the one with less foliage. This suggests that planting more trees is one of the solutions to reduce the rising level in temperature. Moreover, differential cooling effects of diverse plants shown in this study is also an important step to address the global warming.

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

249

Fair Category

L8

Project Number

2513

Title: Less is More: A Test of the Minimal Amount of Water Needed to Grow Crops

Student Name(s): M. Maciejewski

Abstract:

Droughts cause significant problems for commercial farms and substance farmers in developing countries and crops must be irrigated. Irrigation consumes as much as 80% of water in areas such as California. To date, many farmers still utilize inefficient methods of irrigation such as flood and sprinkler. While drip irrigation has potential water savings up to 80%, studies have shown that farmers with drip irrigation systems over-water their crops trying to keep the soil moist and do not save much water. My project was to determine the minimal amount of water needed to grow a plant. First, I tested different amounts of water added to the plants each day for radishes, beans, and peas and found that around 12 ml/day of water was sufficient for proper plant growth. At this level, the plant was using all the water that it was given and the soil moisture level was very low. I repeated the experiment again, using only radishes and more watering levels along with better measurement of the soil. I found that 20 ml/day was the sufficient for radish growth. It is suspected that experiment 2 needed more daily water due to dry conditions during plant growth. In both experiments the addition of additional water did not change the plant growth significantly and demonstrates that farmers could reduce the amount of water given to their crops without reducing plant health. Lastly, I engineered a drip irrigation system delivering 20 ml/day of water to 30 radish plants.

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

248

Fair Category

L8

Project Number

2514

Title: Hydroponics vs. Soil Gardening

Student Name(s): M. Bencivengo

Abstract:

Some of the biggest issues facing our world today involve climate change, global warming, learning how to use and recycle precious resources and adapting to our ever changing world and beyond. One of these adaptations or “future farming” is Hydroponics: a way of growing plants in water, using a mineral nutrient solution in the water instead of the plant growing in soil. I wanted to experiment with this type of growing using a variety of plants grown together in comparison to the same plants grown in soil.

I focused on three different plants, Basil (herb), Dieffenbachia (houseplant), Croton (tropical). I bought two of each type of plant and measured both plants to make sure they were similar in size, height, vigor, and leaf area. One of the plants continued growing in soil while the other plant went on to grow hydroponically using a static solution water culture system. Both groups, received the same amount of light and temperature (68-70 degrees). The hypothesis was that the hydroponically growing plants will continue to grow at a faster rate, have greater height, more root hairs and greater vigor and overall health than the same plants that remained growing in the soil.

The results of my experiment supported my hypothesis. The plants that continued to grow hydroponically grew at a faster rate, had more root hairs, taller height, more leaves, larger leaf area and greater overall health than the same plants growing in soil. This growth was sustained for over a month.

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

PS EA 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

L8

Project Number

2515

Title: Is Tap Water Safe to Drink in Connecticut?

Student Name(s): B. Lee

Abstract:

The purpose of this research is to find if water filters can filter out contaminants from tap water. My research question is if filters can filter out the contaminants. My hypothesis is if I filter the tap water in Avon, Connecticut, then the number of contaminants in the water should be significantly reduced. To test my hypothesis, I first pour water into the pitcher. After the water has gone through the filter, I pour the water into a testing cup. I dip one test strip into the water for the stated amount of time which varies with each type of test strip. I compare the color of the testing zone on the test strip to the color code provided and record the amount of material is in the water. With this case of water, I test five strips. After, I replace the water and repeat. I repeat these steps to find the pH of the water and the amounts of lead, copper, total hardness, iron, and free chlorine. Data proves that my hypothesis is correct. The amount of contaminants was reduced significantly. The water of Avon, CT also proved safe as well with no lead found in the water. The Pur filter was the best out of the four filters I tested. Health of the people should be a priority and monitoring city water is an example of how governments can show this. This science project contributes to the earth and life sciences by providing scientific evidence.

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

EM 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

L8

Project Number

2516

Title: pH levels of water in Hartford, Connecticut

Student Name(s): N. Davis

Abstract:

In the study of hydrology which means the study of water it's long been understood that water is essential for human survival and that various chemicals can affect the quality of water and human health resulting in public health standards for drinking water. But, there is no known general knowledge about how location affects pH levels of water in Hartford. The literature describes that the quality of water affects human health and urban areas typically have lower quality water than suburban and rural areas. In this science project a typical method was used to analyze the water using the pH scale however water samples from around Hartford were used to see if there was a difference in water quality. During this experiment I collected water samples from around Hartford and used pH strips to measure the pH. The following results were obtained; water from the South end had an average pH of 6.6, water from the North end has an average pH of 7, and water water from West end had an average pH of 6.3. In conclusion, the end of Hartford that has the best pH is the North end of Hartford. This experiment is important because by testing pH of water in different areas it can help people's health by making them aware of how acidic the water in their homes are. Next steps include collecting more water samples throughout hartford to increase the sample size and comparing to surrounding suburban and rural neighborhoods.

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

EA EV

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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

211

Fair Category

L8

Project Number

2517

Title: Sponge It Studnets

Student Name(s): S. Pena

Abstract:

The objective of my study is to find out how students best absorb information. I thought that more students would be visual learners instead of auditory learners. I'm doing this because I want to help better study methods. I separated 6 students into two groups of 3 students in each. For 3 trials, one group read an article and the other listened to the same article in another room. They took a quiz on the article. I switched up the groups after each quiz and had them do the same. I used 3 different articles for each trial. I found that whichever group read to themselves, got a higher average, meaning more are visual learners. The groups that read to themselves wouldn't look back a lot on the article. Throughout my study, I concluded that whichever group read independently, got a higher reading level. I think that reading independently gives a higher reading level because reading independently, eliminates distractions. So my research question was answered and my hypothesis was proven correct. The findings highlight the need for further research so if I were to do this project again, I'd test larger groups. I'd test a wide range of ages, I'd try having my volunteers read different types of articles as well.

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

BE

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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

160

Fair Category

L8

Project Number

2518

Title: Gum v.s. Mints

Student Name(s): C. Rhone

Abstract:

The purpose of my project is to see if eating a mint or chewing gum helps a person focus better. This is important for students when they are taking a test in school. My experiment shows people can focus best in school or at work when chewing gum. I gave an adult, child, and teenager a stick of gum or mint and tested their reading comprehension with a MAZE test. I found that for all age groups, when they chewed gum the amount of words they read per 2 minutes increased. Overall, when people had gum their score was 36/55. When they had mints it was 33/55. With the use of nothing, they scored 28/55. Possible errors were that the person remembered words off of their MAZE. What I will do next time to fix this is use different MAZE assessments. In conclusion, I was wrong because I thought that eating a mint would improve your focus better than gum.

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

BE

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 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

242

Fair Category

L8

Project
Number

2519

Title: A Comparison of Mineral and Organic Fertilizer on the Growth of Black Simpson Baby Lettuce in an Indoor, Controlled, Environment

Student Name(s): K. Doolabh

Abstract:

The purpose of this experiment was to explore which type of fertilizer (organic, mineral, a combination of organic and mineral, and no fertilizer) would result in the best growth (average plant weight and length of leaves) of lettuce seeds. Research shows that mineral fertilizer contains nutrients that will help plants produce the most yield. Secondly, organic fertilizer has organic carbon that helps to keep soil healthy. It was therefore hypothesized that Black Simpson baby lettuce seeds that were grown in soil fed with a combination of mineral and organic fertilizer would produce the best growth. Solutions were created for each fertilizer condition. Lettuce seeds were planted in pots and divided into four conditions, one for each type of fertilizer. A grow light was used to produce a constant source of light. The plants were watered on a daily basis for a period of forty-two days. On the final day, the plants were uprooted and measurements were taken. It was found that the plants watered with the combination of mineral and organic fertilizer weighed the most and had the longest leaves on average. The hypothesis was therefore proven correct. This finding could be useful in the production of crops as it can help farmers grow larger plants in a shorter amount of time. One suggestion for future research would be to vary the amounts of organic and mineral fertilizer used in the combination. This can help to determine the optimal fertilizer solution.

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

PS

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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

250

Fair Category

L8

Project Number

2520

Title: Why do certain colors stand out to certain people more than others?

Student Name(s): A. Montuori

Abstract:

Because I love color and am fascinated with how colors trigger different things in people's minds, I chose this experiment so I could learn more about color. Though my results may not have changed lives or determined the most efficient product, they do tell more about color. The problem I was testing was "Why do certain colors stand out to certain people more than others?" and in very simple terms, "What color do you see first?" I thought most people would see their favorite color first. The subjects filled out a survey about colors and their moods. It asked the subjects' favorite and least favorite colors, color shade preferences (lighter, brighter or darker colors). I used 5 color sheets and each had 9 different colored squares on them. Each subject told me what color they saw first when I showed them the color sheet and I recorded their answers to calculate the results.

My hypothesis was rejected by the results. I found that 28% of my subjects saw their color preference shade at least three out of the five times, 8% saw their favorite color three out of the five times, and 26% saw at least three colors that matched their mood. Moods and colors often correspond and my results show this as well. Even though my results didn't prove my hypothesis correct, I met my objectives. I learned more about color and the experiment as a whole does tell more about color and how the brain reacts to colors.

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

BE

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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

250

Fair Category

L8

Project Number

2521

Title: Re-Think What You Drink

Student Name(s): E. Borges

Abstract:

Background: Beverage color and acidity have a staining effect of on your teeth. Tooth enamel is porous making it extremely susceptible to stains. Colored foods and beverages get absorbed by your teeth and stains become embedded. The level of acidity also affects tooth color.

Acidity promotes stains by wearing away the enamel and temporarily softening the teeth which makes them more susceptible to stains. The purpose of this experiment is to determine which beverage has the greatest effect on tooth staining.

Method: Hollowed out eggs were used to simulate the composition of human teeth. Eggs were submersed into one of five solutions in sealed containers. Each egg was removed from its container, photographed, inspected and felt for textural changes. The observations were compared to an appearance and textural scale then assigned a value. The results were recorded each day for 7 days then tabulated.

Results: Cola had the greatest effect on staining and texture followed by brewed coffee. Cola and Coffee both had a PH of 6.2. Tea PH of 6.2 had the third most observed changes in staining but no textural changes. Lemon Lime soda PH 6.2 had textural changes but no staining was observed. Water PH of 6.8 had no changes in staining or texture.

Conclusion: Colored liquids have the greatest staining powers. Acidic clear liquids such as Lemon lime soda caused textural changes. People, who ingest acidic beverages, colored or clear, with a regular frequency, should brush their teeth or choose to ingest non acidic clear liquids.

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

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

171

Fair Category

L8

Project Number

2522

Title: Computer simulation if segregating students by classroom during lunch time during a viral outbreak will reduce the length of the viral outbreak and the number of students infected.

Student Name(s): I. Benson-Clarke

Abstract:

The purpose of this project is to better understand the relationship of the number of interactions a student has with different people versus the rate that the flu spreads in schools.

This is achieved by running two different computer simulations. The first computer simulation shows the various students in classrooms and not interacting with students outside the classroom.

The second computer simulation shows all the classes interacting together in a lunch room.

The hypothesis is that limiting student interaction to just their one classroom will decrease the incidence of the flu.

Because the students do not switch classrooms in between subjects this is modeled after an elementary school. In the future the project could be expanded into a middle school and high school approach. The purpose of this would be to see how switching classrooms impacts the spread of the flu.

The results show clearly that preventing students from interacting in a lunch room and being limited to their classrooms during flu season decreases the spread of the flu by 14%.

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

ME 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

L8

Project Number

2523

Title: Memory Mnemonics

Student Name(s): J. Rivera

Abstract:

In my experiment my testable question was, “can mnemonics affect people’s ability to remember a list of words?” From my research I have learned that mnemonics are devices that are intended to assist the memory and I wanted to test this to see how effective mnemonics can actually be. To conduct my experiment I used two groups of three people. One group was the control group and the other was the experimental group. My plan was to create two lists of words (seven words long). I created a list of words that don’t contain mnemonics for the control group. Then I created a list of words with mnemonics for the experimental group. I tested each group individually. Each group had 5 minutes to try to remember the words. Then we would go off and do anything to kill time for an hour. After the hour was up I tested each person individually. During this whole experiment I observed the two groups to try to see a difference between how they worked. My results had showed me that the group that didn’t have mnemonics had done a better job at recalling the words than the experimental group. I then reanalyzed my data to conclude that it all depends on the type of person you are and how your brain works because as human beings we are all different so our brains work differently than others. Mnemonics are not for everyone due to the reason that everyone’s mind works differently.

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

BE

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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

235

Fair Category

L8

Project
Number

2524

Title: The Rate of Corrosion: The Effects of Acids and Temperature

Student Name(s): A. Harding

Abstract:

In my science experiment, I was testing to see if pH and temperature would affect the rate of corrosion. I hypothesized that the rate of corrosion would be highest with liquids that were most acidic, or had the lowest pH. My second hypothesis was if I change the temperature of the vinegar, then the sample with the higher temperature will increase the rate of corrosion. In my procedure, I put the steel wool in the treatments of distilled water, lemon juice and vinegar. I then inserted it on the thermometer probe. I placed the probe with the steel wool into a test tube with a stopper closing it tight. I recorded the temperature change and took observations to see if the steel wool had rusted. I did the same procedure to test my second hypothesis. I changed my treatments to vinegar that was 60°F and 80°F and compared my results.

My observations showed that the steel wool that was put in vinegar had the most rust. My results also showed that the treatment of the 80°F temperature had rusted faster compared to the 60°F treatment.

My results supported both of my hypotheses. I concluded that the vinegar increased the rate of corrosion because it was most acidic. I also concluded that the sample with the higher temperature sped up corrosion because when temperature rises, molecules have a better chance to combine.

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

CH

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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

161

Fair Category

L8

Project Number

2525

Title: Will Seeds be Affected by Space Exposure

Student Name(s): B. Wolf

Abstract:

It is hypothesized that earth based seeds will have faster growth rate than space exposed seeds. The reason that its faster growth is because space radiation changed the direction of the embryo in the seed. The hypothesis is correct. Only 1/3 of the space seeds that I put in a cup of soil grew. The earth variable all of the plants grew. Then, in the speed of germination earth grew 2 days before the space seeds. Also same with trial 2 of speed of germination earth seed grew 3 days before space. It was interesting how much of a difference in leaves there were, 7 leaves space leaves and 24 earth leaves grew. Almost in all of the trials earth won except in biggest leaf (length) where space had 3 cm in length and earth had 2 cm in length. Also space won in root development in a 1/2 of an inch. In conclusion, space radiation does affect cinnamon basil seeds.

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

PS PH

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 vertebrate animals controlled substances

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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

223

Fair Category

L8

Project
Number

2526

Title: An Egg-cellent Experiment

Student Name(s): A. Seaman

Abstract:

The goal of this experiment is to help consumers find the best whitening toothpaste. A survey of twenty adults was conducted to help determine the importance of having white teeth. The survey shows that 100% of the adults polled drink coffee, tea, and/or cola. 55% of the the adults polled think having white teeth is very important. Therefore, the experiment was conducted as follows. Nine white eggshells representing human teeth were soaked in coffee, tea, and cola for five hours. These beverages were chosen because they are often consumed by many people and the survey showed that all of those polled are not willing to give up coffee, tea, and/or cola for whiter teeth. Everyday for five days, the stained eggshells were brushed with three different name brand whitening toothpastes, Crest 3D White Luxe, Colgate Optic White Platinum, and Sensodyne Extra Whitening. Each day, after every brushing, the shade of each eggshell was measured against a shade guide to determine how effective each toothpaste was at removing the stains. Tables and graphs were created based on the color of each egg after each brushing. It was concluded that Crest 3D White Luxe was most effective when removing coffee stains, Colgate Optic White Platinum was most effective when removing tea stains, and all three toothpastes were equally effective when removing cola stains.

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

ME

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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

242

Fair Category

L8

Project Number

2527

Title: ToaDiet

Student Name(s): J. Naticha

Abstract:

I enjoy keeping amphibians as a hobby and someday I might like to breed and sell them. I am always curious about how to make them live long, happy, healthy lives. I also want to see what helps them grow best, so I thought investigating different diets could help me with this. Whatever diet causes them to gain the most weight will probably be a very effective weight gainer for many other amphibians. I thought that the crickets would cause the toads to gain more weight than the waxworm diet because I have tried this with my tiger salamanders and they gained more weight on a cricket diet.

Using a sample size of four toads I fed two toads only wax worms and fed the other two only crickets. I weighed them every four days. After forty days I calculated the total average weight gain for each diet and determined which diet caused the most weight gain.

After forty days, the wax worm diet resulted in the most weight gain: an average of 3.85g. The fire belly toads in the wax worm diet group gained an average of .35g more than the cricket diet group, who gained an average of 3.5g grams. This showed that my hypothesis was wrong. A possible explanation for these results is that cricket exoskeletons could be more difficult to digest.

This information would be important to hobbyists or veterinarians trying to get amphibians to gain weight quickly.

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

AS EM

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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

254

Fair Category

L8

Project Number

2528

Title: Does Eye Color Affect Peripheral Vision?

Student Name(s): M. Mancuso

Abstract:

Does the color of a person's eyes affect his/her vision? The objective of this project was to examine the effect of eye color on four different dimensions of peripheral vision. My hypothesis was that eye color would affect peripheral vision with dark eyes having better peripheral vision than light eyes, because dark eyes have larger pupils, which let in more light. The experiment utilized 12 volunteers having 3 different eye colors: blue, brown, and hazel. Each volunteer took a peripheral vision test. The test utilized a vision protractor and four different colored shapes with letters printed on them. Each participant was asked to look at a focus point while an object was moved into the field of vision starting at an angle of 0 degrees and moving continuously up to 90 degrees. They were asked to report when they saw the object, and when they recognized the shape, color, and/or letter of it. The results showed that my original hypothesis was not entirely correct, because on average, the brown-eyed group did not perform the best on the test. Furthermore, there was no difference between the eye color groups in terms of detection, color recognition, or shape recognition. Letter recognition was the only dimension where a difference was seen between the groups. On letter recognition, the blue-eyed group performed worse than both the brown and hazel eyed groups, which were about the same. My conclusion is that eye color has an effect on some but not all dimensions of peripheral vision.

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

BE 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

249

Fair Category

L8

Project Number

2529

Title: Which Mineral Based Water Filtration System Is Best For Eliminating Daphnia, Preventing Dracunculiasis

Student Name(s): S. Barta

Abstract:

Many 3rd world countries today are lacking clean water systems. My project was inspired to help change the world by providing safe water to drink. One epidemic disease that occurs in many 3rd world countries is Dracunculiasis. This disease is also known as the Guinea Worm Disease, and it's very known in Africa, Asia, and South America. Furthermore, Guinea Worm Disease is the parasitic host of Daphnia. Whenever someone drinks brackish water with daphnia, they also contract the Guinea Worm Disease. Fortunately, the daphnia dies inside of you, but the worm still lives on causing health issues. Moreover, my research was to build a water filtration system using economic and organic materials to remove daphnia from brackish water to prevent Guinea Worm Disease. In addition, I think my mineral based water filtration system will remove the daphnia from brackish water because the materials I will be using are iodized charcoal and gravel. These two main resources can help filter water because of their natural properties. When conducting my experiment, I realised I wanted a filtration system that was easy to use and affordable to make. In addition, instead of using daphnia, I decided to use brine shrimp because they are relatively similar to daphnia. The first step was to grow the brine shrimp by using the given instructions. The next step was to actually make the water filtration system. This was the most challenging part because I had to visual a specific design to create a successful filtration system.

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

EM 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

190

Fair Category

L8

Project Number

2530

Title: ELECTROLYTE CHALLENGE

Student Name(s): J. Vidal

Abstract:

My project is titled Electrolyte Challenge. The purpose of this project was to see which drink contained more electrolytes. The problem I solved was identifying which drink would replenish your body better. I used two types of Gatorade, and orange juice as my samples.

To find the answer, I created a conductance sensor. Electrolytes are the same as conductance. Once I got the reading from the multimeter I put the reading in an equation which the reported the conductance. The conductance tells me how many electrolytes for each drink.

The result of the project was orange juice had the most electrolytes. The two types of Gatorade had almost the same amount of electrolytes. I conducting a small survey of friends and family asking which drink each individual believes has more electrolytes. Most people said Gatorade. I think people are influenced by the amount of advertising done by Gatorade.

After viewing this project, many people will be aware of the greater electrolyte amounts in orange juice and choose to drink orange juice more often. I am satisfied with the project and enjoyed conducting the experiment. Doing the survey was fun, too.

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

248

Fair Category

L8

Project Number

2531

Title: Designing a water purification system

Student Name(s): D. Gaudoin

Abstract:

Abstract

The United States is very fortunate because of our drinking water, which is very high quality. Many cities and towns provide clean water to its residents; however in many parts of the world people do not have clean water. Due to contaminated water, many people have health problems and leads to diseases and even death. This science project has allowed me to learn about how to purify water that would provide assistance to people who do not have one of life's necessities in order to survive.

The problem in this project was to determine whether water could be purified by using certain materials. The results disagreed with my hypothesis, due to the fact that cotton did not filter as well as a coffee filter.

A filtration system was constructed and with the use of gravel, activated charcoal, and fine sand. The dirty water was purified and then drained into another container. There was a sizeable quantity in certain systems tested. The coffee filter allowed the water to flow through without many contaminants.

The results were that the combination of a coffee filter, gravel, and activated charcoal worked best. A total of 0.047 milliliters emerged from the filter.

From this experiment, while some water did drain from certain combinations used, only one produced the greatest amount of clean, purified water. From the data, it can be concluded that a coffee filter functioned better than a piece of cotton material. All objectives were met and this project was successful.

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

EV EA 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

205

Fair Category

L8

Project Number

2532

Title: T.E.E.T.H
The Egg Enamel Teeth Health watch

Student Name(s): L. O'Donnell

Abstract:

In my experiment I tested what rots your teeth. I used eight different liquids, coffee, pop, sugar water, orange juice, carbonated water, orange juice, milk, and water. I used hard boiled eggs in place of actual teeth. Why eggs though? Eggshells are similar to your teeth enamel. Both have the same coloring, light yellow to white. The eggshell protects the egg from breaking like the tooth enamel as it protects your teeth from decaying. Eggshells and teeth also are similar in the makeup. Eggshells contain calcium carbonate and teeth contain calcium phosphate. This makes them similar enough so eggshells can represent teeth. I observed the eggshells in the liquids for a week, then I took them and cracked open the shell to see the inside. I thought the coffee would rot the most, I was wrong it was the orange juice. In the end I picked the three that rotted the most, orange juice, Coca-Cola, and coffee, and soaked three new eggs in fluoride solution for a day and then repeated the process, I didn't think it was going to help but it did. I was proven incorrect on both of my hypothesis but I did succeed in learning what does rot your teeth.

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

247

Fair Category

L8

Project Number

2533

Title: Egg Substitutes in Baking

Student Name(s): J. Wurms

Abstract:

The purpose of my experiment was to find out which egg substitute people liked best. To figure this out, I baked 3 batches of chocolate chip cookies; one with egg, one with applesauce replacing egg, and one with commercial egg replacer as the egg substitute. I made one batch of cookies using egg as a control so I would have a basis to compare the egg substitutes to. I assigned each cookie a letter: egg = A, applesauce = B, and egg replacer = C. Then I gave 20 participants one of each cookie and they told me which they liked best. I did not tell participants what was in each cookie, only telling them the letter assigned to it. I then wanted to see how the flavor and texture of the cookies factored into which one they preferred, so I did another trial. In this I added a survey where participants rated each cookie's flavor and texture from one to ten, and analyzed the data by averaging the scores each cookie got. The data collected showed that Cookie B was rated highest in flavor and texture and was best liked overall (in both trials). Cookie C was liked the least, and was reported to have a slight salty aftertaste. A possible real world application for this is for people with egg allergies. Since many people have allergies, this is important. It is also applicable for vegans because they don't eat eggs, so they would also benefit from this information.

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

250

Fair Category

L8

Project Number

2534

Title: Liquefaction in Action

Student Name(s): E. Lifrieri

Abstract:

Soil liquefaction happens when vibrations or water pressure within a mass of soil cause the soil particles to lose contact with one another. When this happens, the soil acts like a liquid and is not able to support weight. The question my experiment asks is what type of soil (sand, clay, or loam) requires the most water before soil liquefaction occurs. My hypothesis is that sand will require the most water before soil liquefaction occurs. To test my hypothesis, I will fill pails with each type of soil and place 3 bricks on top of the soil in each pail. I will draw a line 30 mm from the bottom of the bricks. I will pour 100 mL of water into the pails until the bricks sink. I will do this for each soil type to measure the amount of water needed for liquefaction to occur. The results showed that sand required the most amount of water to collapse the bricks (2600 mL). Clay required 1800 mL of water for the bricks to collapse, and loam required the least amount of water for the bricks to collapse (1000 mL).

The results of my experiment were what I expected based on my research about soil type and liquefaction. Sand is a type of soil which is granular and can be compacted. Soils can be tested for whether they will experience liquefaction. It is important to understand the characteristics of soils because soil liquefaction can cause damage to buildings and harm people.

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

EA

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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

125

Fair Category

L8

Project Number

2535

Title: The Effect of Baby Food on Sucrose, Glucose, and Fructose

Student Name(s): H. Krekoska

Abstract:

In this project, the glucose concentration was measured in different baby foods before and after invertase was added to the food. It was hypothesized that if there is more sucrose in a food, then it will convert to glucose making the glucose concentration increase. The hypothesis was correct. First the glucose strips and invertase activity were tested on water just to make sure that the invertase and glucose strips worked. Next, the baby food was tested. A 1:10 ratio was made of baby food and water because baby food is very thick and it would be hard to test the glucose concentration on a thick substance. The glucose concentration was measured by the glucose strips before and after the invertase was added to the food.

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

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

251

Fair Category

L8

Project Number

2536

Title: Online Homework and Screen Time: Are We Going in the Right Direction!

Student Name(s): A. Mangla

Abstract:

Screen time is the amount of time that one spends looking at the screen of an electronic device. As we progress into a “paperless” future, more types of screens are dominating the lives of students. Anticipating the negative effects of increasing screen time on health, various scientific societies have advocated limiting daily screen time and adopting various techniques of screen hygiene. The purpose of this study is to determine the screen habits of middle schoolers. It tests the hypotheses that middle school students often exceed the daily recommended screen time guidelines. It also proposes that they are not aware of, and have limited education about, screen hygiene techniques. A sample of sixth, seventh, and eighth graders were surveyed through a questionnaire to assess how much time they spend on screen activities, (including homework), their knowledge of the recommended screen time guidelines, and whether they have healthy screen habits. Results from the survey show that the behavior of middle schoolers and their knowledge of screen time does, in fact, concur with the hypotheses. 78% of middle schoolers go over the recommended two hours of screen time per day. Only 32.5% students know about the daily recommended screen time. As for screen hygiene, 87% do not use an anti-glare screen. Only 30.3% students know about proper lighting in the room. The study concludes that middle school students exceed recommended daily screen time. It further concludes that awareness about, and education of, screen hygiene techniques is low, necessitating the need for educational initiatives.

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

BE ME 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

244

Fair Category

L8

Project Number

2537

Title: There's Something in the Water

Student Name(s): Z. Parsadanov

Abstract:

Hydroponic basil is a common crop commercially grown in the United States. It is important to know how water pH affects basil growth in order to produce crops healthier and more efficiently. We know that nutrients become unavailable or abundant at different pH levels. I predicted that if the pH of the water deviates from an optimal pH of six, then the plant height and root growth will be negatively affected and not grow as healthy as the plants growing in the optimal pH of six. To test this prediction I took several basil plants and I transferred them into three hydroponic raft systems, one with an optimal pH of six, another with a high pH of ten, and last one with a low pH of three. I was able to adjust the pH by using calcium chloride and sodium carbonate. I measured the pH level on a daily basis with a pH meter. My data showed that the plants grown in a pH of six grew the tallest and had the the strongest root system. The plants grown in the control pH of six grew 46.5% taller than the plants grown in the pH of three. Likewise, the plants grown in the pH of six grew 26.5% taller than the plants grown in the pH of ten. I observed that the basil grown in the pH of ten was chlorotic because of the amount of nutrients that become unavailable at this pH level.

Technical Disciplines Selected by the Student
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PS BI EA

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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

236

Fair Category

L8

Project Number

2538

Title: Influence of Climate Change on the Lobster Population in Buzzards Bay Massachusetts: Implications for Long Island Sound

Student Name(s): B. Kerr

Abstract:

The lobster population in Buzzards Bay, Massachusetts has been decreasing over the past 15 years. This decrease negatively affects the 250 million dollar shellfish industry, causing severe economic effects on the state. The purpose of my experiment was to characterize this decline and to determine its cause. My hypothesis is that climate change is a major factor in this decline; therefore I set out to find if the lobster harvest was correlated with several aspects of climate change. My results showed that there was a 93% decrease from the peak in 1996-1998 to its lower limit in 2001-2003. This decrease was associated with the increase in the male to female ratio and the reduction in the amount of egg bearing lobsters. Furthermore, the decrease in lobsters was correlated with increased water temperature, increasing air temperature and decreasing pH levels, likely due to ocean acidification. In a follow up experiment, I demonstrated a 35% growth rate decrease with lobsters grown in water at pH 6.5 as opposed to lobsters grown at a control pH of 7.5. These results suggest that climate change may be negatively affecting the lobster population and growth and is seriously affecting the ecology of the bay and causing severe economic as well as environmental concerns. These effects have implications for Connecticut's Long Island Sound. If climate change continues, it could have even more severe effects on other species, their habitats, and the economy.

**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

5. 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

2539

Title: CAN YOU FIND THE THE MISTAKE???
123456789

Student Name(s): E. Smith

Abstract:

The brain is the power house of the human body. It produces our thoughts and emotions- it's the reason we do what we do.

For my science experiment, I decided to try to understand how different age levels thought through puzzling brain teasers. To do this, I would create two tests- one to be taken in a quiet environment and one in a loud environment. Then, I would present these tests to participants ranging from first to tenth grade. My hypothesis was that the older group of participants would solve these tricky sets of problems better than the younger group. My objective was to see if the older participants could solve the problems without overthinking, or if the younger, more creative minds could defeat the older ones.

In the end, I tested 36 participants- eighteen from the younger group and eighteen from the older group. My hypothesis was correct. The older group solved the problems more accurately than the younger group. The younger group answered many of the answers logically, however, I was correcting the tests based on accuracy.

Everyone's brain works differently. I only tested 36 students from a couple of local schools. What would have happened if I tested 1,000 people from around the country? Would the results have been different if I had tested people from a European country? What would've changed if I had given the test to every single person on the planet? The brain isn't a big thing, yet it is everything you are.

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

BE

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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

250

Fair Category

L8

Project Number

2540

Title: Designing a Water Purification System

Student Name(s): S. Hong

Abstract:

Oil spills are quickly growing to become the biggest disaster around the world. They pollute the water causing long term effects on the animals, the environment, and even the economy. To try and solve the problem of polluted water on a smaller scale, water can be purified by different filters. One important question is “how can polluted water be made safe for living things?”

This experiment tests different methods of water purification using filters. Set up three water filtration models using clear bottles. Place nylon fabric over the narrow opening and secure with a rubber band. Add a coffee filter to one, another with gravel and sand, and leave the last bottle empty with only the nylon covering. Dirty water is placed in the top of each filtration model and gravity pushes it through the filters. Observations can be made about what filter purifies the water best.

My hypothesis is that if you use a coffee filter, then water will be the cleanest since coffee filters have already been tested and standardized for efficiency.

This experiment proved that the coffee filter cleaned the water best. Results of the experiment show that when you put water through the coffee filter, it cleans the water since the coffee filter produced 63 total dissolved solids which was less than the control system which produced 64 total dissolved solids. The coffee filter also reduced the hardness of the water from 4 grains per gallon to 3 grains per gallon. This data supports my hypothesis.

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

EV 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

247

Fair Category

L8

Project Number

2541

Title: Reported Youth Tobacco Use Decrease in Connecticut from 2009-2013

Student Name(s): D. Lee

Abstract:

In the study of smoking and health, it has been long understood that cigarettes have about 4000 chemicals in them and have been proven to negatively affect human health. But, there is known general knowledge about how vapes affect health and about why there is a decrease in the number of tobacco users from 2009-2013 in CT. The literature describes that both vapes and cigarettes are used by teens and that cigarettes can cause cancer, decaying of teeth, brain malfunctions, throat cancer, lung cancer, and skin cancer. In this science project, data analysis methods were used to look at average tobacco use over time in Connecticut according to the Youth Tobacco Survey, however there is no current data showing the number or percentages of people or teens that use vapes. Additionally, there is no current information that shows the negative effects of vapes on the human body. During this experiment I used data from the CDC Tobacco Youth Survey for Connecticut and asked youth in Hartford about what they know about vapes. The following results were obtained: tobacco use decreased 2.5% during from 2009-2013 while smokeless tobacco increased 0.9% during the same years with teens reporting little knowledge about vapes. In conclusion, the data shows that youth smoking has decreased while smokeless tobacco is on the rise which could lead to unknown health problems due to the limited vapes research. Next steps include, creating a survey and conducting research to investigate vapes use among adolescents in Hartford.

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

BE ME

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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

244

Fair Category

L8

Project Number

2542

Title: Effect of Pollutants on Aquatic Life

Student Name(s): E. Bradford

Abstract:

How do pollutants affect aquatic life? How much does it take to impact these precious organisms? I tested to see how or if pollutants, such as bleach and car windshield antifreeze, affect aquatic life as represented by Daphnia (water fleas). Daphnia were the best choice to monitor pollutants because they are extremely sensitive to pollutants and are used as a common indicator species for freshwater. I hypothesized that bleach would affect the Daphnia most which was correct. I placed Daphnia in dilutions of antifreeze in sets of three and monitored them sporadically for twenty hours. My dilutions were so small, in microliters, that I began with 2 μ L and then worked down with a dilution series. My measurements were from Lake Whitney, I took the volume of the lake and found what happened if 1 gallon of chemical was diluted in the lake, and then 10 gallons, 100 gallons, and 1,000 gallons. I discovered that antifreeze had barely any effect on the Daphnia, very few died and I had to account for the deaths due to the change in environment. Bleach had a huge effect. The Daphnia in 1000x, the strongest solution, died overnight. I concluded that when people dump antifreeze into water or it comes off their windshields we shouldn't be too worried. Yet it remains poor for the environment. Bleach is dangerous for our aquatic life and therefore should have stricter laws and penalties against people who dump it into water sources.

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

EV MI

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

185

Fair Category

L8

Project
Number

2543

Title: Acid-Base Chemistry: Bath Bombs

Student Name(s): A. Good

Abstract:

I was interested in testing the reactivities of bath bombs composed with different acids. Bath bombs are commonly made using citric acid. I wanted to compare the rates and strengths of the chemical reactions produced by bath bombs made with citric acid, malic acid, and potassium bitartrate. I made nine bath bombs, three replicates of each kind, and dropped them into a bowl of water measuring 105°F. I observed and analyzed the reactions and concluded that the citric acid had the strongest reaction but the shortest reaction time, three minutes on average. The malic acid maintained a fairly strong reaction for an average of five minutes. The potassium bitartrate bath bombs maintained an extremely weak reaction for five minutes on average. Each acid was tried three times and the reactions were observed. My experimentation confirmed that citric acid is more ideal compared to malic acid and potassium bitartrate in the making of bath bombs. I am interested in furthering my studies and experimenting with various acids to discover an acid that will increase both reaction strength and time for a longer effervescent bath experience!

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):

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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

168

Fair Category

L8

Project Number

2544

Title: Basketball Positions

Student Name(s): M. Whittle

Abstract:

The purpose of my experiment was to discover more of the reasons of results that occurs with a change in environment and setting in basketball. My motivation was to discover more about my favorite sport, basketball, and how and why things happen. The question I was trying to solve was "Do youth basketball players perform better in a regular position or in an irregular position?" I hypothesized that youth basketball players will perform better when they play in a regular, or familiar position. In order to perform my experiment, I attended two local youth girls basketball practices. With permission from the coaches, I observed five players, each from two different age groups, both for five minutes in a regular position, then five minutes in an irregular position. In my results, I proved my hypothesis correct. In my results, almost half of the participants had either scored a basket or had control over the ball for at least 3 minutes. In my experiment, I met my objectives and goals.

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

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

L8

Project Number

2545

Title: Growing plant cuttings

Student Name(s): M. Rahman

Abstract:

I investigated how the amount of leaves on a cutting affects the amount of roots and leaves that it produces. My results could prove useful to classes growing plants at our school because they would tell people how many leaves they should have on their cutting for it to grow the best. I took 30 cuttings of spearmint plants, and had 6 each of cuttings with 0,3,6,9 and 12 leaves. Then I put the plants in a mixture of half perlite, half peat. I watered the plants every day and recorded the amount of roots and leaves they had each week. I found that the more leaves on the cutting, the more leaves and roots that it produced. Two pieces of evidence that show this are: 1) At week 2 the average number of leaves for the 0 leaf cutting was 3.67 leaves, 3 leaf cutting was 4.33 leaves, 6 leaf cutting was 5.83 leaves, 9 leaf cutting was 7.17 leaves, and 12 leaf cutting was 8.50 leaves.; 2) At week 4 the average number of roots for the 0 leaf cutting were 11, 3 leaf cutting was 23, 6 leaf cutting was 24, 9 leaf cutting was 26, and 12 leaf cutting was 39 roots. I learned that cuttings with more leaves will produce healthier plants. This may benefit people working in our school greenhouse. This may also be valuable to people at a commercial level because they could grow more plants at a faster rate.

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

PS EM 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

246

Fair Category

L8

Project Number

2546

Title: Seed Germination in Different Mediums

Student Name(s): A. Cowen

Abstract:

The world's water sources are being polluted at greater rates than ever before; but exactly if, or how, these contaminated sources affect the growth and health of plants is seldom mentioned. To test the relationship between plant growth and the substances seeds are germinated in, an experiment was conducted to see if bean, sunflower, and cilantro seeds will germinate successfully during the most crucial stage of growth and development in plants, imbibition. The three seed types were germinated in nine different liquids- plain coffee, orange juice, tonic water, soy milk, sugar water, diet Pepsi and water as a control for 10 days; with every seed/liquid combination being tested. It can be concluded that the chemistry of the liquid completely controls the growth and overall health of the plant. The seeds that germinated in water grew the best by far, with the bean seeds' radical growing up to 120mm in length. The second most successful liquid was coffee; which is mainly composed of water. Contrary to the success of the seeds that were germinated in water, seeds in acidic substances such as vinegar and 100% orange juice did not germinate at all. Osmosis also has a crucial effect on how seeds germinate, since the seed must fill with water to activate the stored enzymes that signal initial plant growth. If the liquid is deprived of oxygen, the seed cannot germinate. This shows that in today's world, preventing deoxygenation of water is crucial to keep life thriving.

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

PS BI 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

L8

Project Number

2547

Title: Which type of allergy decongestant dissolves the fastest in stomach acid?

Student Name(s): M. Di Cicco

Abstract:

Millions of people use allergy decongestants to try to relieve their symptoms as fast as they can. But is the decongestant of their choice really doing it's job as efficiently as it could?

Although they are expensive, that doesn't mean it isn't the best choice to get the fastest relief. The future impact of this experiment could lead to the new development of a type of drug that could act faster yet more efficiently in the body all at the same time.

Finding which allergy decongestant was the quickest to dissolve was a real challenge as I had to simulate hydrochloric acid, stomach acid, to get the appropriate environment for the decongestant. The decongestant would then be placed into the stomach acid and tested by its time-to-dissolve without residue.

My results found that from the three major brands, Allegra, Claritin, and Zyrtec, Claritin dissolved the quickest and the most efficiently. But according to the research I had done, the main drug in the decongestant known as Loratadine is known to take affect slowly in the human body compared to Zyrtec. This decongestant took the longest to dissolve but is known to take affect quickly in the body because of the drug Cetirizine.

So although my results had a clear and definite outcome, it just depends whether or not you'd like something that dissolves quickly or if you'd want something that takes affect in your body quicker but takes longer to break down in your stomach.

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

196

Fair Category

L8

Project Number

2548

Title: Using Artificial Neural Networks to Diagnose Prostate Cancer Malignancy

Student Name(s): Z. Huang

Abstract:

Artificial neural networks work by simulating processes in the human brain and have been shown over again to have applications in areas such as speech recognition, natural language processing, image recognition, and other intelligent tasks. Cancer misdiagnosis is one of the largest issues of modern medicine. Inexperienced pathologists frequently misdiagnose malignancy in certain ambiguous samples from the fear of being liable for the patient's health. This is accompanied by the fact that pathologists cannot read every single pixel in an image, therefore can miss out on certain details. In this paper, research is done by neural networks to target prostate cancer, one of the deadliest and most commonly misdiagnosed forms of cancer in humans. Neural networks are a suitable candidate for prostate cancer diagnosis, and they are hypothesized in this paper to have at least a 95% accuracy rate on average. In this experiment, a Convolutional Neural Network was trained to detect four of the most common and prevalent gleason types of cancer including gleason 3, gleason 4 cribriform, gleason 4 noncribiform, gleason 5, and normal prostate glands as a control by analyzing images of biopsy samples acquired from the Urological Center at Johns Hopkins University.

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

CS ME 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

L8

Project Number

2549

Title: Brain Games

Student Name(s): J. House

Abstract:

I'm sure some of you have seen those commercials on TV that say they will help improve your brain, but do they really? Do brain teasers or riddles in general make you smarter, well that's what I was trying to find out in this experiment. My hypothesis is that exercising your brain will improve your time between the Stroop Tests by about ten seconds or so. I first found some riddles and brainteasers to test people on. I found some test subjects, adults and kids, to be tested on. I gave some of the test subjects a Stroop Test, gave them some brain teasers and riddles to try and solve, and then gave them another Stroop Test to see if they improved their time by doing these brain games. I gave each test subject a maximum of five minutes to try and complete each of the six tests. I repeated this process for the others, but instead of giving them the six tests, I allowed them to do their usual activities between the Stroop Tests. I recorded each subject's results, compared them with the other's, and came to a conclusion. 100% of people who did try the riddles, logic puzzles, and brain teasers showed more than seven seconds of improvement on the second Stroop Test, compared to the first. 83% of people who did not, showed little or no improvement. My hypothesis was correct. Brain Games did help with reaction time tests such as the Stroop Test.

Technical Disciplines Selected by the Student
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BE

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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

188

Fair Category

L8

Project Number

2550

Title: Hatch by Day, Hatch by Night:
Brine Shrimp Egg Hatching Rate With Exposure to Light

Student Name(s): T. Hoyt

Abstract:

We are interested breeding brine shrimp at our school so that we can feed them to our fish. I wanted to find out the best way to hatch them from eggs. I wondered if exposure to light affected brine shrimp hatching, since plankton tend to live at the surface of the water where there is light.

To investigate this, I exposed one container of brine shrimp eggs to light and kept another container of brine shrimp eggs in the dark and counted how many hatched after three days. I found that more shrimp hatched in the container that was exposed to light than the eggs that had not. I found an average of 21 nauplii per 3ml of water in the container that was exposed to light. The average amount of nauplii found in the dark container is 16.67 per 3ml drop of water. My data shows that if you expose the brine shrimp eggs to light, you will hatch more eggs quickly and get more nauplii to feed to your fish. This information could also be useful for people who raise brine shrimp on a commercial scale.

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

AS EM EV

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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

L8

Project Number

2552

Title: Turning Plants into Biofuel..are some better than others?

Student Name(s): D. Harrison

Abstract:

In the study of biofuel, which means how energy is created from plants, it's long been understood that biofuel is the way of the future using living organic materials that may be ending up in the regular garbage. But, there is no known knowledge about how the type of plant leaves affect the ability of combustion. The literature describes that biofuel is created by animal waste and plant material and is a safer, eco friendly energy source however there is a lack of information regarding the types of plants that are used for biofuel and if waxy and non waxy leaves change the type of combustion possible. In this science project different biomasses in the form of waxy and non-waxy leaves were compared to see how the type of material affects combustion. During this experiment waxy (ferns) and non-waxy leaves (pine needles) were burned to investigate combustion of biomass. The following results were obtained: waxy plant leaves did not catch on fire and the non-waxy leaf made a small ember causing air bubbles to appear on top of the leaf and the leaf to catch on fire while non-waxy leaves did catch on fire for period of time. Therefore, when creating biofuel it would be better to use nonwaxy leaves for the creation for biofuel because they will burn more readily. Next steps include trying to make biofuel from the plant leaves and other plants in Hartford.

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

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

142

Fair Category

LS

Project Number

3001

Title: STOMPING STIGMAS ASSOCIATED WITH CLINICAL DEPRESSION

Student Name(s): A. SMITH

Abstract:

Clinical Depression is a mental illness that affects all ages and gender groupings. By definition, depression is severe feelings of dejection and despondency. There are numerous stigmas associated with this disease, such as that it is “fake” and those who have been diagnosed “can just get over it”. Several studies have been completed to analyze the effects of these stigmas, and how they make depressed people feel embarrassed about their illness. This study is being conducted to determine what high school students know about depression. It was hypothesised that by gaining knowledge about how clinical depression affects the brain, people will be more aware that it is an objective and provable illness. Once this research study is completed, it is expected that it will create awareness towards this illness. Furthermore, it will aid to stomping out the stigma associated with Clinical Depression.

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

ME BE 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

270

Fair Category

LS

Project Number

3002

Title: The Optimization of Nanoparticle-based Drug Delivery of Melittin in a Colloidal Suspension as A Selective Method to Target HIV Structural Antigen p24

Student Name(s): S. Sathish

Abstract:

The HIV-1 strand of the human immunodeficiency virus is an evasive retrovirus due to its ability to invade a cell and use the outer membrane to multiply and invade other cells. The p24 capsid protein that protects the RNA plays an important structural role in transporting the multiplied virus as it leaves the phospholipid bilayer. Previous studies have shown that melittin, a peptide found in bee venom, has the ability to selectively target p24 and other primary structural components of HIV that are found on the cell surface during replication. This research will investigate if melittin, introduced via a Fe₃O₄-Citric acid nanocarrier (CA-NP), will act to target HIV p24, thus inhibiting replication of the virus. First, CA-NPs were synthesized according to Racuciu, et al., with minor modification. Following confirmation of CA coating and NP size via FTIR and SEM, 130mg CA-NPs were immersed in 250µl of 2-10µM melittin (in 0.1M KCl) for 12hours peptide loading. Following centrifugation, the solid melittin-CA-NPs were re-suspended in di-water for use on simulated HIV-cell phospholipid bilayers (cpbs), created using an electroformation chamber (3Hz, 2Vp-p). To simulate HIV-cell targeting, 5ul melittin-CA-NPs were introduced to cpbs composed of 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC) and p24. Using p24 selective ELISA at 450nm, results demonstrate that the introduction of 0.05µM melittin caused a 20% decline in p24 expression (8.51ng/ml to 6.89ng/ml), while "normal" cpbs containing only DOPC were unaffected. These results highlight the success of CA-NP as a nanocarrier for melittin, which in turn was selective in disrupting HIV replication.

**Technical Disciplines Selected by the Student
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CB MI

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- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project Number

3003

Title: A Polymorphism in Mertk Associated to the Risk of Contracting MS

Student Name(s): A. Dixit, N. N/A, N. N/A

Abstract:

Multiple Sclerosis (MS) is a debilitating and incurable disease that inflicts 2.5 million people globally. A polymorphism in a gene called Mertk, also known as MER proto-oncogene receptor tyrosine kinase, has been studied and associated with MS due to its role in the inhibition of inflammation. People with the inactivating polymorphic Mertk gene rs55792453 may have a higher risk of developing MS. It's known that MS incidence varies among various ethnicities. The hypothesis was that different ethnicities may have a higher frequency of Mertk gene mutations, and thus enhance the risk for developing severe MS. The 'Thousand Genomes Project' provides information on the incidence of the inactivating mutation of Mertk in 5 major ethnicities. The global database to reference the epidemiology of MS cases is found in the Atlas of MS by the MS International Foundation. Analysis suggested the hypothesis was supported. With a less percent of polymorphic gene Mertk, the risk of contracting MS decreases. For example, the East Asian population had the least percentage of Mertk (10%), and they also had the least percentage of MS cases (0.002%). The same trend goes for Europeans with 26% of Mertk and the South Asians with 35% Mertk respectively. However, epigenetics may also play a significant role. By knowing whether certain individuals tend to have a higher chance of developing people, such as higher risk Africans, they can start taking a proactive role to avoid the development of MS such as regular screenings and a lifestyle change.

Technical Disciplines Selected by the Student
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ME MI

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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

262

Fair Category

LS

Project Number

3004

Title: Battling Honey Bee CCD via Reduction of Neonicotinoid Content in Guttation Droplets using Biochar Soil Additives

Student Name(s): D. Woo

Abstract:

Colony collapse disorder (CCD) continues to threaten honeybee populations and agriculture worldwide. Much research regarding CCD has pointed to neonicotinoids as having a significant role in this honeybee disorder. In particular, research on guttation water of corn plants grown from neonicotinoid-coated seeds suggests that these droplets may contain enough pesticide to cause honeybees to become disoriented, or die instantly. Biochar, a charcoal-like powder formed from oxygen-free carbonization of biomass, has been shown to stimulate growth properties of soil, and is highly absorbent. This research investigates (i) whether imidacloprid gathers within the guttation water of *Draccaena deremesis* (corn substitute), when systemically introduced into the soil, and (ii), whether the addition of 10% Biochar soil additive acts to sequester systemically applied imidacloprid. To mimic field pesticide application, 30ml water containing 100ppm imidacloprid was introduced to (20each) normal and 10%Biochar *Dderemesis* plants on alternate days, so that a total of 12mg imidacloprid was added to the soil in 1week. Guttation droplets were collected on opposing days; HPLC analysis indicates that the pesticide migrated to the guttation water after 3days, reaching 46.4ppm after 1week. For those plants with 10%Biochar, imidacloprid content in guttation water was 90% less; 5ppm. To mimic the pesticide coating of corn, 0.5mg imidacloprid was inserted into (20each) normal and 10%biochar plant soil, followed by normal watering. On day3, normal-soil plant guttation water contained 16ppm imidacloprid; those with 10%biochar contained only 0.33ppm. These and previous results underline that without biochar sequestration, guttation water imidacloprid content can reach 382% of the initial soil/seed/watering content.

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

EM

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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

171

Fair Category

LS

Project Number

3006

Title: How Does UV Light Affect the Lifespan of Bacteria?

Student Name(s): M. Schroeter

Abstract:

The purpose of this experiment was to see what type of UV light (UVA, UVB, or UVC) is the best at killing bacteria.

The procedure that I used was to grow three types of nonpathogenic bacteria (Staph, Strep, and E coli) in petri dishes with agar. I kept each petri dish in the incubator for six days in total but took them out briefly on the third day to take a photo and test each with the three types of light. At the end of six days, the bacteria were brought out to take another picture.

I gathered my data by comparing the before and after pictures. My results indicate that each light managed to kill the bacteria after varying amounts of time spent underneath the light.

I concluded from my observations that all three UV lights are effective in killing bacteria by damaging their DNA which prohibits further growth. However, UVC was the most effective. It would be interesting to perform additional trials to see if my results are reproducible.

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

MI 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

251

Fair Category

LS

Project
Number

3007

Title: Cancer Cells Invasion into the Stroma

Student Name(s): S. Raghavan

Abstract:

Cancer cells are known to originate at one organ, invade through tissue, enter the blood vessels and spread to different parts of the body. It is still not clear if the invasion occurs at steady rate or varies with time. In the present study, using endometrial cancer cells in an in vitro model, images were captured by my mentor that show the process of cancer cell invasion into the surrounding stroma at regular intervals over a period of 18 hours. Using ImageJ software, both the distance traveled (in μm) and the area (in μm^2) occupied by cancer cells at various time points were measured. Measurements were taken at four different points for each time interval and averaged. The rate at which the invasion of cancer cells travel was calculated as the distance over time and expressed as $\mu\text{m}/\text{hr}$. The results show that, after a fast acceleration in the rate of invasion into the stroma in the first hour, speed started to decelerate. Although the distance traveled by cancer cells into the stroma increase with time (7.2 μm at 2 hours and 7.7 μm at 18 hrs.), the rate of invasion varies. There was a sudden increase in speed of cancer cells at 2 hours (0.08 $\mu\text{m}/\text{hour}$) and gradually slowed to 0.03 $\mu\text{m}/\text{hour}$ at the end of 18 hour time point in the experimental set up in this study. The results obtained may vary in different cancers and sub types within a cancer originating from the same organ.

Technical Disciplines Selected by the Student
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CB ME MI

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- Yes No

CSEF Official Abstract and Certification

Word Count

228

Fair Category

LS

Project Number

3008

Title: Investigating the Proteolytic Effect of Serine Protease Esp Against Staphylococcus aureus on Glass and Stainless Steel Surfaces

Student Name(s): T. Kajita

Abstract:

Staphylococcus aureus, a highly infectious bacterium, has developed resistance to commonly used antibiotics, such as methicillin. Methicillin-resistant Staphylococcus aureus (MRSA) cells have the notable characteristic of clustering in a matrix of extracellular proteins, allowing them to adhere to and colonize on hospital equipment and furniture. This research investigates the effect of serine protease Esp (spEsp), an enzyme shown to selectively degrade 11 proteins essential to biofilm formation, on S. aureus biofilm formed on stainless steel and glass surfaces. Stainless steel washers (12mm) and glass microscope coverslips (8mm) were selected to simulate contact surfaces where S. aureus biofilms are commonly found. MRSA-10 cultures were grown atop these materials within a sterile 24-wellplate format; for those wells where spEsp was added, 2.5ul of 0.9 mM Esp extract was added to the culture at the onset of growth. To quantify biofilm inhibition by spEsp, 100µl of 0.1% crystal violet stain (in 2M Acetic acid) was added to each well after 1 week of growth, and the absorbance at 550nm was measured. Those glass and metal samples that contained spEsp demonstrated reduced biofilm formation when compared to those where no enzyme was added. Specifically, the addition of spEsp produced 50.8% biofilm inhibition on glass, and 54.5% biofilm inhibition on stainless steel. By suppressing the formation of MRSA biofilm, the cells' ability to colonize hospital equipment can be significantly limited.

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CB BI MI

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- Yes No

CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project Number

3010

Title: Densities of Phytoplankton in an Acidic Ocean

Student Name(s): M. Switz

Abstract:

The purpose of this experiment was to determine what cell concentration of Tetraselmis PLY429 is most effective in increasing the pH of an acidic ocean. Through photosynthesis, phytoplankton should be able to reverse the effect of ocean acidification. The procedure tested Tetraselmis PLY429's ability to reverse ocean acidification at its naturally occurring density, 103cells/L, and two higher densities, 104cells/L and 105cells/L. A control without phytoplankton augmentation was also conducted. The three densities and control were tested in two environments. The first environment, pH 7.7, replicated the ocean's current pH and the second environment, pH 7.2, replicated the ocean's pH in 100 years. The experiment was monitored for 24 hours because after this time it is likely densities will change. The results show that pH increases are directly proportional to increases in phytoplankton densities; on average, environments with the highest densities increased pH by 0.5465 units more than environments with the lowest densities. Furthermore, environments designed with a lower starting pH, aimed to replicate the ocean in a century, showed average pH increases 0.109 units greater than environments designed with a higher starting pH. The analysis of the variances with an alpha of 0.05 proved that the relation between higher phytoplankton density and increased pH was significant. Thus, the augmentation of phytoplankton appears to be a viable way to combat ocean acidification now and in the future. Additional investigations concerning the effects of phytoplankton augmentation over lengthened times should be conducted to further determine the ecological effect of this method.

Technical Disciplines Selected by the Student
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EM EV MI

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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

258

Fair Category

LS

Project Number

3012

Title: Selective Improvement of Anti-Cancer Drug Sensitivity via D-Glucosamine Inhibition of STAT3 Oncogenic Expression

Student Name(s): M. Zhou

Abstract:

While chemotherapy continues to be a popular treatment for cancer patients, up to 90% of metastatic prostate, lung, or breast (PLB) cancer patients may develop resistance to the drugs used. There are many factors that can contribute to resistance, including STAT3, a transcription factor that is prominent in many different cancers and regulates the expression of pro-proliferation and anti-apoptotic genes. Fortunately, scientists have recently discovered that glucosamine, an amino sugar used to treat arthritis, could potentially limit the expression of STAT3 in cancer cells. This research seeks to combine glucosamine with chemotherapy drugs, namely docetaxel and dasatinib, to improve the efficacy of treatment. First, glucosamine (1-8mM) was added to prostate, breast, and non-small cell lung cancer cells. MTT assay results indicate that increasing concentrations of glucosamine reduced cancer cell growth by 65%/39%/33% for PLB cancers, respectively. To measure glucosamine improvement in chemotherapy treatment, 2mM glucosamine was added to 0.25nM docetaxel for each cancer-cell type. PLB cancer cell growth was further reduced by 79%/62%/6%, relative to chemotherapy treatment alone. Similarly, addition of 2mM glucosamine to 0.2μM dasatinib increased chemotherapy effectiveness by 16%/63% for lung/prostate cancers. Finally, to correlate glucosamine's reduction in cancer cell growth with STAT3 expression inhibition, a pSTAT3-specific ELISA was conducted. Addition of 4mM glucosamine to dasatinib or docetaxel reduced pSTAT3 expression in prostate cancer by 29% and 42%, respectively, in comparison to the drugs alone, providing direct evidence that singular and synergistic inhibition of cancer cell growth is tied to glucosamine's targeting of STAT3 expression.

Technical Disciplines Selected by the Student
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ME BI CH

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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

261

Fair Category

LS

Project Number

3013

Title: Assessing the Efficiency and Ecological Impact of Various Anti-fouling Methods

Student Name(s): E. Kane

Abstract:

Biological fouling, the accumulation of sedentary aquatic micro and macro organisms on submerged surfaces, is a substantial problem faced by the shipping, and aquaculture industries, as well as any water-intake systems, and various ecosystems. In order to combat biofouling, anti-fouling techniques, primarily anti-fouling paint, are used. I studied copper based paint, zinc(ZPT)-based paint, and a weekly fresh water “pressure washing”. Four 4 square-foot fiberglass panels were respectively painted with copper, painted with ZPT, and pressure washed weekly, and suspended approximately 5-feet underwater in Pine Island Marina for upwards of a month, in addition to a blank control piece of fiberglass. The rate of fouling growth, measured in biofouling mass, percent coverage, and biodiversity, was used to determine the efficiency of the respective method. The second part of my experiment focused on the ecological impact of each method tested, using a lethal concentration test on Daphnia, a test which determines the required concentration of a chemical, using different tested concentrations and a line of best fit, in order to be lethal to 50% of a species population. My findings indicate that a ZPT-based paint, with only 37.2g of biomass, has the greatest efficiency at preventing aquatic growth, followed by copper with 57.2g, and pressure washing third, with 126.7g, still less than the control’s 230.3g. ZPT also had a measurably higher lethal concentration, 0.25mL/L*2Hr and therefore, a lower toxicity, as opposed to that of copper, 0.21mL/L*2Hr. ZPT-based paint proved to be the most effective and most ecologically sound biofouling method.

Technical Disciplines Selected by the Student
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EM EV 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

240

Fair Category

LS

Project Number

3014

Title: Groundwater Effect and Correlation to Organic Carbon Levels in Soil

Student Name(s): K. Sun

Abstract:

This project in its present form is the results of comparing the depth to groundwater and the percent of organic carbon in the soil. The initial idea was to determine the effect of groundwater on the release of CO₂ from soil. Data collecting failure resulted in the formulation of the depth to groundwater and its correlation to the organic carbon percent in soil. The depth to the groundwater data was obtained from the US Geological Survey (USGS), which compiles data from wells across the country. Before running the analysis, it seems as though there are varying numbers across the country. These points were picked with no particular order or reason, just to try to get data from all aspects of the country. There were 25 point used in this analysis, and their longitude and latitude were recorded and as closely matched as possible to the pedon database. The organic carbon levels were obtained from the National Cooperative Soil Survey Soil Characterization Data (NCSS). They conducted pedon samples from across the globe and used the Walkley-Black method to find the organic carbon level at different depths. The data used in this project was from a depth of 4-7 cm, and is presented as a percent. As the project presents itself now, there seems to be no correlation between these two data sets, and therefore no influence on each other. There will be further analysis to support the lack of correlation.

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

EV CH 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

251

Fair Category

LS

Project Number

3015

Title: Examining the effectiveness of phytoremediation of heavy metals in water using *Elodea Canadensis* and *Brassia Juncea*.

Student Name(s): J. Siveyer

Abstract:

As a result of industrial and agricultural activity, heavy metals have contaminated the food chain. The contamination spreads extensively and is difficult and expensive to remove. Heavy metals can then cause serious health problems to humans and animals. An effective and environmentally-friendly way to decontaminate affected areas is required.

This experiment used living plants *Elodea Canadensis* (grows in water) and *Brassia Juncea* (grows in soil) to remove heavy metal pollution from water. Copper was chosen as a representative heavy metal because it is safer to handle than other heavy metals. The hypothesis is that the plants will absorb/adsorb the copper from the water source.

The plants were grown in clean unpolluted soil and water. A quantity of copper sulfate pentahydrate, which was mathematically calculated, was mixed in water to achieve 4ppm of copper. Plants were split into 20 different batches, the root system cleaned and then replanted in individual containers with identical quantities of polluted water. Simultaneously control batches with no plants or pollutants were prepared. The plants were left to grow and regular tests were made to see what changes in the level of copper occurred. The copper pollution in the water was reduced by approx. 50% within a few hours. Statistical analysis of the results shows that during the 3 week study, pollution was reduced by 75% – 87%, dependent on the plant type. The data proves the hypothesis for removing heavy metals through phytoremediation.

This could potentially be duplicated at a larger scale for real world application.

**Technical Disciplines Selected by the Student
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PS EM EV

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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

255

Fair Category

LS

Project
Number

3016

Title: An Evaluation of the Accuracy of a Nanoribbon Microfluidic System to Measure Cytokine Concentration

Student Name(s): L. Low

Abstract:

Identification of an efficient method for ultra-sensitive protein detection is necessary in advancing clinical diagnosis, high-throughput screening, and recognition of potential biomarkers to assist in drug development. Advancements in technology through the use of nanoribbons would provide the potential to accurately identify proteins at picomolar (pM) concentrations in a time and cost efficient manner.

Silicon nanoribbons, narrow strips of highly sensitive, low electrical noise transistors, provide potential advantages over currently available detection methods. A primary objective of this project was to compare the nanoribbon detection system, pH meter, and optical detection of IL-1 β (interleukin 1 β) at various concentrations ranging from 0pM to 7.8125x10⁴pM. Four comparative experiments were conducted: (1) a PDMS (Polydimethylsiloxane) well plate ELISA (Enzyme-Linked Immunosorbent Assay) with HRP (Horse Radish Peroxidase) and optical detection; (2) a PDMS well plate ELISA with urease and pH meter detection; (3) a PDMS well plate ELISA with urease and pH sensitive nanoribbon readout; and (4) an ELISA with urease and nanoribbon readout method combined in a microfluidic assay.

In non-nanoribbon readout experiments, an expected increase in absorbance and pH were observed at increasing concentrations. Furthermore, in both nanoribbon readout experiments, an increase in the surface potential as a result of increasing IL-1 β concentration demonstrated successful voltage steps.

The nanoribbon system, while still early in development, holds promise as a sensitive method for detection of proteins such as IL-1 β and other cytokines. Further studies to improve the sensitivity by reducing drift and noise would enhance the development of this system.

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

EE AT 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

108

Fair Category

LS

Project Number

3019

Title: The Health of Bermuda's Coral Reefs Based on Biodiversity Analysis

Student Name(s): A. Viton

Abstract:

Reefs in Bermuda are being taken over by turf algae and it is hurting the biodiversity of corals. In the location of study, the coral on the reef was not as diverse as it appeared to be. The coral biodiversity falls at only a 1.098 (out of 4) on the Shannon's biodiversity Index. It was found that 65.8% of the organisms (not including fish species) were turf algae, while only 31.1% were living corals. The percentage of corals should be much higher, this study shows how much the turf has begun to dominate the coral reefs in Bermuda and how the coral population is suffering because of it.

Technical Disciplines Selected by the Student
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EV EM AS

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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

231

Fair Category

LS

Project Number

3020

Title: Protein Markers of Peripheral Blood Mononuclear Cells

Student Name(s): U. Dubovik

Abstract:

Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death worldwide, but specific therapies are limited. In addition to aging, cigarette smoke exposure (CSE) is the most common risk factor for COPD. This study was done to determine the properties of the cells, the cell surface, and intracellular protein markers on peripheral blood mononuclear cells (PBMC) isolated from never smokers, current smokers, and former smokers with COPD. To accomplish this, a CyTOF machine was used, which utilizes a mass spectrometry technique based on inductively coupled plasma mass spectrometry. The blood samples of smokers, non-smokers, and former smokers with COPD were run through the CyTOF machine which marked the PBMCs. Currently there is insufficient data to formulate a conclusive statement. However, the present data points towards the fact that MIF-CD74 is critical in protecting against COPD and that its augmentation to those with COPD will be therapeutic. To further support the validity of this conclusion, additional data is being gathered and analyzed. This research is a valuable addition to the quest for the cure of COPD. This disease impacts an immense section of the world's population and yet has no definite cure. Therefore, by supporting the hypothesis that MIF-CD76 augmentation will be therapeutic, it opens up another possibility towards aiding the afflicted. Thus, this research may help find a cure, or at least a more effective treatment.

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

ME CB 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

243

Fair Category

LS

Project Number

3022

Title: Examination of Mere Proximity and Race in Adults Focusing on Intelligence and Wealth/
Social Standings

Student Name(s): M. Dolberry

Abstract:

Children's social evaluations are impacted by many factors, but most research studies the influence of race and proximity. Children ages of 5 through 10 years old associate traits and judge individuals based on the people they have associated with. This experiment was designed to determine if race and mere proximity effect traits associated with any one individual. In this experiment, a group of college students were selected to take a survey displaying a series of three pictures and instructed to focus on the subject in the middle of the three pictures. For each set, three questions were asked that could be answered on a likert scale. The two variables in the experiment were the occupation and race of the subject pictured. One set used pictures of doctors and focused questions on perceived intelligence and capability, while the other used pictures of businessmen/women with questions that focused on perceived wealth and respect. The order in which the subjects were presented varied between four sequences of race: 1) Black, Black, Black 2) White, White, White 3) Black, White, Black and 4) White, Black, White. It was predicted that results would show a general white bias and support the idea of mere proximity. These results are significant because they contribute to the knowledge the psychology community about the legitimacy of mere proximity and to the field of Developmental Psychology. Future research should expand this study to compare age groups in order to determine whether there's a trend.

**Technical Disciplines Selected by the Student
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BE

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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

184

Fair Category

LS

Project
Number

3023

Title: Using Eco-friendly Acids to Accelerate the Decomposition of Polystyrene

Student Name(s): J. Hyland

Abstract:

Humans fill up more precious space in landfills everyday. The more space people use to bury trash, the more severe the environmental effects will become. This experiment was conducted to try to find an eco-friendly method of dealing with polystyrene, a plastic that takes up a lot of space in these landfills. Four solvents were tested on their ability to dissolve polystyrene over a 20 minute time period. Styrofoam was cut into pieces that each weighed 0.1 gram and placed into 20 mL of solvent. The solvents included were: water, 100% acetone nail polish remover, lemon juice, and limonene. One piece of Styrofoam was put into each glass. When that piece was almost completely dissolved, another piece of Styrofoam was dropped in. This process was continued for twenty minutes. Also, the experiment was run two more times to validate the results. Lemon juice and water were both unable to dissolve even one piece of Styrofoam. Acetone dissolved an average of 1.43 grams and limonene dissolved an average of 1.2 grams. While acetone dissolved the most polystyrene, limonene is the most eco-friendly solution.

Technical Disciplines Selected by the Student
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EM CH 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

250

Fair Category

LS

Project
Number

3024

Title: An Application that Takes Notes Reliably for Full Student Engagement in a Teacher's Lecture

Student Name(s): M. D'Ostuni

Abstract:

During course lectures, students' cognitive processes are expended on note taking, reducing their ability for conceptual comprehension, connections to overarching theories, and formulation of clarifying or philosophical questions. This same principle applies to occupational and daily life. To simultaneously encode and retrieve in the brain presents students with a difficult task. Last year's project focus included researching note taking requirements and existing applications, while designing a more intricate application with functions necessary during active note taking. This current year, additional research on active versus passive note taking, necessitated a slight design modification for greater learning and long-term retention results. Throughout application development, code was created and adjusted for each requirement - ability to highlight and touch words to view definitions, take pictures to appear within notes, type spoken words, and inform end users how to enhance learning. The highlighting, typing words spoken and adding pictures sections have been written. The dictionary function is currently being written. The function compiling the application layout is in design phase. Numerous bugs continue to be fixed and discovered with each new version of the application, similar to software company update releases. This application takes notes passively word for word, allowing students to divulge in beneficial cognitive processes during lectures. Afterwards, the capability of highlighting and defining directly in the document aids users in deeper understanding of complex material. A connection between the passive notations of the application and critical thinking of users provides a crossover which can be utilized by most businesses which exists.

**Technical Disciplines Selected by the Student
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CS AT

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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

250

Fair Category

LS

Project Number

3025

Title: Orchids and Dandelions: Testing Differential Susceptibility in Children from Different Backgrounds

Student Name(s): S. Kwon

Abstract:

In research on human development, children's "difficult" temperament style has traditionally been thought of as a point of vulnerability. Specifically, prior research has consistently found that children with difficult temperaments tend to be at risk when it comes to social and academic skills in contrast to children with "easy" temperaments. However, an emerging theory in child development called Differential Susceptibility reframes our understanding of difficult temperaments from being a factor of vulnerability to one of plasticity: that is, some children's brains are more plastic than others, and therefore they are more sensitive to their social experiences than other children, for better or for worse. In light of differential susceptibility theory, this study will examine whether children's temperament, a characteristic that is thought to be innate in the child, is related to parental sensitivity. In prior research, most studies find that parental sensitivity—a type of parenting in which the adult is attentive and warm toward the child—is a strong predictor of children's social, emotional, cognitive, and physical development. However, according to the differential susceptibility theory, some children will benefit from sensitive parenting more than others. This study will examine whether children's temperament moderates the relation between parental sensitivity and children's social and academic skills. That is, if some children have a temperament style that makes them more susceptible to their parental support, will they demonstrate more gains in social and academic competence than children with a temperament that enables them to be much less sensitive to their parental scaffolding?

**Technical Disciplines Selected by the Student
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BE

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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

225

Fair Category

LS

Project Number

3026

Title: Evaluating the Volume Lost in Cylindrical vs Rectangular Packaging

Student Name(s): K. Baker

Abstract:

This project outlines packaging and the immense amount of wasted space in shipping containers due to cylindrical packaging. My investigation aims to determine how packaging companies can optimize their shipping methods in order to increase the efficiency at which their products are sold and distributed. By introducing a rectangular design, the currently popular cylindrical containers will be seen as obsolete. In an area with dimensions of 1 ft by 1 ft by 1 ft, for example, a rectangular container would be able to fill up the entire space. A cylindrical can, on the other hand, would only be able to fill up about 79% of the available space. When using rectangular containers, it will be expected of companies to charge proportionately more for their products due to the volume increase of about 127%. Containers are usually packaged in boxes, which are loaded onto pallets then into a ship or truck for transportation. As discussed further within the project, the substitution of rectangular prisms for cylinders has an immense impact on the modern day shipping industry. Although the surface area of a rectangular prism is slightly larger in comparison to a cylinder of the same dimensions, there are ways for a company to maintain, if not increase, their profits. This project provides information that may assist in the future of the shipping and distribution industries.

Technical Disciplines Selected by the Student
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EN PS EA

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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

214

Fair Category

LS

Project Number

3027

Title: Bioaccumulation of Total Mercury in the Poquonnock River System and its Implications for Local Fisheries

Student Name(s): K. Ashbey

Abstract:

Total mercury (HgT) is a highly toxic element that can be found both naturally and introduced to an environment as a contaminant. The bioaccumulation of HgT causes various health issues in both humans and marine organisms, however they have to date not been a point of emphasis in the monitoring of coastal ecosystems. Samples of sediment, American oyster (*Crassostrea virginica*), blue crab (*Callinectes sapidus*), and green crab (*Carcinus maenas*) were collected at replicated sites across the Poquonnock River system in Groton, CT, in order to determine if there is in fact evidence of bioaccumulation of HgT. Samples were homogenized and a DMA-80 was used to determine HgT concentrations. Results showed a more than seven fold increase in HgT concentrations from sediment to oyster population (29.608ng/g vs. 215.846ng/g). The HgT concentration in the crab species was high, but did not correspond with the overall pattern of bioaccumulation; various literature suggests that this is due to the crab's migratory habits, which is why the highest level (495.74ng/g) was found at the mouth of the river. There is evidence of bioaccumulation, and if not controlled the levels will only become more dangerous. Mercury levels are threat to the humans who consume marine organisms that have been exposed to biomagnified levels of this contaminant.

Technical Disciplines Selected by the Student
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EM EV

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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

226

Fair Category

LS

Project Number

3028

Title: An Investigation into the Effects of Bivalves on the Eutrophication of Ocean Waters

Student Name(s): A. Cloud

Abstract:

Still today, in many parts of the world, untreated sewage water is discharged into the ocean. This can lead to serious effects on marine and human life, as well as eutrophication. The installation of an affordable technique that rids water of harmful microorganisms and eutrophication-promoting nutrients such as phosphate and nitrate, would be monumental in the effort to rid our oceans of harmful toxins. By using the bivalve *Crassostrea virginica*, commonly known as the Atlantic oyster, it is possible to significantly reduce the number of pollutants found in ocean water due to their use of “filter feeding.” Filter feeding is a method of separating bacteria and phytoplankton from the rest of the water, consequently removing harmful pollutants in the process. Through altering the number of oysters in a single tank, it is evident that the presence of phosphate, nitrate, and bacteria is inversely proportional to the number of bivalves present. Using only 9 oysters, the levels of phosphate in a tank of ocean water decreased by 44% while the turbidity decreased by 66%. This information can be applied globally through the use of oysters in water filtration systems. Not only would it assist in efforts to restore a rapidly declining species, but the implications of this experiment suggest that it can reduce the astounding number of deaths due to diseases related to water pollution worldwide.

Technical Disciplines Selected by the Student
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EV EM AS

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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

267

Fair Category

LS

Project Number

3029

Title: Non-Invasive, Low-Cost Diagnosis of Atherosclerosis via Tattoo-Based Iontophoresis of Macrophage-Targeting Silver Nanoparticles

Student Name(s): W. Yin

Abstract:

Atherosclerosis causes nearly one-third of all deaths in the developed world. Unfortunately, atherosclerosis commonly remains asymptomatic for decades, and is properly diagnosed only after a severe, life-threatening cardiac event. Proactive patients are frequently deterred by the high-cost and low-efficiency of existing methods for early detection. This work details the fabrication of a cost-effective and portable bidirectional tattoo-based system for the detection and quantification of atherosclerosis progression. The system utilizes human immune response in order to quantify macrophage concentration in the bloodstream via the transdermal iontophoretic administration of spermine-silver nanoparticles (spAg-NPs). In clinical usage, the patch is placed on the skin directly above the carotid bifurcation, where plaque quantification/diagnosis accuracy is significantly higher than existing tests (CIMT-ultrasound). On skin, an iontophoretic, constant-current circuit is allowed to run for 15min for spAg-NPs to enter the interstitial fluid matrix. The patient then waits 30min for macrophages within the body to engulf a portion of the spAg-NPs. A second patch is applied on the same location; remaining spAg-NPs are extracted via a reversed-current (reverse iontophoresis) for 15min. A spermine group of spAg-NPs reacts with amine oxidase on the patch to produce H₂O₂, which then electrochemically reduces Prussian-Blue to Prussian-White, to catalyze the reduction of H₂O₂. Current produced is measured to determine concentration of spAg-NPs, and thus the concentration of macrophages in the bloodstream, which correlates directly with progression of the atherosclerotic plaque. This novel diagnostic system is also promising in the diagnosis and treatment of tuberculosis, HIV, and cancer via macrophage targeting.

Technical Disciplines Selected by the Student
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ME EN EE

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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

247

Fair Category

LS

Project Number

3030

Title: Using the Physiological Energetics Model to Study the Effects of Contaminating Microscopic Plastic Particles on Blue Mussel, *Mytilus edulis*

Student Name(s): C. Herrick

Abstract:

There are many products, such as cosmetics and toothpaste, which contain microscopic plastic polystyrene divinylbenzene microspheres, also referred to as “microbeads” or “beads”. Microbead remnants end up in the water supply leading to detrimental health effects of marine life. The discovery that 8 trillion microbeads per day are “admitted into aquatic habitats in the United States” has prompted the passing of a federal bill in the United States banning microbeads beginning on January 2018.”

The goal of this experiment was to measure the physiological traits of the blue mussel, *Mytilus edulis*, to determine if there were detrimental effects of plastic pollutants. A physiological energetics model, which included digestion, respiration and ammonium excretion, was used to determine the impact of microspheres, composed of polystyrene divinylbenzene. In each experiment, mussels were exposed to one of three diet treatments “diet”, “diet and beads” and “beads” and were fed every two hours for duration of 12 hours. Rates of excretion and respiration were standardized to 1 g of dry tissue mass using the equation given by Bayne and Newell (1983).

Mean absorption efficiency (AE), a measure of the energy taken up from the ingested food, was different between the mussels given “diet” only (73.60%) and “diet and beads” (55.63%) and “beads” only (16.73%). No large difference in the oxygen consumption or ammonia excretion of mussels were found between treatments. The findings suggest microbeads affect energy uptake in mussels but do not have a negative effect with oxygen consumption or ammonia excretion.

**Technical Disciplines Selected by the Student
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EV MI 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

194

Fair Category

LS

Project Number

3031

Title: Membrane-bound receptor genes' roles in osteosarcoma tumorigenesis

Student Name(s): S. Perry

Abstract:

The purpose of this study is to independently validate if four genes lead to the initiation and progression of osteosarcoma. These genes include LEPR, FUT6, PDDC1 and AVPI1. All four are membrane-bound receptor genes. By gaining knowledge about the effect these genes have a therapy to target these genes that is less harmful and more effective than chemotherapy, the current osteosarcoma treatment, could be developed. Knowledge of any differential expression of these genes could also help to identify osteosarcoma. In order to preform this study, laser capture microdissection was used to isolate homogenous bone cells, tumor and non-tumor. These cells were then prepped for quantitative polymerase-chain-reaction, qPCR, using isolation, lysis, reverse transcription, and pre-amplification. Signals for the four genes were tested in the qPCR. The results were then compared between tumorous and non-tumourous cells. The study was ultimately looking for some correlation between a difference in gene expression and the cell type. Large differences in the expression of a gene could signify a gene's involvement in the development of a tumor. Throughout the study samples were taken from multiple osteosarcoma tumors to gather more reliable and applicable results.

Technical Disciplines Selected by the Student
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CB ME MI

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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

214

Fair Category

LS

Project
Number

3032

Title: Bioencapsulation of Vitamin D3 In Brine Shrimp to Determine the Shrimp's Efficacy As A Delivery Mechanism

Student Name(s): M. Metro

Abstract:

Bioencapsulation is an efficient delivery candidate for supplementing animal feed with macro and micro nutrients and antibiotic therapies. This project is investigating the bioencapsulation of Vitamin D3 with brine shrimp to determine the shrimp's efficacy as a delivery mechanism. If bioencapsulation in this specific case is beneficiary then it can be used in other areas of not only animal feed but also for human consumption of nutrients and antibiotics. Brine shrimp were placed in a range of vitamin D3 concentration solutions. The concentrations include a control without Vitamin D3 , and test trials with 20 mcg, 40mcg , and 60 mcg of Vitamin D3, with an exposure time of 48 hours. The shrimp were analyzed to establish the maximum sorption concentration. Data induces that there was a presence of vitamin D3 found in the bioencapsulated brine shrimp. In the FTIR scan for vitamin D3 the major peak is found at 1059.55 cm-1 representing the functional group alcohol C-O; likewise a similar peak was found in the bioencapsulated brine shrimp. The bioencapsulated brine shrimp which are found to have the highest concentration of vitamin D3 will be fed to lobsters. To validate the metabolic sequestration of the vitamin D3 future research should include testing the lobster fecal material for determining the vitamin D3 sorption rate.

**Technical Disciplines Selected by the Student
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AS EN

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- Yes No

CSEF Official Abstract and Certification

Word Count

268

Fair Category

LS

Project Number

3033

Title: Open-Wound Administration of Coagulant and Antibacterial Therapeutics via CaCO₃ Microparticle Self-propulsion

Student Name(s): M. Woo

Abstract:

The cessation of severe bleeding caused by hemophilia, severe nosebleed, surgical procedures, or wound trauma is often challenging, due to the difficulty of delivering therapeutics deep into the tissue, against the force of flowing blood. A self-propelled drug delivery method that can spontaneously deliver coagulant and antibacterial agents is highly desirable, to achieve rapid, infection-free hemostasis. Recently, CaCO₃ microspheres have received attention as a possible model for self-propelled drug delivery, as the spheres are hollow, and can house therapeutics that are immediately delivered upon dissolution of the salt in blood. In this research, a new open-wound drug delivery system, consisting of thrombin (a coagulant) and phloxine-B (an antibacterial) loaded, self-propelled CaCO₃ microspheres, was designed. Spherical CaCO₃ microparticles were formed via rapid mixing of CaCl₂ and Na₂CO₃; uniform size of 1µm was determined via SEM. Using mutually exclusive fluorescence properties of phloxine-B (488/560nm) and thrombin (380/445nm), the loading capacity of each drug was determined to be 10.72µg/mgCaCO₃ and 5.80µg/mgCaCO₃, respectively. Following drug loading, FTIR analysis confirmed that both reagents were housed within the microspheres. To simulate release of the therapeutics in a simulated blood environment, equal masses of loaded-CaCO₃ microsphere and hydrogenated-tranexamic acid were mixed in a saline solution. Following self-propulsion, 8.73ug/mg phloxine-B and 2.59ug/mg thrombin were delivered, representing 81% & 45% delivery efficiency, respectively. Loaded-CaCO₃ microsphere bubble size and velocity were measured via slow-motion imagery. Bubble size ranged from 200-450µm, while velocity (6-10mm/s) was dependent on bubble size, allowing for continual, "up-stream" delivery of drugs over the course of 2-5secs.

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

LS

Project Number

3034

Title: The Effects of Metformin Hydrochloride on Zebrafish Embryonic Development

Student Name(s): P. Patel

Abstract:

Polycystic ovarian syndrome (PCOS) is a common cause of anovulation and infertility in women. These women are incapable of ovulating regularly and as a result have irregular menstrual periods. A method of treating women with PCOS is using an oral medication called metformin. Metformin is most commonly used in patients with Type 2 Diabetes, by controlling high blood sugar in the body. Not only is metformin hydrochloride used in patients with diabetes, it is also used in women with polycystic ovarian syndrome. The use of this drug in women with PCOS has shown to reduce the rates of early pregnancy loss, preterm labor, and prevention of fetal growth restriction. Since many women experience good results from the drug when used during pregnancy, it would be interesting to see if the drug had any negative consequences in utero by using zebrafish as a model.

The zebrafish model system is one of the most commonly used organism systems and is becoming extremely popular for drug discovery. Zebrafish are easy to breed and take care of, and share a high degree of sequence and functional homology with mammals, including humans. Zebrafish embryos will be used in this experiment due to their transparency which makes it easier to see changes in their development. Since my project focuses on seeing if there will be any negative effects of the metformin on the zebrafish, factors such as heart rate and morphology will be observed.

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):

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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

3035

Title: Using Embryonic Chicken Forebrains to Visualize the Localization of L1CAM Protein Mutations

Student Name(s): E. Murphy

Abstract:

CRASH syndrome is a rare X-linked genetic disorder associated with a mutation in the L1CAM gene. This genetic disorder affects the nervous system. The L1CAM gene provides instructions for producing the L1 protein. L1 protein plays a role in the development and organization of neurons, formation of myelin sheath and formation of junctions between neurons where cell communication occurs. Mutations in the L1CAM protein interfere with the development process and lead to CRASH syndrome. Embryonic chick forebrain neurons in a culture as a model system were used to examine aspects of how L1CAM proteins function in neurons. They will be used to look at how L1CAM and L1CAM mutations get targeted, trafficked, and localized in different areas of the neuron. L1CAM is involved in directing growth of axons during nervous system development and is specifically localized to the axons of neurons. L1CAM mutations, P941L and D544N, are known to lead to CRASH syndrome. This experiment will compare the expressions of mutant L1CAM proteins in neurons and compare it to normal L1CAM to analyze if they are targeted to different areas of the neuron or have an altered expression on the cell surface. We have concluded that the P941L mutation has localized along the axon as expected. However, the D544N mutations localizes in cell soma, which was not expected. This is because the mutation likely causes the protein to change shape and get stuck inside of the endoplasmic reticulum; therefore, causing the mutation to localize in the soma.

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

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

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

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

4. Is this project a continuation? Yes No

5. 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

3036

Title: Modified Compost Leachate as a Narrow Spectrum Targeting Herbicide

Student Name(s): S. Beck

Abstract:

It is proposed that modified compost leachate (MLC) can be applied as a narrow spectrum targeting herbicide. This technique will eliminate the need for highly-toxic and environmentally hostile products. To ensure validity, all trials were performed in triplicate with a control group

and all plants were grown under iso-environmental conditions.

To evaluate the efficacy of leachate, the experimental design consisted of a control (commercial herbicide) and test groups of MCL. The herbicide characteristics are attributed to the chemical profile of the leachate. Analysis determined the profile to be composed of a Ph of 9.5, and varied Nitrite, Nitrate, and Ammonia levels relative to the concentrations. During data collections, sets three and four (commercial herbicide and modified compost leachate) of both grass and clover plants stay equal in scale. Final data sets demonstrated that both had 100% impact on grass and the commercial herbicide clover exhibited only 14.3% higher impact than the modified compost leachate. Trial 2 presented impact on clover and mixed plants when exposed to 4 ml of modified compost leachate. After the experimental period concluded, data indicated that leachate with 133% concentration had the highest impacts on its plants. This represents a 133% concentration herbicide equal in strength to commercial herbicides.

Further research will be conducted to determine the specific quantity of leachate required for the highest impact and to repeat completed trials. Data indicates the feasibility of a modified compost leachate is equivalent to that of commercial herbicides. Continued research will corroborate these findings.

Technical Disciplines Selected by the Student
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PS EM 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

109

Fair Category

LS

Project Number

3037

Title: Expansion of the Agrilus Planipennis (Emerald Ash Borer) in Northwestern Connecticut
Decreasing the Population of Fraxinus Americana (White Ash)

Student Name(s): C. Kaczegowicz

Abstract:

Through this study, the connection between rising temperatures and drought resulting in an increase in survival of emerald ash borers in Connecticut was researched. In other states such as Minnesota and Pennsylvania, the extreme temperatures reached in the winter have been rising, likely due to global climate change. This study connects these temperatures in Connecticut to an increase of the emerald ash borer and compared the results to the temperatures and increase of the beetle in other states. The effect that the EAB will have on primarily ash forests in Connecticut as these winter extremes continue to rise was estimated with the help of other researchers in the state.

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

PS EM 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

189

Fair Category

LS

Project Number

3039

Title: The Effect Dawn Soap has on Wild Caught Phytoplankton that have been Exposed to Crude Oil

Student Name(s): T. Rock

Abstract:

Oil spills are events often caused by our actions. When they occur, organisms in the environment are harmed dramatically. Studies have linked negative impacts of crude oil toxicity to detrimental impacts of the organisms. However, the possible negative impacts on microorganisms from the use of surfactants to clean the oil are understudied topics. In this study, wild caught marine phytoplankton were exposed to crude oil to simulate an oil spill, and Dawn, a commercial detergent, was used as the cleaning agent in replicated treatments where different levels of the soap were added. The results obtained from the experiment indicated that the Dawn soap had no significant impact on the phytoplankton ($p > 0.05$). The deformity rate had decreased for Trial 1 and had increased in Trial 2. However, in both trials there was a decrease in abundance, which leads to the oil's toxicity causing a high mortality rate. This indicates that Dawn soap is not showing a harmful impact at the microorganism level. The results from this study could help lead to more studies on using different surfactants that are environmentally friendly to phytoplankton and also clean up the oil.

Technical Disciplines Selected by the Student
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EM 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

253

Fair Category

LS

Project Number

3040

Title: Identification of Differentially Expressed Genes of Membrane-Bound Proteins as Potential Targets for Osteosarcoma Therapy

Student Name(s): R. Homma

Abstract:

Osteosarcoma is the most common type of bone tumor that has a high tendency to metastasize. The most effective way to treat osteosarcoma is chemotherapy. However, this involves drugs that cause many detrimental side effects to patients. In order to find better means of therapy—specifically, targeted gene therapy—previous studies have identified the specific genes that are potentially associated with osteosarcoma tumorigenesis. However, further validation of this association is needed to mark them as targets for therapy. Therefore, the aim of this study was to validate that the three potential gene targets—suppressor of cytokine signaling 5 gene (SOCS5), immunoglobulin superfamily containing leucine-rich repeat (ISLR), and lysyl oxidase homolog 1 gene (LOXL1)—are correlated with tumorigenesis by confirming that they are differentially expressed in osteosarcoma tumor than in normal bone. To achieve this, laser capture microdissection was used to obtain homogeneous populations of tumor and normal bone. The RNA from these cells was isolated and reverse transcribed into complementary DNA. Measurements of the expression levels of three target genes was done by real-time quantitative polymerase chain reaction. When the expression levels of these three genes in tumor were compared to the control group, it was found that they were overexpressed in the tumor. Thus, for the first time, this confirms that these genes are indeed associated with tumorigenesis of osteosarcoma. The overexpression of these genes shows promise for future studies on their specific function in tumorigenesis, which will prospectively ensure that they can be used as targets in osteosarcoma treatment.

**Technical Disciplines Selected by the Student
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CB ME

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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

246

Fair Category

LS

Project Number

3041

Title: Murine Antibody Responses to the Relapsing Fever Spirochete *Borrelia Miyamotoi*

Student Name(s): E. Criscuolo

Abstract:

The objective of this study was to learn more about the proteins of a relapsing fever spirochete, *Borrelia miyamotoi* that are targeted by antibodies after mammalian infection. To investigate this, sera from laboratory mice experimentally infected with *B. miyamotoi* was analyzed for antibodies to a *B. burgdorferi* lysate in addition to three recombinant proteins of *B. miyamotoi* using an IgG immunoblot assay. The proteins: Glpq, HH-1, and FHBA were tested individually to determine the degree to which the mice were producing antibodies in response to these proteins at the time of convalescent sera collection. The independent variable was the recombinant protein. The positive control in the protein blots was the positively infected mice and the negative control was the normal mouse sera. The dependent variable was the presence or absence of a band corresponding to the molecular weight of the protein on the immunoblot. It was hypothesized that the GlpQ and FHBA proteins would result in significant antibody activity. The reactivity of antibodies to the HH-1 protein is unknown. This hypothesis was disproven because of the high degree of reactivity in the HH-1 recombinant protein assay, followed by unexpected, wide-range activity to the GlpQ protein that may be due to nonspecific binding while the FHBA blot resulted in surprisingly low reactivity due to a lack of protein attachment. Further data collection and investigation is necessary to support these results and augment our understanding of the kinetics of antibody responses to *B. miyamotoi*.

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

CB ME MI

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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

248

Fair Category

LS

Project Number

3042

Title: An Electronic Model of The Patellar Reflex Arc

Student Name(s): J. Snyder

Abstract:

Neuromimetics, the modeling of neural systems, has significant applications including use in artificial intelligence, robotics, and medicine. This study creates the first electronic neural net modeling the patellar reflex arc, and evaluates its accuracy in comparison to its biological counterpart in terms of neuronal firing rates, action potential (AP) waveform accuracy, and excitatory and inhibitory behavior. Multiple electronic neuron models were assessed for biological accuracy and feasibility for use in this study, and the Fitz-Hugh Nagumo model was selected. The project had two stages: virtual simulation and testing, and then physical construction and testing of the individual neurons and neural net. Using SPICE computer software, neurons were designed and optimized to simulate the firing rates (12-25 Hz) and AP waveforms produced by the Ia afferent sensory fiber, alpha motor neurons (to quadriceps and hamstring), and inhibitory interneuron. Each neuron was constructed physically from electronic components and testing was conducted, including the measurement of proper voltage potential production, transistor bias conditions, and component connectivity, to discover and eliminate sources of error in accurate AP production. The electronic neurons were then connected to form a complete analog of the biological arc, and observations of the neural cascade revealed that replication was successful, despite variance in frequencies. The analog electronic model has the potential to be implemented into robotic systems, to further the study of electronic neural circuitry to replace damaged biological neural nets, and to be scaled and integrated into neural prosthetic systems to maintain stability through proprioceptive feedback.

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

EE EN 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

203

Fair Category

LS

Project Number

3043

Title: An Investigation of the Ability of Pseudomonas Putida to Counteract Elevated Heart Rate in Daphnia Exposed to Nicotine

Student Name(s): J. Driscoll

Abstract:

The purpose of this study was to investigate the ability of Pseudomonas putida to counteract elevated heart rate in the hearts of Daphnia exposed to nicotine in an aquatic environment. The importance of this project was to create a baseline investigation towards a potential cure for nicotine addiction utilizing the nicotine-consuming bacteria Pseudomonas putida and its corresponding enzyme NicA2. Materials used in this experiment included the organism Daphnia magna, the bacteria Pseudomonas putida, media, Daphnia food pellets, a microscope, glass slides, and 0.1% nicotine solution. Daphnia were exposed to specific levels of nicotine and bacteria, including a control media solution, a bacteria only solution, a nicotine only solution, and a bacteria/nicotine solution at various levels of nicotine. Heart rate data was collected by extracting Daphnia from their various media and recording slow-motion microscope video to count heart rate. Five Daphnia were observed from each tank and at each nicotine level and recorded for three 20 second intervals. Heart rate data was analyzed for statistical relevance. It was concluded that the Pseudomonas putida did have an effect on Daphnia heart rate, but the results were statistically insignificant due to uncontrollable variables related to the obtained Daphnia including age and overall health.

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

BI ME 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

256

Fair Category

LS

Project Number

3044

Title: The Effect of Temperature on Productivity of Marine Phytoplankton

Student Name(s): A. Diaz

Abstract:

Phytoplankton are microscopic organisms found in the ocean that forms the base of the food chain and take in excess carbon dioxide from the atmosphere for photosynthesis. If any necessary nutrients for photosynthesis are in short supply the overall number of phytoplankton will be lower. The effect of factors such as sunlight and temperature on phytoplankton growth have been understudied. The effect of temperature on phytoplankton growth was investigated in this study by measuring oxygen production. Phytoplankton, collected from Long Island Sound, were either placed in conditions of extreme cold or extreme heat, and oxygen levels were measured after 24 hours. Afterwards, oxygen levels were converted to carbon production in the phytoplankton, in order to compare the productivity between the treatments. Temperature plays a role in phytoplankton production. The data shows that colder temperatures have a greater effect on phytoplankton production, resulting in lower oxygen and carbon production (for the Control the amount of carbon production was 7.5 gC/m³/day; the Cold treatment dropped to -5.7 gC/m³/day; lastly, the Heat treatment produced 2.6 gC/m³/day). In areas where the temperature is low the phytoplankton can still survive by feeding off of nutrients running off of the land. In warm areas, such as the tropics, phytoplankton production does not decrease due to the high temperatures, and they receive excess nutrients from runoff. These areas of high temperature are more prone to producing harmful algal blooms (HABs). In those areas, managing runoff is important in order to decrease the possible risk of producing HABS.

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

EV EM 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

253

Fair Category

LS

Project Number

3045

Title: Polyetherketoneketone (PEKK), 3D Printed, Bipartite Surgical Implant: An Alternative and Supportive Cure for Internal Coxa Saltans in Female Adolescents

Student Name(s): S. Edelstein

Abstract:

Coxa Saltans, a condition of the hip, comes in three forms that manipulate a snap, but the contributing factors vary. Internal Coxa Saltans, for which this research focuses on, occurs when the iliopsoas muscle-tendon snaps over bony protrusions on the front of the pelvis. The condition is commonly seen in female adolescents due to the hips growing faster than the muscle-tendon can accommodate for. The muscle-tendon cannot span such a large area without complications. This results in a tight, inflamed iliopsoas that is prone to snapping. Basic treatment is administered. If the snapping persists and becomes increasingly painful, a psoas lengthening surgery is performed. Research has shown that this method is taking away valuable support from the patient's hip joint.

This research seeks to design, 3D print, and mechanically test a bipartite surgical implant that prevents the snapping and provides support for the patient. Using a CAD software, Solidworks, the two parts of the implant were designed, combining the properties of a doorstop and channel like mechanism. The bipartite implant was 3D printed using the Oxford Performance Materials facilities, and then tested mechanically via an Instron Machine. The implants were tested for compressive strength in different positions. When tested mechanically, each individual part demonstrated a strength of at least 100 pounds in multiple different directions. Taking the general anatomy of the hip and the strength of the implant into place, it can be concluded that the implant is providing support to the hip, while preventing the snapping at the same time.

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

EN ME 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

214

Fair Category

LS

Project Number

3046

Title: The Anomaly of Climate Factors on Ixodes scapularis Subsistence and the Incidence of Borrelia burgdorferi- Caused Maladies

Student Name(s): G. Colangelo

Abstract:

This project in its present form is the result of anomaly of various climate factors in relation to the prevalence of the Incidence of Borrelia burgdorferi- Caused Maladies over time. The initial idea was to determine the evolving subsistence of Ixodes scapularis through analyzing the prevalence of such illnesses in CT, and, more specifically, Fairfield County. Data was obtained from the city that contributed most significantly to the Borrelia burgdorferi incidence in the county: Bridgeport, CT. Climate factors were analyzed on a monthly scope and considered also with their yearly average, and included temperature (mean dry bulb reading in Fahrenheit), Relative Humidity (Hour 07 LST), and Precipitation (water equivalent, in inches). Ixodes scapularis subsistence was measured in relation to Borrelia burgdorferi prevalence and was represented by number of cases reported and rate reported per 100,000 population. Anomalies in Borrelia burgdorferi prevalence in Fairfield county, as well as anomalies in climatological data, raised the suspicion that change in climate factors influences the spread of Ixodes scapularis borne illnesses. The contributions of this project are twofold. First, the influence of climate factors on Ixodes scapularis borne illnesses was found to have different significance than previously believed. Secondly, the findings of this project could potentially be extrapolated to relate to other vector-borne maladies across the world.

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

MA 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

250

Fair Category

LS

Project Number

3047

Title: Can Playing Video Games Improve Academic test Performance?

Student Name(s): S. Siveyer

Abstract:

Video games are played by nearly all teenagers. There are many theories about whether video games are detrimental to student's studies. Some theories suggest video games take away from traditional learning, but there is an increasing trend of studies that show significant benefits to the way students think and their ability to focus. So I put it to the test and developed an experiment to see if playing a puzzle game before taking a test would increase students score in a test. After researching commercial games that claim to increase focus, I made a puzzle game that used problem solving and hand eye coordination (requiring focus) that could be played on a computer. I then got a class of students (A) to play the game for 5 minutes before taking a test which included both Math and English questions. I also had another class (B) take the same test without playing the game first. The test scores from these two classes were compiled and compared. The results showed that the group of students that played the puzzle game before taking the test scored higher overall by 57%, with a significantly higher score in Math (203%). According to classroom test scores there should only have been an 11% difference between class (A) to class (B). On the other hand the English scores only had a .5% difference which is insignificant. This data proved that playing the puzzle game did help the students score better in the math part of the test.

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

CS 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

252

Fair Category

LS

Project
Number

3048

Title: The Effects of Technology on Aging

Student Name(s): V. Wang

Abstract:

With the increased use of technology in modern times, people are spending hours every day facing screens. The screens of smart phones, tablets, and laptops all emit blue light or “high-energy visible” (HEV) light. Research has previously shown this is harmful towards the eyes and circadian rhythm, but there is scarcely any investigation on the effects of blue light on the skin. The objective is to see if an increased amount of blue light exposure will lead to damage that accelerates aging. For this experiment, three 60-millimeter petri dishes of established human endothelial cell lines were prepared. They were labelled A, B, and C. Each received a different amount of time under the tablet (iPad), which acted as the source of blue light radiation. Dish A was the control, receiving no exposure time, while dish B received two hours, and dish C received four. Photos of each dish were taken under a microscope before, immediately after and 24 hours after exposure. There was an obvious initial disturbance between the cell junctions in dishes B and C, potentially affecting communication between cells, membrane permeability, growth, etc. However, both had recovered when photos were taken after 24 hours. This parallels what would happen to human skin if it were continuously exposed to screens that emit blue light. Though the cells recovered the next day, one can foresee the effects of continuous repeated exposure. Without being given the time to mend, the skin would soon be destroyed and unable to protect the body.

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

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

258

Fair Category

LS

Project Number

3049

Title: Assessing the Effectivity of Instructional Videos in Medical Education: A Meta-Analysis Study

Student Name(s): M. Morosky

Abstract:

Today, access to videos is more widespread than ever before. The purpose of this study is to examine the effectiveness of video-based instruction compared to traditional instruction methods in teaching medical students clinical procedural skills. I performed a meta-analysis of studies published in peer-reviewed medical journals. Studies were chosen through a systematic review process. To do this, I performed an electronic search of the databases PubMed and Scopus using the key terms “medical students”, “video recording”, and “instructional videos”. Inclusion criteria for the meta-analysis were prospective, randomized, controlled trials comparing video education to traditional instruction methods for teaching medical students procedural skills. The primary outcome was the performance score of the procedural skill. Review Manager 5.3 (available from the Cochrane Collaborative) was used to perform the meta-analysis for the primary outcome and to assign risk of bias for each article. I identified 681 articles in the initial search of which 45 were selected for closer review. A total of 5 articles with 6 procedural skills were included in the final meta-analysis. For the primary outcome, video education was associated with a 23.3% [95% CI 3.4-43.2%] increase in performance scores compared to traditional instruction methods. Risk of bias was high for allocation concealment and blinding of participants. Risk of bias was low for blinding of outcome assessment and incomplete outcome data. Using the findings of this meta-analysis, professors in medical schools should strongly consider using video-based methods for teaching their students procedural skills since its effectiveness is better than traditional methods.

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

BE MA 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

139

Fair Category

LS

Project Number

3051

Title: What the Capturing and Recapturing of *Limulus polyphemus* Reveal about their Ecological Patterns of Spawning and Migration

Student Name(s): P. Tricarico

Abstract:

A solution to the decline of horseshoe crabs (*Limulus polyphemus*) is crucial to the environments in which the species inhabits. In the attempt to solve this growing problem the root causes are being determined by studying the population dynamics of the horseshoe crabs. A group based from Sacred Heart University (Mattei and Beekey) has begun a long-term study of the patterns in which horseshoe crabs spawn and migrate in the Long Island Sound. It becomes crucial to understand the way in which horseshoe crabs utilize their environment when formulating a solution to increase their prevalence once again. Being a density dependent population, horseshoe crabs begin to develop difficulty finding a mate as their prevalence decreases. Project *Limulus* aims to prevent the extinction of horseshoe crabs by formulating a solution based on the patterns in which the crabs reproduce.

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

AS 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

236

Fair Category

LS

Project
Number

3052

Title: Utilizing Biochar and Capsaicin as a Non-toxic Agricultural Systematic Pest Inhibitor for Glycine max

Student Name(s): S. Reyes

Abstract:

Glycine max is the second largest field crop grown and the second most consumed oil in the world. There are numerous insects which attack the leaf, stem and roots. Biochar serves as a carrier of capsaicin in a treatment during the growth of soybeans. Topical capsaicin treatments require a monthly application, but a systematic treatment would be more cost efficient and less manual intensive because of its incorporation into the soil. Each trial used 2 controls and one 1 experiment plant; One control is just the seedling, the other is control for the biochar that is used to contain the capsaicin. The experimental plant has biochar that has been treated with capsaicin. The capsaicin used has been diluted in a .5 gram to 500 ml methyl alcohol solution, which is .001 ppt g/L. The damage to the plant will be assessed by a scale adopted from the University of Illinois, there was an average of 18% destruction to the control group, 21% to the biochar group and 10% to the capsaicin. Correlating to 36% of the control, 42% biochar and 2% of the capsaicin plants leaf damage. A trial conducted measuring mass loss was held that demonstrated the Capsaicin supplement caused a 16% decrease in mass loss when compared to the control. Future research has the potential with an increased of the concentration of capsaicin within the biochar will lead to a near zero consumption.

**Technical Disciplines Selected by the Student
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PS EM EV

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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

252

Fair Category

LS

Project Number

3053

Title: The Intracellular Motility Factors of *Listeria Monocytogenes* as a Platform for Liposomal Drug Delivery in Cancer

Student Name(s): T. Stedman

Abstract:

Some major impediments to chemotherapy in cancer are poor penetration of anticancer drugs in possibly hypoxia-resistant regions of solid tumors further from blood vessels, lack of access of anticancer drugs to tumors due to tissue barriers surrounding the tumor or local vasculature, and rapid renal clearance of drugs or nanoparticles with slow uptake. *Listeria monocytogenes*' intracellular invasion strategy, allowing the bacteria to spread throughout tissue entirely within host cell cytoplasm and cross major biological barriers, is a single means to address these issues. This research aimed to mimic *Listeria*'s invasion strategy for use in cancer drug delivery by incorporating two virulence factors of *Listeria* — ActA, responsible for actin polymerization and “actin-rocketing” motility, and Listeriolysin O, a pH-dependent cytolysin responsible for *Listeria*'s phagosomal escape into host cytosol — into multilamellar liposomes. ActA was successfully isolated from *Listeria monocytogenes* as indicated by a fluorescent tag, purified by gel column filtration, then reconstituted with encapsulated Listeriolysin O in multilamellar liposomes. ActA and liposomes were confirmed to be colocalized by microscopy. Multilamellar liposomes including ActA and Listeriolysin O were shown to experience higher and faster rates of uptake than control multilamellar and unilamellar liposomes and unilamellar liposomes including ActA and Listeriolysin O in pancreatic adenocarcinoma cells. Internalized liposomes including ActA and Listeriolysin O in fixed cells under fluorescence microscopy appeared as intact liposomes with linear trails of liposome shell fragments, indicating that Listeriolysin O allows the multilamellar liposomes to escape into cytosol while retaining inner layers and likely exhibits actin-rocketing motility inside cells.

**Technical Disciplines Selected by the Student
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EN BI CB

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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

198

Fair Category

LS

Project Number

3054

Title: Handedness and The Stroop Effect Test

Student Name(s): E. O'Clair

Abstract:

This experiment was used to assess the correlation between one's handedness, and the ability to do the Stroop Effect Test. The Boreas's area of the brain is where language is processed. For almost all right handed people this area is located on the left side of their brain, but for left handed people it's only like this 70% of the time. However, because the left side of a brain controls the right side of the body, and vice versa, a person's ability to do the Stroop Effect Test changes based on what side of their brain they use more. It is not known if one side of the brain handles cognitive functions better or worse. This test took a group of left handed people and right handed people and tested how well they could do the Stroop Effect Test. This test showed that left handed people scored across the board. Some were very good and some were very bad. The data was very divided compared to those of the right handed participants. To conclude, people who are left handed, can be very good at this kind of test, however it depends on the way their brains are built.

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

BE

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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

247

Fair Category

LS

Project Number

3055

Title: The Effects of Sea Squirts on the Habitats of Native Species in Long Island Sound

Student Name(s): W. Simics

Abstract:

A major issue facing the shell fishing industry dependent on Long Island Sound is the emergence of invasive species, particularly the sea squirt. Sea squirts are immobile filter feeders that live on the ocean floor. There are more than 3,000 known sea squirt species found on the seabed around the world. They can vary from just 3cm to 30cm in length, depending on the species of sea squirt and its habitat. Sea squirts primarily feed on the plankton and nutrients in the water along with the algae that grows on them. To seek possible solutions for this epidemic, this experiment was broken down into two parts: research and experimentation.. To test their effect, water samples as well as seaweed were gathered to see what the sea squirts would do to the native seaweed in a simulated aquatic environment similar to that of Long Island Sound. Sea squirts are relatively easy to locate because they stick to things such as boats and docks and enjoy the increasingly warm water of Long Island Sound. The extent to which the sea squirts blanketed the seaweed was measured over time to show how rapidly they spread and compete for habitats of native species such as seaweed. The testing and research proved the detrimental effects of sea squirts on seaweed and other species of Long Island Sound, as the sea squirts blanketed the seaweed in a short period of time and controlled both its habitat and the nutrients available in the water.

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

EV EM AS

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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

187

Fair Category

LS

Project Number

3056

Title: Optimizing growth of Phaseolus vulgaris using Hawaiian Cinder Cone soil as a proxy for agricultural conditions on Mars

Student Name(s): N. Saah

Abstract:

The purpose of this project was to optimize growth factors of Phaseolus vulgaris using Hawaiian Cinder Cone Soil and Rhizobium inoculum as a proxy for agricultural conditions on Mars. If and when successful colonization of Mars occurs, food production will be essential to the long-term survival of the colonists. Food must be high in calcium and protein given the evanescence of bone structure in outer space as well as the body's need for protein. An optimal food to comply with these requirements is the common white bean, Phaseolus vulgaris. In total, forty plants were grown, twenty of which grown in Martian regolith simulant soil and the other twenty raised in traditional potting soil, where variables such as Rhizobium inoculum, pH of the water source, and light intensity were introduced. Over four weeks each plant was measured for its leaf length, stem thickness, and stem height. Data was analyzed for statistical relevance and it was concluded that when the colonists arrive in Mars, scientists should consider growing Phaseolus vulgaris under a 5500k light source with no Rhizobium inoculum and should be watered with a slightly basic pH.

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

PS 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

3057

Title: The affect different foods have on short and long term memory

Student Name(s): M. Marino

Abstract:

Everyone has been told that chewing gum improves memory. A previous study hypothesized that gum improves memory by tricking the brain into anticipating a large food intake and therefore starting glucose production. The brain requires a lot of energy, which is why additional glucose would improve cognitive abilities. This experiment tested if tricking the brain would improve a person's memory more than foods with nutritional value and glucose would. Long and short-term memory tests were set up and 3 types of foods, with differing amounts of glucose, along with gum and the action of chewing were tested. Each participant was a high school student. They ate one of the foods, chewed gum or chewed while taking a short term and then a long-term memory test. In between the tests participants completed a word search to allow their memory to convert from short term to long term. The data indicated that the participants who ate the Doritos while testing scored the highest on both tests, while the participants that chewed gum during the test scored the lowest on both tests. The Doritos had the lowest amount of glucose. This indicates that the more glucose in the food does not increase memory. It also shows that food improves memory more than tricking the brain by chewing. In a survey of the participants, 90% said they snack while studying. This experiment can help students improve their studying skills by telling them what foods are the most beneficial to eat while studying.

Technical Disciplines Selected by the Student
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BE

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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

192

Fair Category

LS

Project Number

3059

Title: The Effects of Shading on Chlorophyll Density in Ulva Lactuca

Student Name(s): K. Sinagra

Abstract:

Recent studies have linked nutrient runoff in local waterways likely from anthropogenic sources rivers to an increase in turbidity in Long Island Sound. It is possible that this increase in turbidity could have an impact in algae's ability to photosynthesize. In this study, the effect of shading on chlorophyll densities in Ulva lactuca were investigated. Ulva sp. is a representative of a critical indicator group in these habitats, the photosynthetic members, which may be affected by the loss of clarity. To test this, replicated trials of Ulva placed in a gradient of shade to simulate different turbidity levels in water. The expected results were that as the level of shading increased, the density of the chlorophyll would decrease due to the lack of sunlight that they would be receiving. Results indicated that there was no significant difference in chlorophyll density due to increased shading ($p > 0.05$). What this means is that losses in water clarity in these areas may not be having an immediate impact on macro chlorophytes. Future studies should focus on managing coastal runoff, in order to prevent extreme events in the event that these impacts are more long term.

Technical Disciplines Selected by the Student
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PS EV

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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

270

Fair Category

LS

Project
Number

3060

Title: The Influence of the LGI-1 Gene on Cognition of APP/PS1 Alzheimer's Disease Mouse Models

Student Name(s): K. Tsui

Abstract:

Alzheimer's disease (AD) is a form of dementia that results in steep cognitive decline and a loss of neuronal synapses. The leucine-rich, glioma inactivated 1 (LGI-1) gene is associated with increased synaptic pruning and deregulated synaptic plasticity. Preliminary Western Blot studies have shown that there is a substantial increase in LGI-1 protein quantity in mouse hippocampi and cortices affected by AD, suggesting that neurodegenerative pathology may be induced by over-pruning of synapses by LGI-1. To analyze the influence of this gene on AD, 15 wild-type, 5 APP/PS1, 13 LGI-1+/- (hemizygous), and 6 APP/PS1/LGI-1+/- mice were genotyped with polymerase chain reaction and gel electrophoresis. They were tested with the Morris Water Maze at 6 months old to determine cognitive abilities through measurements of path length, escape latency, and percentage of time in the target quadrant. It was expected that APP/PS1/LGI-1+/- mice would exhibit stronger cognition than APP/PS1 mice with wild-type expression of LGI-1, because suppressing LGI-1 would rescue some brain functioning by decreasing rates of synaptic over-pruning. Surprisingly, analyses processed by IBM SPSS Statistics 2.0 have indicated that the hemizygous LGI-1 gene status is not correlated with improved cognition in a statistically significant manner. However, more supportive data are projected to come to light when older mice and fear-conditioning behavioral tests are used in future trials of this experiment. Final results will provide the scientific community with a better understanding of how synaptic pruning affects AD, and how certain genes should be targeted for therapy of such a debilitating disease.

**Technical Disciplines Selected by the Student
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ME BE CB

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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

248

Fair Category

LS

Project Number

3061

Title: The Effects of Saccharin and Aspartame on Bacillus clausii

Student Name(s): C. Loring

Abstract:

Before any research had been conducted, I knew that I wanted to research topics that would produce results that would be relevant to a large amount of people. After conducting extensive research, I encountered an article about diet soda, and its possible adverse effects on different parts of the body. It explained how the artificial sweeteners in diet soda could be bad for the bacteria in your gut. This gave me the idea to test the effects of artificial sweeteners, specifically saccharine and aspartame on the effects of the gut bacteria Bacillus clausii. Because of the popularity of soda drinking with artificial sweeteners, it would be beneficial to these soda drinkers to confirm whether or not it is having a negative effect on their overall digestive health. The human gut is the home of a whole microbiome of bacteria. It holds over 1,000 different species of bacteria, most of which are beneficial to us. If some of these species begin to die out, necessary functions in the gut may become less efficient. I plan on testing the effect of artificial sweeteners on the growth of Bacillus clausii using growth curve and plating experiments. I hope to discover whether or not aspartame or saccharin has a negative impact on Bacillus clausii growth. I will be using the concentrations of 58mg/237mL and 125mg/237mL for aspartame and 36mg/296mL and 72mg/296mL for saccharin. I will be using 6 plates per trial: one of each concentration and 2 controls.

Technical Disciplines Selected by the Student
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CB MI 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

250

Fair Category

LS

Project
Number

3062

Title: A Novel Comparison of Environmentally Friendly Organic Acids Against Expensive Toxic Herbicides on Raising the Soil pH to Eliminate Invasive Japanese barberry (*Berberis thunbergii*)

Student Name(s): B. Ruffing

Abstract:

Japanese barberry is an invasive shrub that has spread rapidly across the northeastern United States. Despite its beauty, it has many negative effects for the ecosystem that have major impacts on the global climate change. An invasive plant disrupts the equilibrium of the CO₂ in the biome. As a result, the invasive can flourish under the changes whereas the native species' suffer. Growing uncontrollably with natural resources favoring the Japanese barberry due to a lack of competition, the invasive can spread uncontrollably in very dense patches. Therefore, the subsequent sequestration of CO₂ is drastically increased. Currently, the most effective from for removal of the shrub is by manually digging out the roots. Yet, the overwhelming number of vegetation has caused the increased use of herbicides to kill the plant. While herbicides are proven more effective on broadleaf weeds, it still has some degree of toxicity on all angiosperms (flowering plants). Unfortunately, herbicides cause additional ecological effects to other terrestrial and aquatic plants and animals and some products are controversial. Therefore, the eradication of the Japanese barberry will be by use of naturally occurring methods as opposed to strong harsh herbicides. The data has proven this hypothesis by experimentation with organic malonic acid. It has killed the barberry at the same rate compared to the Roundup herbicide over a period of just five days. Therefore, there is an effective organic alternative to toxic herbicides such as Roundup. Malonic acid at 0.5 M concentration will kill the barberry in a safer manner.

Technical Disciplines Selected by the Student
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EV PS

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- Yes No

CSEF Official Abstract and Certification

Word Count

219

Fair Category

LS

Project Number

3063

Title: Quantifying the Effect of Carbon Dioxide on the Growth of *Chlorella vulgaris*

Student Name(s): S. Xu

Abstract:

There is an increasing need for green energy sources, one of which is biofuel derived from algae, in this era of increasing climate change and geopolitical instability. This project will examine the growth behavior of *Chlorella vulgaris* algae when exposed to heightened levels of aqueous carbon dioxide, CO₂, as a selective pressure over multiple generations, to assess both the algae's adaptation to higher levels of CO₂ and the viability of CO₂ as a selective pressure. An increase in CO₂ is expected to cause a general increase in the algal growth rates compared to samples growing concurrently as well as across generations of growth. *C.vulgaris* was grown in three aquariums, one with a constant CO₂ pressure, one that has been exposed to CO₂ pressure and restored to ambient conditions, and a control. Throughout the growth period, spectrophotometer data was taken of the algae to determine its growth through absorption of specific wavelengths. It was found that the presence of CO₂ had a positive effect on the growth of algae to a statistically significant degree, but its ability to function as a selective pressure appeared inconclusive. For that reason, even though future research is necessary and CO₂ tends to increase algae growth in established literature, at this time CO₂ as a selective pressure to increase biomass yields does not seem viable.

Technical Disciplines Selected by the Student
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PS

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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

247

Fair Category

LS

Project Number

3064

Title: Measuring Reaction Times Using Mechanical and Computer Engineered Driving Simulation

Student Name(s): C. Kirschbaum

Abstract:

For my project I developed a model that simulates an individual's reaction to stimuli while driving. The model is structured much like an actual car, with a gas pedal and a brake. When the brake is pressed, a lever is pulled that presses the space bar of a wireless keyboard attached to the back of the contraption. The subject sits staring at a white computer screen with their foot resting on the makeshift gas pedal until the screen turns yellow, at which time they must press the brake as quickly as possible. The time it takes for them to react is immediately recorded. I utilized HTML and CSS to develop the basic structure of the program, while JavaScript allowed it to actually function. This model allowed me to manipulate various variables and see their affect on reaction times while driving. Two of the variables that I manipulated were age and outside distractions. My data showed that reaction times tend to be significantly slower for older people, as well as for people faced with distractions. These results hold great significance, particularly for outliers of the elderly group, who demonstrate that in certain cases, elderly drivers are as capable as younger drivers when it comes to reacting to sudden dangers. This model could be used in place of conventional reaction tests, which do not require the same muscle movements used while driving a car, and therefore do not provide a sufficiently accurate representation of reaction times while driving.

Technical Disciplines Selected by the Student
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BE

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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

254

Fair Category

LS

Project
Number

3065

Title: In silico Prediction of Breast Cancer Cellular Response to Drug Therapies Using Random Forest Algorithms

Student Name(s): S. Sundaram

Abstract:

Predicting the response of breast cancer cells to drugs is a major goal in oncology, guiding the development of personalized treatment. Various computational methods, such as quantitative structure-activity relationship models, have been used to screen compounds and unveil relationships between drug structure and activity. Such models are limited by a sole focus on usage of drug properties to predict cell response. Recent innovations have focused on using both genomic and drug properties, in an effort to expose more complex drug-cell relationships, and thus build more robust models. This research investigates the application of a data-mining approach, using data from both the mutational status of breast cancer cell lines and chemical properties of considered drugs, to generate predictive learning models capable of predicting cell response, quantified through IC50 values. In order to increase the accuracy and adaptability of the model, Random Forests algorithms were used instead of decision trees or other common machine learning methods. Models were derived using data on the copy number and mutation status of 44 relevant genes for 37 breast cancer cell lines, as well as molecular descriptors, target information, and IC50 values when applied to the cell lines for 97 drugs. Comparable machine-learning approaches to predicting drug sensitivity have achieved Pearson correlations of 0.6. The Random Forests models developed herein were capable of predicting IC50 values with an R2 of 0.75 and Pearson correlation coefficient of 0.87. Such results suggested that integration of new features such as drug targets increase the value and accuracy of models.

Technical Disciplines Selected by the Student
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ME CS AT

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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

250

Fair Category

LS

Project Number

3066

Title: Developing a Novel Progranulin-Derived Biologic for Gaucher Disease

Student Name(s): H. Liu

Abstract:

Gaucher disease (GD), the most common lysosomal storage disease, is caused by a deficiency of the lysosomal enzyme glucocerebrosidase (GBA). This mutation results in the accumulation of its substrate glucosylceramide, leading to swelled lysosomes resulting in enlarged spleens, livers, and lymph nodes in patients. The current treatment for this condition is enzyme replacement therapy (ERT); however, ERT has been unsuccessful for some patients and for some, adverse effects have been reported. Furthermore, the cost for treatment is approximately \$350,000/year. Reports that the loss of progranulin (PGRN), a growth factor with multiple functions, also causes lysosome storage dysfunction prompted us to test whether PGRN could have therapeutic effects in treating GD. Recombinant PGRN prevents glucosylceramide accumulation and ameliorates GD symptoms in various cell cultures and animal models. Binding assays demonstrated that PGRN binds directly to GBA and is required for the delivery of GBA from the nucleus to the lysosome. More importantly, we determined the essential fragment needed for this binding, Pcgln, a PGRN derivative composed of 98 c-terminal amino acids that retains the binding activity to GBA. Pcgln appears to be the crucial part of PGRN that ameliorates diseases in GD patient fibroblasts and animal models. Heat Shock Protein 70 (HSP70) was identified as a GBA-associated protein that mediates trafficking of GBA through PGRN. Sortilin was recognized as a lysosomal receptor that allows for the endocytosis of PGRN. Pcgln encompasses the binding motifs to these proteins. Collectively, these findings offer a novel drug candidate for Gaucher Disease.

Technical Disciplines Selected by the Student
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ME CB EN

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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

3067

Title: Improvements in Chemotherapy: The Implementation of HSP90 Inhibitors in the Suppression of Chemoresistance

Student Name(s): L. Novak

Abstract:

HSP90, or heat shock protein 90, is recognized as a selective facultative chaperonin involved in the stabilization of proteins during their molecular configuration in heat. Nevertheless, HSP90 can be overexpressed in cancerous cells, contributing to the proliferation of these cells through its interruption of the apoptotic p53 pathway, wherein its direct attachment of inhibitory proteins represses p53 activity as well as the transcription of proteins involved in the activation of caspase-9 and caspase-3. Through this particular action, HSP90 also ascribes chemoresistance to recurrent cancer cell lineages and diminishes the efficacy of chemotherapy treatments in patients experiencing relapse. With this information in mind, I investigated the effects of a combination treatment of the chemotherapeutic agent carboplatin and an HSP90 inhibitor on the concentration of proteins associated with the p53 pathway such as BAX, PUMA, and Fas, caspase-3 and caspase-9 expression, in addition to rates of overall cell death. Initially conducting a Western Blot to confirm the localization of HSP90 in the nucleus of chemoresistent lung cancer cells, qPCR and RNA fragmentation assays revealed a noticeable upregulation of the p53 transcriptional products PUMA and BAX following exposure to the combination treatment. Expression analysis of caspase-3 and caspase-9 with a fluorescent Cas-Glo kit demonstrated higher concentrations of the p53 pathway products, whereas observations of cell morphology and cell viability assays displayed larger numbers of healthy cells under the combination treatment. These results verify the significance of HSP90 inhibitors in chemotherapy and the chemosensitization of resistant cancer cells.

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

ME MI 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

252

Fair Category

LS

Project Number

3068

Title: Effect Of Marine Aquaculture on Horseshoe Crab Growth and Development

Student Name(s): J. Dalal

Abstract:

Limulus Polyphemus have played a vital role in anyone who has received an injected medication. An extract of of the horseshoe crab's blood is used by the pharmaceutical and medical industries to ensure their products (intravenous drugs, vaccines) are free of bacterial contamination. The copper-based blood and amebocyte cells of crabs are combined in a test called Limulus Amebocyte Lysate (LAL) to detect endotoxins and bacteria. The crab's eggs provide the nutrients for migrant birds to make their long journey to South America. Although these crabs are important, their populations over the last two decades have decreased dramatically, (30%). This decrease not only impacts medication manufacturing and businesses, but it also affects the population of the shorebirds as reports indicate that their numbers fell by 60%. This threat to populations and growing interest in their utilization for research, education and bio-medical applications have prompted demand for improved techniques to rear and maintain them. This experiment investigated the effect of temperature, water salinity, and diet on the crab's growth and development as well as yielded an ideal captive environment where the crab's population can increase. The study was conducted for six months (June-Nov). Though a large mortality rate occurred, there was a presence of a robust hatching rate and a behavioral phenomena. The data revealed that temperature and frequency of feeding had the biggest impact on their survival and growth. Further studies can be performed with adult horseshoe crabs or crabs that have survived the bleeding process, testing similar factors.

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

AS EM BE

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project Number

3069

Title: Significance of osteosarcoma tumors of different stages, histological phenotypes, and clinical outcomes on the expression of BMPR2

Student Name(s): K. Malani

Abstract:

Osteosarcoma (OS) is the most common type of bone cancer. OS cells facilitate their proliferation by increasing the production of osteoclasts, cells which resorb bone. Studies regarding the role of BMP2 protein, which induces bone growth by binding to the receptor, BMPR2, have been conducted, but the type of bone formed-normal or tumorigenic- was unknown.

Thus, additional studies were performed. Some studies, specifically, Mesenchymal stem cells with rhBMP-2 inhibits the growth of canine osteosarcoma cells, concluded BMP2 caused OS tumors to grow more slowly, suggesting BMP2 is beneficial in treating OS. Another study, Osteogenic BMPs promote tumor growth of human osteosarcomas that harbor differentiation defects, found BMP2 caused OS tumors to become more motile and metastatic, suggesting BMP2 had a negative effect on OS treatment.

Throughout all these studies, however, the role of BMPR2, the receptor for the BMP2 protein, has not been discussed. These conflicting results presented the need to find whether OS tumors of different stages, histological phenotypes, and clinical outcomes correlate with level of expression of BMPR2. To do this, I performed immunohistochemistry on fixed tumors, counterstained the tumor nuclei using DAPI, and used a microscope and the Openlab program to analyze the amounts of fluorescence of BMPR2. Later, I conducted retrospective tissue analysis to determine data points to use in a statistical significance test.

The findings of this experiment could provide a treatment option for the thousands of patients suffering from OS because it could influence its 90% mortality rate of tumor metastasis.

**Technical Disciplines Selected by the Student
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ME CB MI

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- Yes No

CSEF Official Abstract and Certification

Word Count

209

Fair Category

LS

Project Number

3070

Title: De-Statolization; the Effect of Ocean Acidification on Squid

Student Name(s): C. Snyder

Abstract:

Ocean acidification is becoming a major problem for many species within the ocean. To see its effects on squid, I tested two aspects, hunting ability and camouflaging ability. I tested for this by catching *Illex illecebrosus* squid and put them in normal ocean water, water with a pH of 7.4, and water with a pH of 7.2. I kept them alive for as long as possible and dissected them after they died. I then measured statolith "area" by finding the length and width of each and multiplying them, and measured average color deviation of the chromatophores. My hypothesis was that these conditions would decrease the overall statolith size and increase the color deviation of the chromatophores. However, this was disproven by my results, as the overall area of the statoliths increased with acidity and the squid in my second experimental tank showed an increase in pigment production, affecting the coloration. These results and collected information led to me concluding the reverse of my hypothesis, with squid statoliths being unaffected by these levels of acidity and chromatophores experiencing changes at a pH of 7.2 or lower. While ocean acidification is still a problem, the adult squid population is not affected nearly as much as other species by short term exposure.

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

EM EV BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project
Number

3071

Title: The Effect of Color on the Perception of Saltiness

Student Name(s): N. Sudhir

Abstract:

A study performed at Penn State University indicated that the color of food affects how bitter and sour flavors are perceived, but shows no correlation to perceived sweetness. No studies have been done regarding perception of saltiness. In this experiment, the question investigated is whether the color of a sugar cookie affects how salty a consumer perceives it to be. The study also showed that 'warm' colored foods, like yellow and red, are perceived to have stronger flavors. Based on this, it is hypothesized that if consumers were to taste an orange colored cookie, a warm color, they would perceive it to be more salty than any other cookie. The independent variable in this experiment is the color of the cookie. The dependent variable is how salty the cookie is perceived to be. The control group has no added dye, and the experimental groups are green, blue, and orange cookies. In order to conduct this experiment, participants tasted each cookie and decided how salty they perceived each to be using a Likert Scale. Results indicate that color does have an influence on taste perception of saltiness. However, data is still being analyzed. Thus far, the data supports the hypothesis that the orange cookies were perceived to be the saltiest. The motivation for this experiment is to see if consumers have expectations about food based on its color. If an association is discovered, businesses can sell their products in different colors to get better sales based on the predicted perceived taste.

Technical Disciplines Selected by the Student
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BE ME

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CSEF Official Abstract and Certification

Word Count

84

Fair Category

LS

Project
Number

3072

Title: Microwaved Sprouting

Student Name(s): H. Kummamuru

Abstract:

The investigation was conducted to study the effects of microwave radiation on the germination of garbanzo bean seeds, to determine if higher exposure time of the beans to microwave radiation would cause damage to the beans.

This study was conducted by microwaving garbanzo bean seeds for 0, 10, 20, 30, 40, and 50 seconds and monitoring their growth over the course of five days. This study would indicate how much potential the microwave radiation has the to increase or decrease the rate of germination.

Technical Disciplines Selected by the Student
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PS

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CSEF Official Abstract and Certification

Word Count

192

Fair Category

LS

Project Number

3073

Title: An Investigation of the Effect of Deicers on the Development of Zebrafish Embryos

Student Name(s): N. Keegan

Abstract:

Introduction

Numerous countries with snowy winters use deicers such as sodium chloride and calcium magnesium acetate, among other chemicals, to keep their roadways clear of ice and snow to make roads safer. Unfortunately the effects of these deicers on the marine creature that live in streams, ponds, and lakes near roads have not been very thoroughly studied. This study attempts to ascertain this effect on fish.

Procedure

The organisms used in this experiment are Zebrafish embryos, as Zebrafish are good model organisms used in many experiments. This experiment will only test two deicers: sodium chloride, and calcium magnesium acetate. There are three test groups and one control group. Each test group will test the effect of one of the deicers in a concentration of 5g/L, and the third will test each at 2.5g/L, with the control being them in normal spring water. They will be kept for 5 days and studied closely before having their final evaluation, followed by their termination. The goal is to conduct at least 3-4 trials.

Data

The is no data at this time due to delayed shipping and the loss of all female breeding fish

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

AS EV

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CSEF Official Abstract and Certification

Word Count

238

Fair Category

LS

Project
Number

3074

Title: Sugar Rush

Student Name(s): A. Eastman

Abstract:

The purpose of this experiment is to analyze how Red Harvester ants react when presented with different types of sugars—glucose, fructose, and Splenda®. I am testing for differences in tunnel depth, width, number of chambers created, and if they prefer one sugar over the others. My procedure is as follows:

1. Fill each farm with dirt provided by the ant farm kits
2. Place sugar in individual pockets in three different places in each farm (left, right, middle) and place seeds above the dirt in each ant farm.
 - a. #1 Splenda, Glucose, Fructose
 - b. #2 Fructose, Splenda, Glucose
 - c. #3 Glucose, Fructose, Splenda
 - d. Control farm no sugar (only seeds)
3. Place a wet paper towel as a source of water in each farm (replace every 2-3 days)
4. Add ants
5. Observe ant tunneling pattern every other day

To avoid any biased results, I will place the sugars in different locations in each ant farm. Sources that I found stated that Red Harvester ants have a strong affinity towards sugar, but won't put in extra effort to obtain it. My results disproved that statement. My data showed that the ants tunneled straight towards the sugars, burying the easily accessible seeds with the dirt they had removed to tunnel. One unanswered question I have, however, is if they prefer one sugar over the others. They demonstrated to have no preference in which sugar to tunnel towards first.

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

EA EA EA

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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

LS

Project
Number

3075

Title: THE CHANGES IN GENE EXPRESSION BETWEEN NORMAL BONE CELLS AND OSTEOSARCOMA TUMOR CELLS

Student Name(s): P. Reddy

Abstract:

The current treatment for osteosarcoma, a primary malignant tumor of bone, is harmful and has not changed in over 30 years. My study was undertaken to determine if differences in genetic expression between osteosarcoma tumor cells and normal bone cells could be identified. Such changes could serve as targets for novel chemotherapies. These changes were determined by analyzing levels of RNA expression for three specific genes: Carboxypeptidase Vitellogenic-Like (CPVL), heat shock protein (HSP), and Glycoprotein-M6B (GPM6B). I used laser capture microdissection to capture homogenous populations of osteosarcoma tumor cells and adjacent normal bone cells from sections of formalin-fixed paraffin-embedded surgical samples. Several hundred isolated tumor and normal cells were captured separately, with normal cells acting as controls. The RNA was then purified from each sample and gene expression was analyzed by qPCR. The differences in gene expression of the tumor and normal cells were examined to see if the changes correlated with the initiation or progression of osteosarcoma. I found lower mean expression values of genes CPVL and HSP in tumor one than in tumor two and the control, suggesting that these genes are more highly expressed in tumor one, while gene GPM6B was highly expressed in tumor two. This suggests that identifying overexpression of specific genes in a tumor can be a potential approach to precision medicine in which chemotherapeutic drugs can be designed to attack genes important in the cancer process, thus only affecting tumor cells without harming normal cells.

**Technical Disciplines Selected by the Student
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CB ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project Number

3076

Title: Mapping the Relationship Between Reading Ability and Successfully Learning an Artificial Lexicon

Student Name(s): A. Kachru

Abstract:

Learning is an essential part of life. Recently, identifying predictors of learning has become an important phenomenon. This study investigated the correlation between reading ability-comprehension, vocabulary, and fluency-compared to an individual's learning rate which was acquired through testing an Artificial Lexicon. Artificial Lexicon is a controlled method that is used to measure learning as it measures an individual's ability to comprehend as well as to accurately define and pronounce terms. This study uses an Artificial Lexicon called Visual Artificial Lexicon (VAL). After a learning phase, VAL will display a word and a pair of definitions on screen. Participants pronounce the word and choose one of the two definitions. From this, VAL tests whether participants can accurately pronounce and define-indicating that the participant has acquired and successfully learned that word. The scope of the study was to identify whether a correlation between reading ability and learning an Artificial Lexicon exists. Correlations were considered through several different approaches of statistical analysis. Results, derived from multiple regressions, demonstrate a positive correlation among all parameters of the study. It has been determined that the Peabody Picture Vocabulary Test seems to be the best predictor for the efficiency of learning definitions and pronunciations. This study delves into the process of learning as well as its crucial, corresponding factors-learning definitions and learning pronunciations. Through this research study, it was determined that vocabulary seems to be the most influential aspect of reading and that standardized tests correlate to the learning process.

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BE

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5. 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

3077

Title: The Effect of Elevated Concentrations of CO₂ on the Growth Rate of Silkworms

Student Name(s): J. Lam

Abstract:

Global warming is the main cause of the increased levels of carbon dioxide levels in the atmosphere, which affects many insects that use CO₂ to detect potential food or danger or regulate bodily functions. This increase in CO₂ affects many insects that use CO₂ as a way to detect potential sources of food and danger. One affected insect is the silkworm. The purpose of this experiment is to evaluate how different concentrations of CO₂ in the atmosphere will affect the growth rate and cocoon size of the silkworms. The silkworms are reared at 80 oC (\pm 2 oC) and fed daily with pre-made silkworm food. One cage is kept at normal atmospheric levels of CO₂ (around 400 ppm CO₂), and 2 more cages are filled with elevated concentrations of CO₂. Each of these cages is filled with approximately equal number of silkworms. These levels of CO₂ were kept constant during their larval stage until they spun their cocoon. The silkworm's size and growth were monitored daily and shown to differ in each cage due to the different CO₂ concentrations. There is growing demand for silk because of its softness, durability, and luster. Although artificial silk is produced, it cannot exactly match the qualities of natural silk. If CO₂ levels continue to increase due to global warming, the silk industry will be severely stunted if the growth rate of silkworms slows down due to CO₂ emissions.

Technical Disciplines Selected by the Student
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CB BI BE

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- Yes No

CSEF Official Abstract and Certification

Word Count

260

Fair Category

LS

Project
Number

3078

Title: Synthesis of Thermosensitive Magnetoliposomes for the Treatment of Atherosclerosis via Controlled Drug Delivery & Magnetic Hyperthermia

Student Name(s): M. Cirino

Abstract:

In recent years, the use of iron nanoparticle-embedded magnetoliposomes (MLs) for controlled drug delivery has been widespread. Unfortunately, the use of MLs for the treatment of arterial buildup of plaque (atherosclerosis) via delivery and release of anticoagulant drugs remains uninvestigated. This research proposes the synthesis of anticoagulant drug-coated thermosensitive MLs for the treatment of atherosclerosis. In the proposed model, MLs are directed to a specific clogged artery via the electromagnetic properties of embedded iron nanoparticle (NP) cores. Then, oscillation via an external magnetic field abrades blood clots through magnetic hyperthermia. This process is further facilitated by the release of anticoagulant drugs as the ML's thermosensitive lipid bilayer breaks apart at temperatures exceeding 38°C. MLs were synthesized with a 105:1 ratio of dipalmitoylphosphatidylcholine to Fe₃O₄/Oleic Acid NP using modified methods from Chen et. al. The resultant MLs were characterized with SEM analysis and FTIR spectroscopy to verify size (~1 μm) and uniform coating. Eptifibatide (a common anticoagulant) was later bound to the functionalized NP (verified by FTIR); drug absorption/release studies were conducted using UV-Vis (280 nm). Temperature-dependent release of eptifibatide demonstrates that as much as 81.3% of an initial 20 μg/mg load was released beyond 38°C. To mimic clogged artery reduction of blood flow and successful ML treatment, 11.8 ml/min (peristaltic) flow was first measured through unobstructed 2.5 mm ID PTFE tubing. Following intentional cholesterol buildup, which reduced flow to 5.2 ml/min, treatment with ML using a magnetic vibration frequency of 0.9 Hz at 37°C reopened the clogged artificial artery so that 88.5% of flow was restored (9.8 ml/min).

**Technical Disciplines Selected by the Student
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EN ME AT

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- Yes No

CSEF Official Abstract and Certification

Word Count

199

Fair Category

LS

Project Number

3080

Title: Using Genetic Programming to Analyze Vitiligo's Predisposing Factors: A Pilot Study

Student Name(s): J. Diorio

Abstract:

Vitiligo is an autoimmune disorder which causes depigmentation of the skin, resulting in severe psychological and emotional stress for those who suffer from it. There are countless gaps in research regarding how vitiligo progresses and how it should best be treated. By using a genetic programming software, the GMAX, a novel pilot study could be conducted. The software has a unique strength in concurrently testing the impact and influence of the combinations of numerous variables. It creates thousands of random models of the data and "evolves" them overtime to develop the most accurate model of the dependent variable. This allowed for the testing of 20 different dependent variables involving 99 variables and 490 patient records. Among the notable findings, the GMAX identified a correlation between vitiligo patients having an allergy and being more susceptible to developing skin cancer. Skin cancer was also found to be associated in vitiligo patients who have itchy and red skin before depigmentation ensues. By using genetic programming to take an original path to modeling vitiligo progression, new findings were identified. The relationships identified by the GMAX can direct other researchers toward designing studies to test correlations that they otherwise would not have considered researching.

Technical Disciplines Selected by the Student
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ME MA

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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

266

Fair Category

LS

Project Number

3081

Title: The Effect of Common Cold and Flu Medications on the Growth of Human Gut Bacteria

Student Name(s): R. Subramaniam

Abstract:

Human gut bacteria are now recognized as critical to humans' well-being in diseases like cancer, autoimmune disease and diabetes; many species are still being discovered. Since many drugs upset the stomach as a side effect, the effect on the growth of gut bacteria of common over-the-counter and prescription medications, viz., acetaminophen (Tylenol), ibuprofen (Advil), aspirin, amoxicillin, amoxicillin/clavulanate (e.g. Augmentin), and azithromycin were investigated. Gut bacterial populations recovered by in vitro anaerobic fecal culture were monitored for growth spectrophotometrically and diversity by 16s-rRNA sequencing following drug treatment. Control in vitro culture samples recapitulated satisfactory fecal diversity to allow comparisons. Most drugs did not reduce bulk growth, except for an 80-fold reduction by amoxicillin/clavulanate. However, overall bacterial diversity was dramatically altered in all drug samples except ibuprofen. The most extreme changes were in amoxicillin/clavulanate and amoxicillin alone, where >98% of the population was the phylum Proteobacteria/family Enterobacteriaceae, followed intriguingly by Tylenol, which doubled the Clostridia/Peptoclostridium population. Proteobacteria/Enterobacteriaceae dominance promotes chronic gut inflammation, Crohn's disease, and innate immune deficiency, while Peptoclostridium difficile (*C. difficile*) is a well-known pathogen. Azithromycin destroyed the Lactobacillales family that contains all of the oral and gut-friendly Lactobacillus species while allowing growth of Cyanobacteria-related organisms, a very recently recognized gut phylum, some of which are known to produce water-borne toxins. These studies reinforce the dramatic effects of medications on gut health, even "safe" drugs like Tylenol, and validate the use of careful in vitro fecal culture as a powerful cost-effective surrogate for monitoring new drugs' effects on gut health.

**Technical Disciplines Selected by the Student
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MI ME

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CSEF Official Abstract and Certification

Word Count

252

Fair Category

LS

Project Number

3082

Title: Observing the Synergistic Effect of Pesticides on Terrestrial and Aquatic Ecosystems

Student Name(s): J. Stefanou

Abstract:

Prior to approval and manufacturing, the FDA and USDA test and rate many pesticides for safety in terms of human consumption; however, limited research is conducted on the downstream mixing of various pesticides once they reach the water table. The purpose of this experiment was to investigate the synergistic effects of pesticides on terrestrial and aquatic ecosystems. It was hypothesized that when multiple pesticides are applied at the surface, the subsequent run-off will impede growth of other plants and the animal life. To simulate earth's layered substrate, diatomaceous earth, soil, rocks, gravel, and peat moss were measured and layered into three, 12 inch long, acrylic tubes: the control tube, the single-pesticide tube, and tube with multiple pesticides applied. Soil at the top of the environments was seeded with grass. Tubes were suspended on a constructed rack and below each tube an aquatic environment consisting of brine shrimp, salt water, and rocks was created. The environments were watered from the top every other day with 200 ml of tap water, and data collected in the form of pH, plant height, and state of aquatic-life. Results of the multiple pesticide system showed a significant and gradual drop in pH, zero plant growth, and that all brine shrimp were dead after four days. The stand-alone pesticide group observed higher shrimp longevity, higher pH levels, and plant growth. Results support the hypothesis that the synergistic effects of pesticides downstream from application will likely result in impeded growth of both plants and animals.

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EV PS EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

241

Fair Category

LS

Project Number

3083

Title: A Look Into Social Anxiety

Student Name(s): M. Haight

Abstract:

For most people, delivering a speech in front of a large crowd will bring sweaty palms, a pounding heart, and a stomach full of butterflies. For individuals with Social Anxiety Disorder (SAD), this sensation can come from a simple interaction with a peer. SAD is a mental illness that countless people across the United States have, yet treatment is rarely sought. One of the leading reasons why people fail to reach out to medical professionals for aid is because SAD is not fully understood by many people. The question being asked is, are high school students who have been taught the facts about individuals with SAD more understanding, empathetic, and accepting of them than students who have not been taught about individuals with this disorder? The researcher hypothesizes that after learning more about SAD, high school students will be more empathetic and accepting than high school students who were not taught about SAD. Four technical career trades from a technical high school were surveyed, two of which received a ten minute presentation on the disorder and a post survey. The conclusions made from this study were that once people are taught about SAD, they are more understanding and knowledgeable about it. To reduce stigmas against mental illness, they should not be displayed on television as a joke or as an attempt to insult someone. With this research project, the researcher has high hopes of changing the way people perceive mental illness.

Technical Disciplines Selected by the Student
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ME BE

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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

253

Fair Category

LS

Project
Number

3084

Title: Which method of creating cellulosic ethanol through enzymatic hydrolysis and fermentation is the most efficient in terms of feasibility, production, and cost?

Student Name(s): S. Kondapalli

Abstract:

An estimated 323 million tons of cellulose-containing raw materials are thrown away each year in the US alone. Transforming them into cellulosic ethanol using efficient and cost-effective enzymes might provide as much as 30% of the current fuel consumption in the United States while also reducing methane from the decomposition of cellulose based waste. Unfortunately, not enough research has been done in the field of cellulosic ethanol to make it efficient. The purpose of my experiment is to produce the most glucose through efficient hydrolysis and then effectively produce ethanol through fermentation. I used 10 ml of Cellulase, Hemicellulose, Peroxidase and Laccase individually to see which one would yield the highest amount of glucose and then tried a potpourri of them. In the second part of my experiment, I used *Saccharomyces cerevisiae* and *pseudomonas bacillus* to see which would ferment the most ethanol from the glucose. My results found that the combination of all the enzymes produced the highest amount of usable glucose while *Saccharomyces cerevisiae* was the most cost effective way to ferment said glucose into ethanol. Overall I found that the most feasible and cost effective method of producing cellulosic ethanol is through mixing different enzymes and using standard fermentation with *Saccharomyces cerevisiae*. In future investigations, I hope to find microorganisms which produce their own enzymes or bio-engineer yeast which would produce its own enzyme's which could make the overall process of making cellulosic ethanol not only more efficient but far less time consuming and relatively less expensive.

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

BI EM 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

264

Fair Category

LS

Project Number

3085

Title: Delivery of Docetaxel via a Modified PEGylated Graphene Oxide Carrier to Inhibit Growth of Prostate Cancer Stem Cells

Student Name(s): H. Dowling

Abstract:

Chemotherapy remains a staple of anti-cancer therapy. Conventional nanocarrier-based chemotherapy, however, has consistently failed to prevent the recurrence of tumors post-treatment. One cause of high recurrence rates is the proliferation of Cancer Stem Cells (CSCs). CSCs are resistant to stress, can survive initial chemotherapy treatment, and can initiate tumors, leading to relapse. This research seeks to increase the efficacy of chemotherapy drugs in the eradication of CSCs by delivering them via a modified Graphene Oxide Nanocarrier (mGON). mGON should provide a water-soluble delivery system, and also may act synergistically to improve chemotherapy's effectiveness. To create mGON, graphene oxide (GO) was synthesized via a modified Hummers method, and characterized via FTIR/SEM. GO was then dispersed in H₂O, and PEGylated as per Liu et al. To load docetaxel (TXT), 35mg of PEG-GO were immersed in 2ml of 0.25mg/ml TXT in ethanol for 6hours. Successful loading of TXT onto mGON was verified via FTIR; a load concentration of 398 μ g/mg-mGON was determined via HPLC. To examine mGON's ability to deliver TXT, and synergistically eradicate CSCs, 0.34 mM of mGON, TXT, and loaded mGON-TXT were administered to human prostate cancer stem-cell lines (PC-3). At 1week growth, tumor-sphere assay was used to determine cell viability. As expected, TXT alone inhibited PC-3 growth by 62.5%; mGON & mGON-TXT, however, increased CSC growth by 125% and 30%, respectively. While this fails to provide evidence for the initial intent of the research, it does, however, point to a new and much needed mechanism for growth of normal stem cells.

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

ME CB BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

LS

Project
Number

3086

Title: Analysis of Honey Derivatives as a Functional Tumor Growth Suppressant

Student Name(s): K. Morris

Abstract:

It is proposed that the antimicrobial properties of honey can be applied as a possible tumor growth suppressant. The antioncogene characteristics due to the phenolic compounds and high antioxidant content resulting in a practical and suitable treatment plan as a tumor suppressant with minimal or no side effects would be invaluable. Furthermore, use of treatment with the primary constituent being honey would bare significant economic value due to its natural occurrence and vast obtainability. This experimentation analyzed the growth inhibition rates of the model organism, *Saccharomyces cerevisiae*, selected for its similar genetic function to that of tumor cells and cell division cycle of human cells, when exposed to honey treatments. Such treatments are liquid solutions of three types of honey and a natural compound at three different concentrations in YPD broth: 0.5g/mL, 0.16g/mL, and 0.1g/mL. The model organism was treated for twelve continuous ten-minute increments. A raw cell count was conducted for each interval to calculate a complete cell count. Data shows that all three honey types have inhibited growth at measurable rates as compared to the baseline growth curve. The highest inhibition was demonstrated by the Pure Comb honey at 0.16g/mL representing a 75% growth curve inhibition at peak log growth in the fifth interval and an extended inhibition of 72% growth in the final testing interval. Further research will explore the application of dosage and other treatment plans.

Technical Disciplines Selected by the Student
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- Yes No

CSEF Official Abstract and Certification

Word Count

271

Fair Category

LS

Project Number

3088

Title: Facilitated Delivery of Mitoxantrone Chemotherapy via High-load Citric Acid Coated Magnetite Nanoparticles

Student Name(s): A. Stefani

Abstract:

The effectiveness of chemotherapy is dependent not only on drug interaction, but also on the methods used to carefully position the anticancer agent next to the target tumor, so that only cancer cells are treated. Recent studies have focused on the use of magnetic ferrofluids as drug carriers; they are stable in biological systems, and are easily maneuvered using external magnetic fields. Starch has been used as an encapsulation layer for the Fe₃O₄ nanoparticles (NP), to facilitate binding and eventual release of pharmaceuticals. Using starch, however, the drug loading efficiency and subsequent release is limited by the number of drug-NP binding sites provided by the carbohydrate's multi-ring structure. Instead, citric acid encapsulation offers increased drug loading efficiency, as its smaller aliphatic structure allows for greater binding sites at the numerous carboxylic ends. In this research, Fe₃O₄-NPs were synthesized as per Anirudhan², et al., and coated with citric acid. FTIR and SEM analyses confirm uniform coating of 10-30nm Fe₃O₄-citric acid (FeCA)-NPs. For drug loading, 54mg FeCA-NPs were immersed in 47μM aqueous Mitoxantrone (Mitox), and monitored via 660nm absorbance. A maximum load of 0.58μg-Mitox/mg-FeCA-NP was achieved in ~400min. Magnetization studies demonstrate weakened yet consistent magnetic properties for each progressive coating (49.5, 0.053, to 0.011 emu/g, respectively), suggesting that the Mitox-FeCA-NPs remain highly responsive to external magnetic fields for mobility. Finally, to mimic Mitox release in a tumor environment, 54mg of Mitox-FeCA-NPs were immersed in 3ml PBS at 37°C. In 210min, 0.30μg-Mitox/mg-FeCA-NP were released, representing 52% release efficiency for this magnetically-localized, hyperthermally-driven cancer treatment.

**Technical Disciplines Selected by the Student
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ME EN CH

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CSEF Official Abstract and Certification

Word Count

177

Fair Category

LS

Project
Number

3089

Title: CRISPR Based Gene Editing Confers Resistance to Human Immunodeficiency Virus (HIV)

Student Name(s): A. Agarwal

Abstract:

Current HIV therapies lead to drug resistance and fail to address the latent viral reservoir which reactivates and inevitably leads to AIDS and mortality. Commonly infectious HIV targets T-cells via the cluster of differentiation glycoprotein (CD4) receptor using its highly conserved chemokine receptor, CCR5. This project aims to create resistance to HIV by preparing novel CRISPR (clustered regularly interspaced palindromic repeats) carrying lentiviral particles that will specifically edit the CCR5 gene in T-cells.

The novel CRISPR lentiviral particles were created to effectively and specifically deliver the gene editing complex to T-cells. Next, T-cells were transduced with these lentiviral particles and resultant genomic DNA isolated.

T7 Endonuclease Assays indicated that approximately 90% gene editing was achieved in the treated T-cells. Further, flow cytometric analysis showed T-cells had lost cell surface CCR5 expression. Therefore, they are resistant to HIV infection.

Resistance is currently being confirmed by challenging CCR5 gene-edited cells with HIV. Such HIV resistance will be tested in vivo in future.

In summation, CRISPR based gene editing confers resistance to HIV.

**Technical Disciplines Selected by the Student
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CB ME BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

242

Fair Category

LS

Project Number

3090

Title: A Statistical Analysis on the Calcification Rate of Crassostrea Virginica Through the Saturation of Calcite in Decreasing pH Levels

Student Name(s): T. Naclerio

Abstract:

The purpose of this statistical analysis is to study the calcification rates of the Native Eastern oyster larvae, Crassostrea Virginica, to see how increasing acidity impacts the saturation state of calcite, a polymorph of calcium carbonate used to form the shells of oysters. The initial idea was to measure the saturation state in order to see if the calcium carbonate mineral would form rather than dissolve in pH levels ranging from high to low. If the saturation state is greater than 1, the calcium carbonate will not readily dissolve, but if it is less than 1, it will dissolve. A decrease in carbon dioxide will make calcium carbonate dissolution more likely because carbonic acid will be less likely to form, as the acid leads to the deterioration of calcium carbonate shells. To find the saturation state with the data from the experiment, water samples were taken and a spectrophotometric method was utilized to examine the various ranges for saturation. The data for the statistical analysis was measured using oyster larvae with 2 millimeter shells and the larvae were treated with pH levels from high to low and the saturation state of calcite was measured. There's a strong positive linear correlation between the pH level and the saturation state of calcite. My results display that as the pH decreases as does the saturation state, showing that the increase in carbonic acid leads to less calcium carbonate and more corrosion of oyster larvae shells.

**Technical Disciplines Selected by the Student
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AS CH EV

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- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project
Number

3091

Title: An Investigation on the Effects of Ascorbic Acid and Rutin on Nematostella vectensis

Student Name(s): R. Rebeca

Abstract:

Nematostella vectensis is known for its ability to regenerate quickly. However, unlike sea stars and other fast regenerating organisms, studies have confirmed similarities in genomic information between humans and Nematostella vectensis through orthologous genes that are shared in the genomes of both organisms. Therefore, it can be concluded that Nematostella vectensis is an ideal model organisms in experiments involved in development, evolution, and regeneration.

This particular investigation will delve and experiment with the regenerative properties of Nematostella vectensis, as well as confirming the properties of both ascorbic acid and Rutin. In particular, the L-ascorbic acid variant will be used in this investigation. This plant based nutrient, found in fruits and vegetables, is essential in the developmental stages in mammals. Ascorbic acid is commonly affiliated in the production of collagen, a necessary protein to create and maintain skin, cartilage, tendons, ligaments, blood vessels, and connective tissue. All of these factor in the mammal's ability to heal wounds and regenerate cells.

Rutin is a flavonoid that has a very similar composition to ascorbic acid. It follows almost the same effects as well, with the exception that this compound is more prevalent in affecting blood vessels. Rutin strengthens weakened veins, preventing strokes to occur. However, not much clinical experimentations and studies have been done with the compound, and most of the studies on Rutin are still on clinical trials or done on animals. But, the notion exists that Rutin acts as a catalyst for ascorbic acid, amplifying the overall effect of both compounds.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

154

Fair Category

LS

Project Number

3092

Title: Exploring the Effects of Eutrophication in an Aquatic Ecosystem

Student Name(s): J. Masthay

Abstract:

The purpose of my experiment was to demonstrate how eutrophication can affect controlled freshwater environments. To show this, I obtained three jars and filled them with a mixture of tap water and river water. I left one as it was, put a small amount of fertilizer in the second, and put five times that amount of fertilizer in the third. The jars were left in a sunny spot for two weeks, and I recorded my observations of them (smell, water color, algae growth, etc.) every two days. After two weeks, I found that the higher the concentration of fertilizer in the water, the higher the concentration of algae, as my hypothesis had originally stated. For example, the jar with excess amounts of fertilizer had a thick growth of algae by the end of the experiment, but the jar with no fertilizer had just started growing a thin layer of algae a few days before.

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

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

250

Fair Category

LS

Project Number

3093

Title: The Effect of Protective Material Type on Concussion Prevention

Student Name(s): Q. Burke

Abstract:

Today, football players face increasing danger from hits to the head while on the field. A recent study of deceased NFL players found that 96% had CTE (Chronic Traumatic Encephalopathy). CTE is a degenerative brain disorder often resulting from concussions, and is becoming increasingly more common in football players. The research question was, "Will replacing current helmet padding technology with new protection such as a memory foam layer improve protection and therefore helmet safety?" The hypothesis was that a helmet equipped with a memory foam layer will be more effective at protecting the brain from concussions than current padding technology. Foam and air padding, or the current helmet model, was the control group, along with a no helmet group. The independent variable was the type of padding material used. The dependent variable was the effectiveness of the materials protective properties. The helmet was created without the aid of mentors and tested with mentor supervision only. The helmets were tested using the helmet crash test machine at the CT Science Center. The machine swung a hammer from a predetermined height, and impacted the side of the helmet. The machine used sensors inside a mannequin head to report the amount of G force felt by the head. In testing the helmets, it was discovered that the helmet with shredded memory foam was a better option for protecting the head. Although only a prototype, the memory foam proved to be a better option for consistently protecting the head, holding up under multiple trials.

Technical Disciplines Selected by the Student
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EE EN ME

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Yes No

CSEF Official Abstract and Certification

Word Count

242

Fair Category

LS

Project
Number

3095

Title: Structure-Activity Relationship Study of Dual Inhibitors of Streptococcus Pyogenes and Methicillin-resistant Staphylococcus Aureus

Student Name(s): S. Tavakoli

Abstract:

Streptococcus pyogenes and Staphylococcus aureus bacteria are responsible for the majority of hospital-acquired infections. They cause complicated bacterial infections in the bloodstream, skin and soft tissue. Often, both bacteria are acquired together. Although there's sufficient knowledge about effective drugs for S. pyogenes and S. aureus individually, further research is required to find a drug that will be effective against both strains of bacteria. This study aims to find DHFR inhibitors that are effective against DHFR enzymes in both bacteria. To do so, the enzyme, Dihydrofolate Reductase (DHFR), is targeted. This is a strong drug target since inhibiting it will halt the synthesis of DNA, RNA, and proteins, eventually resulting in cell death. Finding effective inhibitors will be accomplished through testing the activity of DHFR in different compounds. Half maximal inhibitory concentrations (IC50) will be used as indicators of compounds potency against enzyme activity by use of a spectrophotometer. Compounds that prevent the growth of the microorganism and inhibit the enzyme are likely to be effective against a combined infection by both bacterial strains. Currently over 10 compounds have been tested. Structures of compounds will be analyzed using Pymol for a structure-activity relationship. This is an upcoming and effective route for drug discovery that takes the compounds and optimizes them to improve their binding and potency based on information retrieved from their structures from the software Pymol. Potent inhibitors will be useful as a drug component in fighting a combined infection.

Technical Disciplines Selected by the Student
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CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project Number

3097

Title: Investigating the cardiac effect of toxicity by microwaved plastic products using Daphnia magna

Student Name(s): H. Lew

Abstract:

It has been accepted publicly that there should be some chemicals given off from plastic products when they are heated with foods in microwave oven. The chemical compounds diffused out from the plastic wraps might be able to give harms on human health in the end. Daphnia has been used long time for acute toxicity. The heartbeat of Daphnia was examined to be changed by the chemicals leached out from the plastic products when heated in the microwave oven.

Three groups of foods on a plate were covered with a plastic wrap respectively, and was heated, or cooked in a microwave oven. And, some plastic containers were heated with 200 mL of water. The condensed water under the wrap was carefully collected and used for incubating solution of daphnia for 30 minutes. The heartbeat changes before and after 30 minute incubation was evaluated.

For negative control, the daphnia was incubated in the culturing water for 30 minutes and measured their heartbeat changes. For positive controls, alcohol solution was used for incubation solution and confirmed their heartbeat change. In addition, bisphenol A solution (0.2mg/mL) was prepared and used for incubation solution. The daphnia heartbeat was measured after 30 minutes' incubation. Bisphenol A has been known the most widely utilizing plasticizer for plastic wrap manufacturing. Various products of plastic wrap and containers was be purchased and used for the research. In conclusion, no significant change in Daphnia's heart beat was observed from the samples of each food group and plastic containers.

Technical Disciplines Selected by the Student
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ME EM EV

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CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project Number

3098

Title: Novel Methods to Reduce Cooking-Oil Oxidation for Healthier Deep-Frying

Student Name(s): S. Wang

Abstract:

During deep frying, oils undergo a process called oxidation. Oxidized oils are unhealthy when ingested and cannot be repeatedly used. Trans-fat oils were used in previous years for deep frying because they do not become oxidized easily. However, they are being banned by the U. S. Food and Drug Administration for their detrimental cardiovascular impacts. Therefore, new methods are needed to prevent oxidation in non-trans-fat oils. The purpose of this project was to develop effective ways to limit oil oxidation. Three different methods were tested. 1: Sunflower oil was bubbled with CO₂ to remove oxygen prior to heating. 2: Sunflower oil was mixed with the antioxidant vitamin E prior to heating. 3: Five types of oils with different polyunsaturated to monounsaturated fat ratios were heated at 2 and 24 hour time intervals to determine the ideal oil for cooking. Using a spectrophotometer, conjugated diene levels were measured to determine the oxidation level of oils. The results showed that both CO₂ and vitamin E treated oils had a smaller increase in oxidation than their untreated counterparts. The comparison of oils with various unsaturated fat ratios revealed that oils with less polyunsaturated fats, in general, had smaller increases in oxidation. The health impacts of oxidized oils were also examined via a *Drosophila melanogaster* (fruit fly) assay. When fed to fruit flies, oxidized oils had impacts on both behavior and life span. In conclusion, bubbling, adding vitamin E, and choosing the right oils can effectively limit oxidation which can impact organisms that ingest them.

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

ME AT BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

209

Fair Category

LS

Project
Number

3099

Title: The Effects of Hydrocarbon Exposure on the Gene Expression of the CaMV 35S Promoter in Genetically Modified Soybeans (Glycine max)

Student Name(s): S. Guijarro-Sines

Abstract:

Genetically modified (GM) organisms (GMOs) have been the source of controversy since their arrival on the market. One of the most common agricultural crops modified is the soybean (Glycine max). Biodiesel is marketed as a sustainable alternative to petroleum diesel in part due to its perceived environmental benefits. The results of this study demonstrate that biodiesel may have unintended mutagenic side effects on the modified crops being harvested. In replicated treatments both wild type (WT) and GM soybeans were exposed to petroleum diesel, biodiesel, and distilled water. Tissues from study plants all having reached similar developmental stages were extracted and tested (PCR and Gel Electrophoresis) for expression of the CaMV35S promoter region, and the results were compared. Expression of the CaMV35S promoter region was altered in 90% of the samples exposed to biodiesel, which was significantly higher than in any other treatment ($p < 0.05$). When herbicide was applied to the plants, the GM soybeans showed evidence of losing structural support, a clear indication that the GM gene was not being expressed. With this knowledge, steps to create more regulations for the use of biodiesel on crop fields and more awareness of potential impacts can be implemented to improve crop produced and the extent of further mutations can be explored.

Technical Disciplines Selected by the Student
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PS CB 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

254

Fair Category

LS

Project Number

3100

Title: Enhanced Cellulolytic Enzyme Production by the Synergism between *Trichoderma reesei* and *Aspergillus niger* for the Production of Cellulosic Biofuel via Enzymatic Saccharification of Perennial Wheatgrass

Student Name(s): T. Zheng

Abstract:

Predictions about the future supply of crude oil together with increase in greenhouse gases has necessitated a search for sustainable and environmentally responsible sources of alternative energy. The bioconversion of organic biomass to biofuels has been viewed as one of the most attractive avenues of research. The cell walls of plants are enriched in carbohydrate polymers such as cellulose and hemicellulose. *Trichoderma reesei* (Tr) is commercially used for the production of cellulosic biofuel, however studies have shown that Tr, when combined with *Aspergillus niger* (An), has a strong synergistic effect in releasing sugars during saccharification. This research seeks to determine whether mixed cultivation can complement the metabolic capabilities of microorganisms, leading to secretion products with improved profiles or better bioconversion capabilities. To evaluate the synergetic effect for cellulolytic enzyme production, Tr strains were co-cultured with An (ATCC-10864) at 28°C. The growth medium was monitored daily using the GOD-Perid method, and then separated by GF/B glass microfiber filtration. Samples were then integrated into the soil of perennial wheatgrass for 1-2weeks. Wheatgrass samples were then processed via the a-amylase oxidize method to determine the amount of starch and glucose present. Based on spectrophotometric measurements at 465 & 505nm, results demonstrate that Tr and An combined increased the overall concentration of starch and glucose compared to samples treated with Tr alone. Combined fungi samples produced wheatgrass biomass with a 106% and 160% increase in starch and glucose, respectively, suggesting that mixed fungi cultures are more efficient than single cultures for cellulase production.

Technical Disciplines Selected by the Student
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EM MI PS

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- Yes No

CSEF Official Abstract and Certification

Word Count

260

Fair Category

LS

Project Number

3101

Title: Influence of Olfactory Gene and Aging on Drosophila Male's Courtship Preference and its Application in AD Research

Student Name(s): M. Hu

Abstract:

Choice making is a highly intellectual behavior involving complex processes including cognition, comparison and decision-making. Among all the choices, courtship preference is especially critical because of its importance to reproduction. Nonetheless, the ability to select the most preferable choice can diminish with aging and/or neuro-degeneration like Alzheimer's Disease (AD). To identify candidate genes involved in AD pathogenesis, *Drosophila melanogaster*, which applies multiple sensory cues including vision, olfaction and gustation in courtship, is frequently utilized as an animal paradigm. This research started with investigating male *D. melanogaster*'s mate choice and its relationship with Or47b, an olfactory receptor neuron. In each sample, one young male was placed in a closed watching chamber with two different-aged females from the same strain, and different influences of Or47b and its mutants (Or47b^(2/2) and Or47b^(3/3)) on male's courtship behavior were compared using Preference Index (PI), which quantifies male's mate preference based on its different singing time and bending numbers to different females in 10-minute-courtship. Resulting PI demonstrated males' preference for younger mates, and decreased PI (-101%) after Or47b was ablated implied its indispensability to this preference. Same experiment was re-performed using aged males, and resulting decline in PI suggested that males' ability to distinguish potential mates' ages diminishes with aging. As this research concludes that discerning potential mates' ages is an age-dependent neuronal activity for male, it establishes a genetic model for future investigation of AD, allowing further research to manipulate Or47b and the related males' courtship preference in the exploration of AD mechanism and treatment.

Technical Disciplines Selected by the Student
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AS BE CB

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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

210

Fair Category

LS

Project Number

3102

Title: The Effects of Cinnamon Powder and Oil on the Growth of Escherichia Coli K-12

Student Name(s): J. Breton

Abstract:

Cinnamon has been known for centuries as a substance with antibacterial properties. Few studies exist that show this relationship with foodborne illness-causing bacteria. If Escherichia Coli K-12 is exposed to various concentrations of cinnamon powder and cinnamon oil, then the growth rate will decrease and the bacteria will die.

In this study, commercially available cinnamon essential oil and ground cinnamon powder were introduced to cultures of the bacteria by filter disks and incubated overnight. Filter disks were placed on soft agar containing an overnight culture of E. coli K-12 in order to view a explicit zone of inhibition. Various concentrations of the oil and powder were tested, along with control cultures to ensure effect.

Upon inspection, the cinnamon oil and powder showed a clear inhibitory effect on the bacteria. In a preliminary test with 100% cinnamon essential oil on the culture, a zone of inhibition with a diameter of 2.5 cm was observed.

Since this study shows the fact that cinnamon powder and cinnamon essential oil have antibacterial properties with foodborne illness causing bacteria, many applications in the food preparation and manufacturing industry are possible. It is hoped that with this study, cinnamon can be used as a natural alternative to food preservatives and synthetic antibacterial substances.

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

MI ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

LS

Project Number

3103

Title: Chemo-responsive Prey Location Behavior of Procambarus Crustaceans when Exposed to Carbon dioxide Induced Ocean Acidification

Student Name(s): L. Albanese

Abstract:

This research will examine the effects of CO₂ levels in freshwater (and therefore decreased pH levels) on chemo-responsive behaviors in Procambarus crustaceans, specifically their ability to locate prey, green algae, in order to further examine the effects of ocean and freshwater acidification on the brain and nervous systems of aquatic animals. Measuring I) time spent in contact with the green algae; II) time from beginning of the trial to contact with the algae; III) duration of locomotion (how much time the crab spends moving); IV) area usage (time spent in each section of the tank); and V) antennae and antennule movement (number of twitches) can reveal the extent to which raised CO₂ levels (and therefore lower pH levels) affect chemoreception in Procambarus crustaceans. Based on data gathered so far, the raised CO₂ levels will most likely affect the behavior of the crayfish, and inhibit their ability to locate the prey. In reference to a worldly consequence, this implies that CO₂ is affecting freshwater creatures neurologically. With continued research, this can be further specified as to which amino acids are being targeted by the increased CO₂, as well possible ways to reverse such effects. This negative affect may have an impact on the species, as well as marine animals overall, both invertebrates and vertebrates. Such will disrupt the ocean, as well as land, ecosystem, as well as suggest possible negative effects in higher-order beings.

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

BI AS 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

179

Fair Category

LS

Project
Number

3104

Title: Stopping the Stigma on Obsessive Compulsive Disorder (OCD).

Student Name(s): C. Fratoni

Abstract:

Obsessive Compulsive Disorder (OCD) is an anxiety disorder that causes a person to do repetitive behaviors (compulsions). OCD can cause those diagnosed to do something repetitively and they can have more than one compulsion. The hypothesis is if people were educated about OCD, they would be more accepting of individuals with OCD than people who are not knowledgeable about this mental illness. This was a quantitative experimental study in a small suburban town in New England at a technical high school. The intervention group took a pre and post survey along with receiving a teaching component. The control group took only the pre-survey. The surveys were anonymous and all information was kept confidential. The predicted outcome was that the intervention participants would show greater knowledge than those who were not selected to be part of the teaching component. After the educational component the intervention group demonstrated they gained knowledge and awareness about OCD. Having OCD does not make a person crazy and students should know the facts in order to decrease the stigmas associated with a mental illness.

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

BE ME

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 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

239

Fair Category

LS

Project
Number

3105

Title: The Effect Of Polyphenols in Tea on Preventing E.coli Growth

Student Name(s): K. Gray

Abstract:

The Effect of Polyphenols in Tea on Preventing E.coli Growth

The purpose of this project is to find out if tea has polyphenol content. Black, white and green tea were used. The predicted result was that white tea would prevent the most E.coli growth, meaning that it would have the highest polyphenol content. Polyphenol content is made up of catechins and epicatechins, which are natural antioxidants. The less the tea is allowed to oxidize, the more polyphenol content it will retain. Since white tea is not oxidized at all, there will be more polyphenols left than green or black tea. This experiment was conducted by steeping the three types of tea and dipping blotting paper in the tea solutions. Then, the blotting paper was placed onto a petri dish which was covered with E.coli. The E.coli was then placed onto the petri dish by using a pipette and a spreader. The zones around the blotting paper were measured after twenty-four hours and after forty-eight hours. The data shows that white tea had zones an average of 3.5 millimeters from both days. Black tea had the second with an average of 2.25 millimeters. Green tea prevented the least E.coli growth with a zone average of 0.75 millimeters. This experiment could help people choose to buy and drink white tea, which has the highest polyphenol and antioxidants. Therefore, white tea is the most beneficial tea to improve general health.

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

MI ME

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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

200

Fair Category

LS

Project Number

3106

Title: The Effect of Nitrate Enrichment on the Ability of Nannochloropsis sp. to Offset Ocean Acidification

Student Name(s): C. Sherman-Watson

Abstract:

Nannochloropsis sp. is a marine green algae that is found throughout the world's oceans. Phytoplankton such as this has the ability to offset ocean acidification by preferring the photosynthesis pathway, which uses the carbon dioxide in the ocean. In this study the effect of nitrate, a common nutrient found in the ocean due to runoff and pollution, was tested to determine if it affected the ability of phytoplankton to offset ocean acidification. Nannochloropsis sp. was contained in test tubes with different pH and nitrate levels, to simulate real environmental conditions. The results of this study proved that nitrate inhibits the ability of Nannochloropsis sp. to combat lowering pH in the ocean, caused by pollution. It is concluded that the culture must be bimodal, meaning it can switch between utilizing nitrate and performing photosynthesis. It showed a preference for nitrate when it was offered, instead of photosynthesizing. Due to this, the pH in the ocean was not lowered, as the algae did not photosynthesize while uptaking the nitrate. If we are to manage coastal runoff, then these organisms can reverse the lowering pH in the ocean by photosynthesizing, making it a more fit environment for many other animals in the ecosystem.

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

MI

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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

248

Fair Category

LS

Project Number

3107

Title: Identification of Novel Small Molecules that Bind to K-Ras and PI3K RBDs, Two Major Protein Components Involved in the Deregulation of the Cell Cycle in Hematological Cancers

Student Name(s): S. Desai

Abstract:

The PI3K Pathway has been an attractive target for cancer research and drug development since its discovery in the 1980's, as every major node of the pathway (RAS, PI3K, PTEN, AKT) is found to be frequently mutated or amplified in a wide variety of malignant tumors. PI3K inhibitors synthesized to date have been directed towards the enzymes active site, serving as competitive inhibitors for ATP (also known as ATP-mimetics), indicating the need to find new molecules directed towards domains of the protein other than the kinase region. In the case of K-Ras G12D, a protein present in the pathway, discovering a small molecule that can successfully bind to it has proven difficult due to the lack of a distinct pocket on the enzyme's surface for drug attachment. Regardless, a library of allosteric compounds (non ATP-mimetics) was tested in this project, allowing for the identification of a completely different class of inhibitors (noncompetitive inhibitors) directed towards the pathway. Likewise, a separate group of inhibitors were tested for their ability to bind to the RBD (Ras-binding domain) region of the PI3K protein, another key protein in the PI3K Pathway. Ultimately, several small molecules were identified and selected on their outstanding ability to allosterically bind to either K-Ras or PI3K. The extensive research and clinical testing of specific compounds that inhibit key proteins involved in deregulated cellular proliferation may hopefully translate to new chemotherapeutics directed towards treating patients with hematological cancers in the near future.

**Technical Disciplines Selected by the Student
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BI ME CB

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- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

LS

Project
Number

3108

Title: A Novel Application of Biochar Providing Economic and Environmental Benefits

Student Name(s): C. Marini

Abstract:

In the southern United States, vulnerability to drought and continuous global climate change have resulted in scarce rainfall, and thereby have made cotton irrigation very challenging. As a result, farmers of cotton crops are forced to utilize large amounts of water to irrigate their plants. However, because the soil is so dry, much of the rainfall and water added manually by the farmers percolates through the soil. Consequently, thousands of cotton plants wither and cannot survive, and are therefore useless to small American farmers, and to the American clothing and toiletry industries.

To test biochar material as a soil amendment, I hypothesized that if I construct two lysimeters, and a white salvia plant in biochar-implemented soil is placed in one lysimeter, and a white salvia plant without biochar in its soil (control) is placed in the other lysimeter, the plant with biochar applied to its soil will retain much more water, yielding tremendous plant growth.

After completing my experimentation, I am able to support my hypothesis. Such can be confirmed from the observations and data I collected, which articulate that during my eight day investigation, the salvia plant with biochar substance implemented in its soil grew 14.1% (8.4 centimeters) of its original height (59.7 centimeters), and only percolated an average of 6.9 milliliters of water each day, whereas the salvia plant without biochar applied to its soil grew only 10.2% (6.2 centimeters) of its original height (61 centimeters), and percolated a large average of 480 milliliters of water each day.

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

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

4. Is this project a continuation? Yes No

5. 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

3109

Title: The Induction of Apoptosis in Leukemia and Lymphoma Cell Lines by Small Molecule Inhibitors through the Inhibition of Antiapoptotic Proteins

Student Name(s): J. Schwartz

Abstract:

The threat of resistant cancers is often due to their dependence on mechanisms that keep cells alive (which leads to their inability to undergo apoptosis). This makes cytotoxic treatment options ineffective. A more specific method for targeting these resistant cancers is protein inhibition. By targeting antiapoptotic (anti-death, survival) proteins, like Mcl-1, Bcl-2, and Bcl-xL, resistant cells lose their survival factors and therefore die. Targeting these proteins frees Bax/Bak apoptosis-inducing proteins to kill cancer cells, while potentially keeping healthy cells alive. A1210477 and Gossypol have both shown inhibitory effects on Mcl-1 as ABT-199 does on Bcl-2 and ABT-737 does on Bcl-2 and Bcl-xL. These drugs have the potential to work in conjunction to inhibit multiple antiapoptotic proteins that code for resistance. This study tests their ability to induce apoptosis in cancer cell lines. The combination of A1210477 and ABT-737 was shown to have the greatest potential for cancer treatment due to its tremendous efficacy in extremely resistant THP-1 cells.

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

ME CB BI

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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

267

Fair Category

LS

Project Number

3110

Title: Oral Delivery of Insulin Therapy via Low Cost, pH Sensitive Hydrogels

Student Name(s): M. Xiong

Abstract:

Diabetic patients rely on insulin, administered predominantly via injection. Oral delivery of insulin is desirable, as it would offer convenience, leading to improved patient compliance and glycemic control. There are also physiological advantages of imitating insulin's natural pathway, to resume the liver's role in glucose metabolism. pH sensitive hydrogels are gaining momentum as a carrier for insulin, however the stability of these hydrogels within the severely acidic stomach environment has limited their adaptation. In this research, pH sensitive hydrogels (Hg) were synthesized using citric acid, ethylene glycol, and methacrylic acid, as per Franklin, et al., with modifications. Swelling studies of the unique Hg demonstrates expansion so that 92.8gH₂O is absorbed per gram-Hg at pH6 (i.e. the small intestine environment). Dried hg were then ground into powder, and immersed in an insulin phosphate buffer solution for loading. Using the native fluorescence of insulin (270/315nm), insulin load on Hg was determined to be 37.6µg/mg-Hg, or 1.1U/mg-Hg (for a 94% load efficiency). FTIR and SEM confirmed the incorporation of insulin within the hydrogels. To verify stability of the Hg encapsulation of insulin in the stomach, insulin-loaded-Hg (Ins-Hg) was immersed in pH2 solution; in 2hours, the Hg resisted swelling and insulin release. To simulate subsequent small intestine release of insulin, the same Ins-Hg was immersed in pH6 solution. 30.5µg-insulin/mg-Hg (0.88U-insulin/mg-Hg) were released in 90minutes (81% release efficiency). Assuming a typical diabetic requires 10U-long-acting-insulin/day, and 0.5% absorption in the small intestine, 228 mg of Ins-Hg would represent a typical daily patient dosage.

Technical Disciplines Selected by the Student
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ME EN BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

180

Fair Category

LS

Project
Number

3111

Title: Development of New Filter for MRI Image Quality Improvement

Student Name(s): J. Yi

Abstract:

Magnetic Resonance Imaging is a commonly used technique produces an image of the subject's anatomy through radio waves, magnetism and computers. The data for the image is first transmitted into a k-space diagram, which is changed into an image through the Fourier Transformation.

The main purpose of this research is to develop better algorithm that would enhance the quality of the final MRI image, decrease the amount of time taken to produce it, and produce the image with less ringing artifact.

In the paper, various filter functions were tested using the MATLAB as low pass filters. All types of functions showed their distinct features and were compared to one another. Finally, taking many factors into account, an efficient new filter was proposed and tested with raw data.

In the part A of this research, a nonconventional approach was used in MRI image analysis. Original MRI image domain was transformed into k-space using Fourier Transform to determine an efficient filter that will produce optimal image. In Part B, image reconstruction using raw frequency data and proposed filters were discussed.

Technical Disciplines Selected by the Student
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PH ME EN

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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

3112

Title: The Correlation of the Development of the Children's Phonological Processing, Intelligence Quotient, and Reading Cognition

Student Name(s): J. He

Abstract:

Reading is a complex cognitive process, requiring many brain regions working simultaneously. Much research has identified phonological awareness (PA), the ability to detect and manipulate phonemes, as a predictor of reading cognition (RC) in children who have not started reading.

This study prospectively investigated the processes underlying reading through the question, "Does IQ correlate with PA and RC in children, and if so, how?" It was hypothesized that IQ is positively correlated with a child's PA and RC.

Forty-two participants aged 4-7 were randomly recruited from the New Haven community and given standardized assessments twice over one year to determine their PA, IQ, and RC longitudinally. Each child's raw scores were standardized based on age.

For data analysis, two cohorts were formed based on age, and further subdivided by their IQs. General linear model analysis of both cohorts indicated a trend as children with higher IQs had higher PA and RC scores, but did not follow a definitive linear pattern.

Correlation analysis indicated higher correlations between IQ and PA and between IQ and RC as children gained reading proficiency, suggesting IQ's increasing influence on PA and RC as reading development progresses. Since IQ remains relatively constant throughout a person's life, IQ can be utilized as an indicator of the development of a child's PA and RC as they become better readers, and denote skills that may impede reading development. Identification can help educators focus their guidance on specific skills for each individual, such as components of PA or RC.

**Technical Disciplines Selected by the Student
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BE 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

251

Fair Category

LS

Project
Number

3113

Title: A Novel Approach for Detection of Early Onset of Chronic Kidney Disease (CKD) in the Rural Communities of Sri Lanka

Student Name(s): S. Gunawardana

Abstract:

According to the Center for Disease Control, over 20 million Americans suffer from CKD, causing a painful, unproductive life. This worldwide issue has become an epidemic in Sri Lanka, where 15% of citizens are at risk of getting kidney disease, according to the WHO. CKD takes many years to develop, essentially meaning early detection is the key to delaying onset of symptoms and lowering disease rates. Currently, the best options available for detection of kidney disease are limited to biopsies and imaging tests– all expensive and only available in certain hospitals. The objective of this research is to create an affordable, simple, accessible test to detect early onset of CKD. To begin experiments, the urine of a healthy person without CKD (the control) was simulated using synthetic urine, and the urine of someone with CKD was simulated by adding protein in increments of 8 mg (albumin) and 50 mg (creatinine) to synthetic urine. Then, test strips were made by soaking chromatography paper in five chemical indicator solutions (citric acid, methyl red, methyl orange, potassium iodide, bromothymol blue) made from reagents administered in hospital procedural urinalysis. There were visible color reactions that changed depending on protein concentration when the methyl red test strip was placed in the mixture for 60 seconds. These results indicate methyl red can be used as a reagent to detect protein molecular markers in a CKD patient's urine. This can be used to develop a self-test people can purchase to track the disease progression and get treatment.

**Technical Disciplines Selected by the Student
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ME CH BI

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Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project Number

3114

Title: Analyzing the application of Moon Jellyfish (*Aurelia aurita*) Collagen as a Viable Alternative in Medical Applications

Student Name(s): K. Fawcett

Abstract:

Dissolvable sutures can be used on both external and internal wounds. These sutures are made from natural materials, such as collagen, which allows the body to breakdown the stitches over time. The majority of these dissolvable sutures are based on the collagen extracted from the serosal layer of beef, bovine collagen. However, three percent of the population is allergic to this specific collagen. Additionally, the cows from which this collagen is extracted are carriers of human pathogens; Black Skin Disease (BSD), Tay-Sachs Disease (TSD), Foot-and-Mouth Disease (FMD), and Mad Cow Disease (MCD). An alternative to the bovine collagen is jellyfish collagen. Both are Type 1 collagens, however jellyfish are not a known allergen and will eliminate disease transmission risk. Applying a pepsin soluble extraction procedure, collagen was extracted from moon jellyfish (*Aurelia aurita*) with an average extraction of 0.2% collagen. The jellyfish collagen was compared to bovine collagen in a FTIR scan confirming parallel compounds. Additionally, the jellyfish collagen was infused with silver nanoparticles to provide antibacterial properties. This was tested by introducing the silver nanoparticle collagen to a lawn streak of E Coli. With 1.2 ml of collagen stabilized in an acidic solution at a ratio of 3 mg/ml, a fibrillar collagen matrices on a 90 mm petri dish can be formed. It is proposed that future research on the tensile strength of fibrillar collagen matrices, properties of jellyfish collagen and other aspects of the product will lead to it being available for commercial use.

Technical Disciplines Selected by the Student
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ME EN BI

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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

257

Fair Category

LS

Project Number

3115

Title: Identifying Quasi-Periodic Patterns in Functional MRI data

Student Name(s): H. Jarad

Abstract:

A functional MRI (fMRI) is a form of Magnetic Resonance Imaging (MRI) that tracks the metabolism of neuron cells in order to measure brain activity by detecting levels of deoxyhemoglobin in the brain, an indicator of high levels of cellular respiration (energy consumption). fMRI scans are video clips depicting energy consumption through color-coding (red=high; blue=low). This study developed a pattern identifying algorithm. The algorithm, searches for semi or “quasi”-periodics, meaning every instance of the pattern looks different; in order to identify only activity that is consistent among all instances, the algorithm relies on excessive averaging. A single instance (template1) is compared to all data. Areas of high correlation are averaged to create a new template (template2) which is compared to the rest of the data just as template1 was (repeated 10,000 iterations). The final template is essentially all activity consistent amongst all instances of the pattern, and is considered the quasi-periodic pattern. However it was observed that as the initial pattern (template1) was altered in length and start time, the final template changed. The research question then arose: Does altering the start time of template1 have a greater impact on the identified quasi-periodic pattern than altering length? A change in the start time of template1 is hypothesized to have a greater impact on the appearance of the final template than a change in the length of template1. Results thus far support the hypothesis. Changing start time changes the pattern being identified while changing the length only results in seeing multiple cycles.

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

ME CS

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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

239

Fair Category

LS

Project
Number

3118

Title: GABA Responses on Adult MCH REsponses

Student Name(s): R. Patel

Abstract:

Melanin-concentrating hormones (MCH) play a critical role in energy and sleep homeostasis, and losing function of these neurons can result in a substantial lack of sleep. More importantly though, MCH neurons express GABA_A receptors which promotes sleep. This in turn depolarizes the MCH neurons, which allows for sleep. According to a study done at the Max Planck Institute in Germany, Ca²⁺ levels increase when MCH neurons are excited from light stimulation of channelrhodopsin. Furthermore, the purpose of this project is to discover if endogenous GABA release from local GABA neurons depolarizes and excites MCH neurons and leads to an increase in Ca²⁺ levels. It is hypothesized that MCH neurons will be depolarized by the release of GABA in channelrhodopsin expressing and photostimulating cells. Brain slices were kept in an ice-cold sucrose solution. A BX51WI Olympus microscope was used to identify viable cells and an A320 electrical stimulator for action potentials. Also, 25 seconds of GABA applied to the cell assisted in identifying in increase in Ca²⁺ levels. The activity present in the results suggested that there was not a possible GABA response in any of the recordings due to the behavior of the inhibitions and depolarizations that are not consistent with the behavior of GABA. However, the Ca²⁺ levels increased after GABA was released into the cells. These results will allow us to determine whether GABA has a unique role based on its behavior and neuronal location.

Technical Disciplines Selected by the Student
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BI CB 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

238

Fair Category

LS

Project
Number

3120

Title: The Effect of Diet on Homeostasis in the Human Body

Student Name(s): M. Madar

Abstract:

A number of factors can alter the homeostatic state of the body, but one is particularly interesting: diet. There have been many theories surfacing about alkaline diets and their positive effects on health. While these theories are still being investigated, the role of minerals in the human body is a known entity. Minerals in the body, such as calcium and potassium, play major roles in maintaining its homeostasis. When diet disrupts their normal concentrations, homeostasis can be lost. When homeostasis in the body is disturbed, it can have severe consequences on many components, including liver enzymes. One enzyme is catalase, which catalyzes the decomposition hydrogen peroxide produced in the body into water and oxygen gas. This is crucial because hydrogen peroxide is a toxic substance that can cause many harmful effects. Much of the catalase in the human body is found in the liver, which filters our blood and helps convert toxic substances into harmless species that are consumed or discarded as waste. When all is in balance, catalase and other liver enzymes are working at peak efficiency to perform their biological task. One aspect of the human body affected by the loss of homeostasis is pH level. My tests found that as pH levels shift away from catalase's optimal pH of 7, its catalytic activity decreases. This demonstrates both the importance of maintaining pH homeostasis in our body and the importance of eating a well-rounded diet.

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

BI

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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

3121

Title: The Effect of Nicotine Concentration on Endothelial Cell Proliferation

Student Name(s): K. Yanagisawa

Abstract:

The current generation has come up with countless new inventions, one of them being the electronic cigarette (e-cig). The e-cig emits water vapor instead of chemicals and toxins that are seen in common cigarettes. This makes them less harmful for the body, but liquid nicotine can be added. This causes the nicotine to get vaporized with the water. It is thought that nicotine would proliferate endothelial cells, which line the lungs, because they did so to lung cancer cell lines. Due to the toxicity and the chemical contents of the nicotine liquid, this study will investigate how the concentration of the added nicotine affects endothelial cell proliferation. Each test was conducted in a five day span. On day one, endothelial were cultivated and plated. The next day, the number of cells within a 96 well plate were counted and recorded. On that same day, eight different concentrations of nicotine were added to the well plate, then cultivated for three more days. On the fifth and final day, the number of endothelial cells were counted and put into a Luminometer for calculation. Results show that the nicotine did not affect the proliferation of the endothelial cells over a 72 hour time period. After the finding the results, the next step is to expose the cells for a longer duration of time. This would be more realistic to someone that got a lung disease or illness from using an electronic cigarette.

Technical Disciplines Selected by the Student
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CB 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

249

Fair Category

LS

Project Number

3122

Title: Biodegradable Plastic Study to Prevent Oceanic Pollution

Student Name(s): M. Peck

Abstract:

The purpose of this experiment was to create a biodegradable plastic based off starches that would dissolve in saltwater. A total of 36 plastic samples were created, 18 had 4 tablespoons of starch in them while the other 18 had 8 tablespoons, each followed the same recipe but with different types of starches (Corn, potato, or tapioca). Each plastic spent 10 days in either tap or salt water. The 36 samples were divided into 4 groups of 9. Each group of nine had sub groups which were based off of what type of starch the sample was made of. Two groups had 4 tablespoons of starch and were added to a saltwater and tap water fish tank. The third and fourth groups had 8 tablespoons of starch and were added to a tap and saltwater fish tank. The mass of the samples were taken prior to putting them in the water, once in the water they were measured every 1-3 days for 7 days. At the end of the experiment the samples were left out for 2 days to dry completely, and were massed. After the samples were taken out and dried completely they showed a significant decrease in mass from anywhere between 22%-70%. Compared to the other starches tapioca starch had the greatest decrease in mass, 37-70%. Unfortunately, it is not confirmed that this plastic will not degrade in tap water which would significantly reduce its number of uses if it were to be put into products.

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

253

Fair Category

LS

Project
Number

3124

Title: Effects of varied concentrations of Propolis and Saccharin on the growth of Zebrafish Embryo

Student Name(s): D. Yetil

Abstract:

In this project, the goal was to test the effects of Brazilian Green Bee Propolis and Sodium Saccharin on zebrafish embryos. Zebrafish embryos are a very good subject to perform research on when testing for developmental effects that could affect humans as well, due to similarity in DNA. This project is important because propolis is becoming a more widely used/researched substance as it has many beneficial effects from antiviral to even being able to kill certain types of cancers. Saccharin is a sugar free sweetener used in many 0 calorie sweeteners today, such as Sweet'N Low. The results of this project would have shown the possible negative and/or positive effects of both propolis and saccharin on a developing organism. No research was conducted due to many complications with the breeding/care of zebrafish, however the project would've been conducted using saccharin and propolis in varying solutions on zebrafish embryos in petri dishes. These embryos would then be observed over the next five days in order to observe any morphological effects on the embryo development. These observations would be compared to several control embryos in order to determine whether there were any significant differences. I have hypothesized that saccharin will have a very negative effect on the development of embryos due to its controversial history of its negative effects on humans as well as rat subjects. I also thought that propolis would have an overall positive effect because of its many benefits to living organisms, maybe causing the embryo to develop faster.

**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):

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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

119

Fair Category

LST

Project Number

3502

Title: The Effects of Nitrate Runoff on the Burial of Hermit Crabs

Student Name(s): C. Hoffman, M. Michel

Abstract:

Anthropogenic pollution may have an impact on animal behavior. Runoff is common in coastal areas and could cause changes in behavior of coastal species that live in the surrounding area. In this investigation the effects of nitrate runoff on burial of hermit crabs was studied. The hermit crabs were buried with different levels of nitrate added into the water in order to determine the effects it would have on the hermit crab's ability to unbury themselves. Hermit crabs buried with a high amount of nitrate in the water had a higher unburial rate. The results from this investigation show the effects of nitrate runoff on coastal species, indicating how organisms respond to the excess chemicals and nutrients from runoff.

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

254

Fair Category

LST

Project Number

3503

Title: The Effect of MCT oil on a Drosophila model of LCHAD Deficiency

Student Name(s): K. Stackpole, T. Nordgren

Abstract:

Long-chain 3-hydroxyacyl-CoA dehydrogenase (LCHAD) deficiency is a condition that stops the body from converting long chain fats to energy. Because people with LCHAD have problems digesting/breaking down long chain fatty acids, they are treated with a dietary supplement of medium-chain fatty acids. We used *Drosophila melanogaster* as a model for LCHAD deficiency and tested how they were affected when fed a normal diet versus one containing medium chain fats (MCT oil). This allowed us to determine if these flies are a good model for further study of human LCHAD deficiency.

We used two different LCHAD-deficient strains created by other labs. The strains were created from y w parent strain and w parent strains, and are referred to as the y w MTP α KO and w MTP α KO strains. Because MCT oil can be an alternate energy source, we expected to measure an increase resistance to starvation and better climbing ability. As expected, we found that MCT oil increased the percent survival of the w MTP α KO strain at 64.5 hours from 28% to 46% in the starvation survival assay. There was no effect on the y w MTP α KO strain. In the climbing assay, we found that there was increased climbing ability in both the w parent strain and w MTP α KO strain. Both of these results together suggest that the w MTP α KO strain is a better model for studies of LCHAD deficiency than the y w MTP α KO strain. However, more trials and results from other assays would be needed to confirm this.

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

BI 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

251

Fair Category

LST

Project
Number

3504

Title: The Effect of Herbal Treatments on Staphylococcus aureus

Student Name(s): K. Shah, A. Rehman

Abstract:

The idea of herbal treatments has always been a great interest to the both of us. We decided to test turmeric, henna, and essential oils on the growth of Staphylococcus aureus. Staphylococcus is a type of bacteria that is generally found on the skin, hair, noses and throats of people. While researching Staphylococcus, we found that it is an antibiotic resistant bacteria. Since Staphylococcus is a common cause of skin infections, we thought it would be a great bacteria for this experiment. We decided on essential oils because they are advancing in the medical field, but specifically chose to test Manuka and Tea Tree oil. Turmeric and henna are types of herbal treatments that provide health benefits and defend the body against infections. Curcumin, the main component in turmeric, along with henna have anti-inflammatory effects. Henna is a medicinal plant and has properties as a skin healer. It contains components that can help to fight infections by reducing bacteria on the skin. The purpose of this experiment is to provide a cheaper, yet effective, alternative for people who cannot afford modern medicine. We wanted to discover a treatment that was natural and cause no harm to the body. We will use different concentrations of the herbal treatments throughout our experiment. To measure the bacterial growth, we plan on using a spectrophotometer which will display the growth curve. We hope to see that when these herbal treatments are applied to Staphylococcus, the growth rate of the bacteria will decrease over time.

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

248

Fair Category

LST

Project Number

3505

Title: Does Sediment from Soil Paired with Potting Soil Increase Crop Yield?

Student Name(s): J. Werenski, Y. Mehta

Abstract:

We sought out to determine if natural sediment paired with potting soil can have different effects on pea plant growth. We paired it by 100% potting soil, 100% sediment, 50% potting soil 50% sediment, 70% potting soil 30% sediment, and 30% potting soil 70% sediment. We measured the amounts out by taking an 8 Oz cup and corresponding it with what percent we need of each. As we predicted, the 70% potting soil 30% sediment worked best. We predicted this because we assumed that natural elements found in the sediment help to increase pea plant size at the fastest rate. Natural elements in the sediment we predicted to be phosphorus and nitrogen, which are for plants to grow. Our test did include validity issues such as the condition of the pea plant bean could have varied and that there could have been more nitrogen or phosphorus per cup in the different tests. We believe our results can be used to increase crop yield on farms. By extracting sediment from lakes, natural elements found in the soil can be given to farmers who will incorporate the sediment into their soil. Farmers depend on cow manure to fertilize the ground, but the soil found in lakes can help to fertilize the ground in a less messy way. In the same way, third world countries could use this technique to fertilize crops that have struggled to fertilize due to inadequate soil for farming. Our results can revolutionize the process of fertilizing plants.

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

PS EV 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

255

Fair Category

LST

Project Number

3506

Title: Comparing the Effects of *Oniscus asellus* and *Armadillidium vulgare* Activity and Associated Decomposition on Soil Composition and Plant Growth

Student Name(s): H. Khan, B. Davidi

Abstract:

This project is meant to show the effect two different isopod species have on soil quality and plant life. This study will investigate the singular and multi-species effects of isopods. Additionally, the study will test how the quality of food available and different population densities alter the effects of isopods. It is hypothesized that a mix of *O. asellus* and *A. vulgare* at a mid-density level with access to nitrogen rich food will create the most nutrient-rich soil and allow plant life to grow the best. As this is a multi-block design experiment, there are several independent variables, including food quality, population density and isopod species. The dependent variable is the soil composition, decomposition rate and plant growth. To conduct the study, 40 mesocosms with 0, 2, 4, or 6 isopods each were set up with homogenized soil. Half the mesocosms had 6 bags of goldenrod litter and the other half with 6 bags of grass litter. Two anion/cation membranes were placed into each mesocosm to measure nitrogen levels. At a biweekly rate, litter bags were massed and nitrogen samples collected. Afterwards, *Poa pratensis* grass was planted into each mesocosm and harvested to measure the viability of plant life. Data thus far indicates that there is an exponential decay pattern in the decomposition rate, much more prevalent in the grass litter (at all densities) as compared to the goldenrod litter group. Additionally, there seems to be a synergistic effect on decomposition rate when the two species interact with one another.

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

PS 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

250

Fair Category

LST

Project
Number

3507

Title: A Study of the Effects of Increased Temperature on Carbon Dioxide Intake of Aquatic Crassulacean Acid Metabolism Plants

Student Name(s): R. Weinstein, C. Kontogiannis

Abstract:

We are looking to see if the efficiency of CAM plants in sequestering carbon dioxide is as effective under increased temperature, which we will be likely to see in the near future due to global warming. CAM plants already take in CO₂ at an extremely high rate and due to global warming, there is fear that their intake can be lowered under increased temperatures. Our hypothesis is that CAM plants will be less effective in gathering carbon dioxide when under the stress of heat. We think that this will cause a slight decrease in the organism's absorption and transformation of carbon dioxide. So far, we have collected data for our control sample. To do this, we cut one of the plant leaves into 1 cm pieces and dried them in an oven at 60 degrees Celsius for 48 hours. We then put them into a solution with deionized water and centrifuged the solution for 30 minutes. Once it was mixed, we measured the pH of the solution and found that it was 6.85, which is slightly acidic compared to the 7.09 measured for the deionized water alone. This is significant because aquatic CAM plants produce malic acid when they undergo photosynthesis, so the more acidic the solution is, the more efficiently the photosynthetic process is running. We plan to run this same test for the plants at increased temperatures to see if the photosynthetic process is running as efficiently under this stress. Our teacher, Dr. Katherine Nuzzo, has helped us.

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

BI 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

189

Fair Category

LST

Project
Number

3509

Title: The Effect of Magnetized Water on the Growth and Health of Kale (*Brassica sabellica*) and its Potential Use in Agriculture

Student Name(s): P. Ehwarieme, L. Bolle

Abstract:

Magnetized water has been reported to have a positive impact on germination rates and overall health for plants, due to the increase in surface tension of water and accelerating the growth of plants. This study investigated the effect of magnetized water on the growth rate the of kale (*Brassica sabellica*). To study this effect, a water polarization system was built, and Kale plants were treated with magnetized and tap water. The growth rates of each plant were calculated and compared using ANOVA tests. The results show no significant difference in plant growth rate between the two treatments ($p > 0.05$). Chlorophyll concentrations were then measured with a spectrophotometer, in order to compare the health of the plants. The plants treated with magnetized water had an average higher chlorophyll concentration than the plants not treated with magnetized water. Magnetized water may not have a positive effect on growth rate, but may increase the overall health of the plant. The results from this study may encourage the agricultural industry to further research using magnetized water to grow crops, since it would allow farmers to use less resources to grow healthier crop yields.

**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

249

Fair Category

LST

Project
Number

3510

Title: The Effect of Multilingualism on Attentional Control Measured with Time Perception

Student Name(s): Y. Zhou, S. Park

Abstract:

Besides communication, what advantages do multilingual individuals have? This study focused on multilinguals' advantage in attentional control by measuring time perception under two distractions. Attentional control is people's capacity to choose what they pay attention to and what they ignore. It was hypothesized that if multilingual and monolingual individuals are both subjected to distractions while performing a task, then multilingual individuals will do better on the experimental time perception test. Previous studies have shown that there is a bilingual advantage in attentional control. In this study, two distractions were used: a horror movie clip and a fast tempo audio clip. First, a time perception test was given, followed by a random task. Then a distraction was given and the second time perception test which was given after 3 minutes of the 5-minute long distraction. A second random task was given followed by another distraction and time perception test. 2-sample-t tests were used to analyze the data and the results did not support the hypothesis. Multilinguals performed worse in experimental time perception tests than monolinguals with the p-values of 0.9065 (tempo) and 0.9259 (movie). There was also no multilingual advantage for the random tasks. Overall, the study did not show multilingual advantage in attentional control. Future plans to extend this study could be adding different types of distractions such as plain visual distractions or making the time perception test into different lengths. Another plan for future research could be using different ways to measure attentional control.

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

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

153

Fair Category

LST

Project Number

3511

Title: Clean the Seas: The Effects of Pollutants on Aquatic Life

Student Name(s): C. Litts, L. Pawlowski

Abstract:

The world faces extreme pollution everyday from a variety of sources that excrete harmful poisons into the environment, such as cars and other forms of machinery. Not only do these poisonous pollutants cause serious harm to plants and animals, but they also disrupt natural underwater ecosystems. To create a world that is cleaner, safer, and more cost efficient, the following question was brought to attention: How do various pollutants affect aquatic life? To solve this problem, a model was used to simulate the pollution of aquatic environments. When using motor oil, sulfates, and grass fertilizer, the data shows that the fertilizer was the most harmful pollutant to the health of daphnia over the course of one week. Therefore, to limit the amount of damage done to aquatic life, environmentalists should pay attention to the amount of fertilizer that is excreted into waterways, and find a safer way to optimize the protection of plants.

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

EV EM 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

249

Fair Category

LST

Project Number

3512

Title: Clarifying Bipolar Disorder and the Stigmas Pertaining to it

Student Name(s): J. Herbert, M. Sanon

Abstract:

This paper explains the researchers conducted and analyzed the results of their experimental study on Bipolar Disorder (BPD). BPD is an illness that causes chronic mood swings of ups and downs that occur during certain periods of time. The researchers looked at the work of Costello (2011) to understand how an experimental study is conducted and how information is acquired to help prove the point that the researchers are trying to demonstrate. The researchers also examined the work of Jasko (2012) in regards to how individuals with BPD are stigmatized. In connection to this the researchers reviewed the work of Lewis (2005) to see the effect that stigmas have on individuals with BPD. There are two major sources of stigmatizations for people with BPD. The first is self-stigmatizing from them knowing that there is a stigma pertaining to their disorder and believing that it is directed towards them. The other is that they are being stigmatized by another person or group that directs put downs towards that individual. With this knowledge the researchers made an educational Prezi to be presented to the intervention group after the participants have taken the pre-survey. The outcome of the researchers' study showed that the control group already had a general knowledge of what BPD is and an adequate knowledge of the effect stigmas have on those with BPD. However the intervention group learned more about BPD and the effect stigmas have on individuals with BPD after being shown the educational Prezi.

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

251

Fair Category

LST

Project Number

3514

Title: Integration of Auditory and Visual Features of Speech Perception in Schizophrenia: An Electrophysiological Investigation of the McGurk Effect

Student Name(s): Y. Zhang, E. Silvert

Abstract:

The McGurk effect demonstrates the profound influence of visual information on speech perception. This illusion occurs when incongruent visual (e.g. /fa/) and auditory (e.g. /ba/) components of speech are presented together and perceived as a single, fused percept (e.g. /va/). The effect is highly dependent on the timing of auditory and visual stimuli. Schizophrenia is a mental disorder characterized, in part, by abnormalities in audiovisual perception. This prompts the question: how are the audiovisual integration processes that contribute to the McGurk illusion affected by schizophrenia? To answer this question, we created a video with four different speech pairings: congruent /ba-/ba/ (/visual/-/audio/) and /fa-/fa/; incongruent /fa-/ba/ (McGurk pairing) and /ba-/fa/. Stimuli were also manipulated by timing of the presentation of auditory and visual components. Six healthy participants and six participants with schizophrenia were presented the video while connected to an electroencephalogram (EEG) and were instructed to report what they heard via button press. Data analysis (ANOVA) revealed significant between-group differences for McGurk conditions ($p = 0.024$). Participants with schizophrenia showed low susceptibility to the illusion (~15%) across all timing offsets, while healthy subjects were significantly more susceptible around the synchronized condition. They experienced peak susceptibility (67%) at 100ms of auditory lead. EEG analysis at this offset revealed a lowered P200 complex in healthy subjects ($p = 0.017$), indicating that this task can detect perceptual differences in audiovisual integration. Experimentation in adolescents at-risk for schizophrenia could inform whether these differences appear in the prodromal stages of the disorder.

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

BE 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

170

Fair Category

LST

Project Number

3515

Title: Post-traumatic Stress Disorder

Student Name(s): R. Smith, A. Stimson

Abstract:

Post-traumatic stress disorder (PTSD) is a mental illness that can affect anyone of any age or gender. It is commonly misdiagnosed because major sets of symptoms common in other mental illnesses such as phobias or anxiety appear. Currently, 7.7 million American adults are affected with PTSD per year. This project's purpose is to collect information on how much knowledge students have on PTSD disorder and their exposure to it. The researchers hypothesized that the students would lack knowledge of the mental illness and would not have much awareness about it. The researchers conducted a non-experimental survey that proves that a majority of the students know what PTSD is, but are not aware of the causes or symptoms. The surveys collected by the researchers prove that their hypothesis was correct and underscore the need for awareness of the mental illness in schools. In the near future, we encourage schools to teach about PTSD, to help reduce stigmatization against people with PTSD and make students more aware of the disorder.

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

BE 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

255

Fair Category

LST

Project
Number

3517

Title: The effect of probiotic yeast on a fruit fly model of human LCHAD deficiency.

Student Name(s): C. Michaud, J. Spitale, K. Tempesta

Abstract:

Long-chain 3-hydroxyacyl-coA dehydrogenase (LCHAD) deficiency is a very rare genetic disorder that affects the breakdown of long chain fatty acids. The purpose of our research was to determine how *S. boulardii*, a probiotic yeast, affects the phenotypes of wild type and LCHAD-deficient *Drosophila melanogaster*. We used fruit flies in our experiment because they have a similar LCHAD protein to humans. We used *S. boulardii* because it makes short chain fatty acids (SCFAs), which can serve as an energy source in place of long chain fatty acids. As a control, we will be using *S. cerevisiae*, a related yeast strain that makes a lower level of SFCAs. We expected to find that the phenotypes of LCHAD-deficient flies fed *S. boulardii* would be more like the wild type flies.

In our experiment, we fed wild type and LCHAD-deficient flies *S. boulardii* and *S. cerevisiae* and then measured the effects on their phenotype in starvation and climbing assays. In the climbing assay, we found that when we fed LCHAD-deficient flies *S. boulardii*, they climbed further than the control. Flies fed *S. boulardii* also climbed further than flies fed with *S. cerevisiae*. In the starvation assay, we found that *S. boulardii* helped the LCHAD-deficient flies survive starvation more than *S. cerevisiae*. This means that *S. boulardii* is more beneficial for LCHAD-deficient flies than *S. cerevisiae*. To confirm these results, we need to do more trials for each assay and other assays to investigate other impacts on the LCHAD-deficient flies.

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

188

Fair Category

LST

Project
Number

3518

Title: Extracting Streptomyces from Soil

Student Name(s): G. Ali, S. Abouneameh

Abstract:

We undertook the present study to isolate antibiotic producing bacterial colonies from soil in order to expand on our last years' research on the effects of streptomycin and ampicillin on E. Coli. We subjected one pre-frost and one post-frost sample to being autoclaved for 24 hours. Afterwards, we serially diluted each of the samples, to 10-10 and 10-12, then plated 1000µl of each sample onto inoculated LB agar plates and incubated them at 30 degrees Celsius for 24-72 hours. After incubation, plates were placed in the refrigerator at 4 degrees Celsius for 6 days. We found that the non-autoclaved post frost plate with the 10-12 dilution yielded the colony with the largest zone of inhibition (a pentagon shaped, dark grey colored colony with a zone of inhibition 1.2mm in diameter). Other plates that exhibited bacteria which produced zones of inhibition include the non-autoclaved post frost 10-10 sample which exhibited total inhibition in the upper right quadrant of the plate, and other colonies with zones of inhibition that measured .7mm, 1mm, and .5mm in diameter. Further examination was conducted to identify the colony, the antibiotic produced.

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

MI 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

251

Fair Category

LST

Project
Number

3519

Title: The Effects of Taraxacum on Mouse Lung Cancer Cells

Student Name(s): N. Doran, J. Klepinger

Abstract:

Cancer is one of the most prevalent diseases in the medical field. Lung cancer is one of highest cancer killers and causes over 150,000 deaths in the United States alone every year. Our focus is to examine a natural substance's effect on lung cancer cells. A significant number of cancer patients from different parts of the world have shared their experience of dandelion root tea seemingly curing their cancer.

The development of cancer in fact, is caused by a mutation in the DNA of a previously healthy cell. This newly mutated cell then passes along the mutations to all the cells around in. The mutations in lung cancer, specifically, can be caused by multiple different factors. They can begin due to the aging process, or smoking and breathing in chemicals. Currently, there are only invasive treatments for lung cancer such as chemotherapy, radiation, and surgery. There are no highly effective natural treatments.

Dandelion root extract is a natural remedy that is used for medicinal purposes. People have used this extract in teas, but it has seldom been employed in cell culture. The dandelion plant is a detoxifying herb that is composed of vitamin A, vitamin C, potassium and magnesium. Additionally, it has been utilized as an antioxidant and support for the immune system.

We are treating our cells with 1, 2.5 and 5 mg/mL of taraxacum using the suspension test approach. We will count our cells using a hemocytometer or western blot analysis. There is no conclusive data at this time.

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

CB 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

232

Fair Category

LST

Project
Number

3520

Title: The Developmental Neuroscience of Rational Decision Making and Risk Taking in Adolescence

Student Name(s): K. Wegener, K. Wright

Abstract:

This project stems from an interest in the fields of developmental neuroscience and psychology and how they relate to risky decision making in adolescents. The question we are investigating is: how does the human mind approach risky decision making, and at what ages do risk-taking tendencies increase and decrease within the period of adolescence? To accompany our research of the neurological component of risk processing, we created and administered a survey to high school-age students which encompasses various aspects of risky decision making. This was done through hypothetical scenarios, measuring how students respond to problem solving under pressure. The survey was designed specifically to target how the adolescent brain processes how a risk is presented. For instance, we wanted to measure if one is more inclined to take a risk if it is presented in a positive light, and vice versa. We have compared our data to a study of the current theories of how the human mind weighs risk in accordance with a statistical analysis of the data from our survey. From the gathered information, we have made new discoveries about how we can best adapt this model to our current education system to better understand what goes into making poor decisions and negative risks, but also how we can utilize these unique aspects of adaptability and flexibility that the teen brain possesses within the high school education system.

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

BE ME

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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

225

Fair Category

LST

Project Number

3521

Title: Stomping the Stigma of Schizophrenia

Student Name(s): L. Garcia, H. Holloway

Abstract:

Schizophrenia is a serious mental illness that affects the way a person thinks, acts, and feels. This mental illness affects one in every 125 people (Culliford 2013). A person who has been diagnosed is often stigmatized because society is incognizant to the realities of schizophrenia. "Schizophrenic individuals most easily lend themselves to be characterized with labels, as if they are things, not people" (Berezin 2014. Para, 2). The question presented is, if a population were more informed on schizophrenia, would they be less likely to label individuals with schizophrenia as crazy, psycho, insane, or scary? With this experimental quantitative research study, the researchers hope to bring awareness to high school students regarding schizophrenia. The researchers also wanted the participants to gain a more empathetic outlook on this mental illness. In order to do this, the researchers created a survey to distribute for the purpose of data collection on schizophrenia. The hypothesis of this study is if high school students were educated about schizophrenia, they would be more accepting of individuals with this serious mental illness. The researchers provided an educational component to the intervention groups with the intention to decrease the stigmas associated with schizophrenia. The control group did not receive a presentation. After analyzing the data, the researchers concluded that the hypothesis was correct. The intervention group demonstrated increased understanding of schizophrenia and stigmatization.

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

ME BE

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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

214

Fair Category

LST

Project
Number

3522

Title: NPK Ratio Effect On Height Growth Rate Of Cherry Tomato (*Solanum lycopersicom* var. *cerasiforme*)Plants

Student Name(s): M. Keefe, C. Sawyer

Abstract:

As the human population increases the demand for an increase in food supply is also rising. Farmers have looked for ways to increase food production one way to do this is by using the right fertilizer. Fertilizers have different NPK ratios, these ratios are the amount of nitrogen, phosphorus and potassium in the fertilizer. To test if NPK ratios could affect the growth rates of plants we tested different NPK ratios on *solanum lycopersicom* var. *cerasiforme* tomato plants. The NPK ratios we used we used were 15-30-15, 4-12-4 and 8-5-5. To test each fertilizer we had three trays one for each fertilizer, we also used a tray with no fertilizer as a control. Each tray got watered each day and every 14 days the trays with 4-12-4 and 15-30-15 NPK ratios got watered with the fertilizer when every 30 days the tray with 8-5-5 NPK ratio got the fertilizer tablets mixed into the soil. Every 14 days height of each plant was measured and recorded. After getting three measurements for each plant we averaged the height of all the plants for each NPK ratio and compared each NPK ratio average to each other. When comparing all the averages it showed that the NPK ratio 15-30-15 had the most significant height growth which supported our hypothesis.

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

PS

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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

251

Fair Category

LST

Project Number

3524

Title: Acropora Grafting: A Feasible Method to Reestablish Zooxanthellae Colonies following a Traumatic Bleaching Event

Student Name(s): T. Scannell, E. Camel

Abstract:

The global stony coral population has decreased at an alarming rate which has impacted marine fisheries and biodiversity within those ecosystems. This rapid mortality rate is primarily due to coral bleaching, a process in which the coral's symbiotic zooxanthellae abandon the colony's polyps due to environmental stress including increased pollution, UV radiation, temperature, and acidity. This desertion renders the coral "dead" though evidence suggests that when conditions reverse, many zooxanthellae repopulate a damaged, but not dead coral colony. The purpose of this project was to investigate stony coral recovery following a traumatic, but not fatal, bleaching event, and to investigate coral grafting as a feasible method to reestablish zooxanthellae colonies. Three saltwater systems were established and 3-5cm Acropora fragments were glued to a rock and placed in each system. Bleaching events were induced as follows: Acropora samples placed close to the UV light source in the first, pH lowered in the second, and temperature was increased in the third tank. The first tank was maintained as the "healthy tank." Once bleaching had begun, the Acropora fragments were moved to the bottom of the healthy tank where temperature, pH, and UV radiation were stabilized and optimal. Next, samples from each experimental tank had additional Acropora fragments grafted onto the bleached regions. Temperature and pH data was collected daily in addition to building a photographic database and making observations of the fragments. It was concluded that partially-bleached Acropora can recolonize the zooxanthellae population, however, data regarding the effectiveness of grafting was inconclusive.

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

AS EM 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

255

Fair Category

LST

Project
Number

3525

Title: Effect of bezafibrate on a fruit fly model of human LCHAD deficiency

Student Name(s): B. Dziekan, A. Missios, G. Roche

Abstract:

LCHAD (Long-chain 3-hydroxyacyl-CoA dehydrogenase) deficiency is a rare condition that stops the body from converting fats to energy. The purpose of our research is to investigate a potential LCHAD treatment in a *Drosophila melanogaster* disease model. We are testing bezafibrate, which is a drug that is used to treat patients with high cholesterol. This drug has also been suggested to increase the process of digesting dietary fats. We hypothesized that feeding bezafibrate to LCHAD-deficient flies would decrease the symptoms of the flies, because it would increase the overall amount of fat digestion. If our hypothesis was correct, we expected to measure longer lifespans, increased starvation survival, and better climbing ability in LCHAD-deficient flies fed bezafibrate compared to the control. In our experiments, we used two models of LCHAD deficiency created from different parent fly strains. The two wild type strains are called y w and w, and the LCHAD-deficient strains are referred to as y w MTP α KO and w MTP α KO. After we determined the optimal concentration of bezafibrate, we set up lifespan, starvation, and climbing assays. The lifespan assay is in progress. In the starvation assay, we found that bezafibrate increased the starvation survival of the y w MTP α KO flies from 28% to 69%, but had a less dramatic effect on the w MTP α KO flies. We also found that bezafibrate increased the climbing ability of the w wild type and w MTP α KO flies. These results suggest that bezafibrate could be useful for LCHAD patients, but more testing is needed.

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

BI 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

226

Fair Category

LST

Project Number

3526

Title: The Effects of Polyploidy on Drosera adelae and Brassica rapa

Student Name(s): P. Wilson, S. Carbone

Abstract:

The condition known as polyploidy is when an organism contains multiple copies of its DNA. In the course of this experiment, seeds of Brassica rapa and Drosera adelae were exposed to the chemical Oryzalin at a .1% concentration for twenty four hours in order to disrupt cell division long enough for duplicate chromosomes to form. The seeds and tissue samples were later cleaned with distilled water before being planted in an appropriate medium. A control group of both plant species was grown alongside the experimental group in order to observe differences between polyploid and regular plants. The polyploid Brassica rapa were several times smaller than the diploid variant, contradicting the hypothesis that polyploidy makes plants larger. In addition to this, there one was one plant in the polyploid group that had eight petaled flowers instead of four petaled, and overall the fertility of polyploid plants was much, much less than the diploid group, indicating either that they lost their self compatibility or that the ploidy level is not even across the entire plant. For Drosera adelae, the polyploid group grew much more slowly and had thinner leaves, with the leaves being nonsticky in one case. For a future experiment, the time exposed to oryzalin would be lessened in order to lessen the amount of extra chromosomes and see how plants respond and grow with that treatment.

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

PS CB 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

LST

Project Number

3527

Title: Research on the feasibility of how a cooperative yeast-algae biofuel production system will effect biomass and an investigation into the feasibility of biofuel as the next clean energy

Student Name(s): A. Wada, C. MacFaddin

Abstract:

The purpose of this experiment was to determine the beneficial effect of a two part biomass production system in a closed bioreactor situation and to evaluate the overall effectiveness of the biofuel production industry. It was hypothesized that the yeast-algae system would produce the greatest biomass, higher oil yields, and minimal impurities. The project started with creating four, 1000ml culture systems: one with yeast, one with yeast and algae, a third with algae, and a fourth system with separate cultures of yeast and algae connected by a tube to enable gas exchange. These cultures were grown for three days, photographed, and counted using a hemocytometer. A third facet of the project tested the algal oil extraction process through engineering and experimentation with Soxhlet procedures. Collected data was analyzed for relevance and used to calculate potential lipid concentration in each system. It was determined that the system with separate yeast and algae cultures had a small but meaningful impact on the cell density in the algae part of the system, while the chi squared analysis of the yeast part of the system showed little impact in terms of cell count. It was concluded that the separate algae-yeast cultures with gas exchange grew best; however, results also indicate the yields and purity of the biofuel industry pale next to consumer oil. The project also throws into question the obsession and hope of algae being the next fuel source when there are many gaping holes in its transformation from culture to market.

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

EN CB 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

255

Fair Category

LST

Project Number

3529

Title: The effect of Lactobacillus treatment on a Drosophila model of LCHAD deficiency

Student Name(s): R. Stollman, C. Papotto

Abstract:

Long-chain 3-hydroxyacyl-CoA dehydrogenase, or LCHAD, is an enzyme that, when mutated can causes a highly rare deficiency, called LCHAD deficiency. In LCHAD deficiency, the body is unable to convert certain fats to energy, causing severe muscle weakness. In our experiment, we attempted to find a treatment that relieves some of the symptoms caused by this disorder. We used wild type and two different strains of the LCHAD-deficient *Drosophila melanogaster* (the common fruit fly) in our experiments because they have a similar genome to humans, including the LCHAD enzyme, and are easy and inexpensive to raise, and reproduce quickly. The treatments we tested were probiotic *Lactobacillus* strains that produce short chain fatty acids (SCFAs). We hypothesized that SCFAs could serve as an energy source that can be used in place of long chain fats.

To test these hypotheses and determine if *Lactobacillus* can decrease the severity of the symptoms seen in the LCHAD-deficient specimens, we performed several tests established by the research group that created these fly strains. We used starvation tests to determine if feeding *Lactobacillus* to the flies will help them survive longer during famine. We also tested the effect of the *Lactobacillus* strains on the flies' energy levels, to do this, we used a standard climbing assay. The average distance climbed by LCHAD-deficient and wild type flies were compared both with and without *Lactobacillus* treatment. However, we only did one trial, so neither was very accurate, nor was the data very conclusive, but did show slight improvement.

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

MI ME BI

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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

PT

Project Number

4001

Title: Emergency Oil Spill Robot

Student Name(s): V. You, B. Goldstein, R. Kelley

Abstract:

Over many years, marine wildlife has suffered from oil spills that boats and booms were unable to clean up. In fact, after the massive explosion of a BP oil rig in 2010: 11 people died, the total cost for cleanup and legal issues was almost \$64 billion dollars, and countless wildlife were killed.

The objective of this project was to create a remote controlled robot that cleans up oil spills in hard, small to reach spots more effectively. Currently, using ships and booms is the most common way to clean oil spills in large bodies of water. These gigantic ships cannot reach and maneuver in shallow and tight spaces. A robot is more agile than a large ship, allowing the robot to get oil in tight and rocky spots. For this project, a scaled-down prototype of the Emergency Oil Spill Robot was designed and constructed. PVC piping was used to be the skeleton of the robot. A circuit board was constructed to power waterproof thrusters that were attached to the robot. To filter out the oil from the water, a filter system was added to the EOSR.

To test this, we filled up a tank of water and put oil throughout the water. Then the EOSR was deployed into the tank and was controlled to collect the oil from the water. The EOSR has the future to aid people in cleaning up oil spills around the world.

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

AT EE EV

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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

238

Fair Category

PT

Project Number

4002

Title: Evaporation Race

Student Name(s): C. Ortiz, D. Hampton

Abstract:

The objective of our study was to find which of the 5 liquids evaporated the fastest. Evaporation is an everyday thing. For example, without evaporation there wouldn't be a water cycle. To test our hypothesis we tested five different liquids, water, salt water (1 tablespoon of table salt), alcohol (90%), Gatorade (fruit punch) and dish soap (Palmolive). We used 350ml of each liquid and put them in measuring cups over a course of one week, we saw how much liquid evaporated at room temperature on a coffee table in the living room. Results were graphed and analyzed. Data was collected every day at 6:00pm over that course of seven days. At the end of our experiment, we concluded that our hypothesis was actually wrong. From all of the liquids alcohol evaporated the most, and water evaporated the least. Our results did answer our research question. I observed that alcohol evaporated the fastest at room temperature. This means that rubbing alcohol is made of mostly ethanol and, and ethanol boils at a lower temperature than water, which leads to it evaporating quicker. The boiling temperature is largely determined by the interactions between the molecules. Based on this, if we would experiment again, we would use different types of rubbing alcohol to observe if they would react differently. Lastly we would do the experiment outside to observe if the rays of the sun would affect how fast the liquids evaporated.

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

EA CH

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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

113

Fair Category

PT

Project Number

4003

Title: Nailed It
Nails and Liquids That Corrode Them

Student Name(s): K. Leyden, M. Lambert

Abstract:

Our thesis statement is about liquids that corrode iron nails. We were wondering how fast water, salt water, Coca-Cola®, Windex®, and bleach could corrode iron nails. We noticed that nobody researched this yet because there would be no gain other than personal knowledge. We tackled the question by putting the liquids in mason jars and hanging the nail off a string in the liquids. Afterwards, we looked up info on the liquids while running the experiment. From our experiments, we have learned that iron can be corroded very fast by certain liquids, but the only reason we could think of that people would care about our research would be for personal knowledge.

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

PH

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- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

PT

Project
Number

4004

Title: Salty Electrons

Student Name(s): J. Ranelli, M. Han

Abstract:

In this experiment we will be testing the pH change of two salt solutions, one connected to the negative side of a battery and the other to the positive. We will be using two different materials as the electrodes, graphite and copper. We hypothesize that the positive anode solution will have a lower pH than the cathode solution which deploys a negative current. This is because the cathode will lose electrons and the anode will gain those electrons. The independent variable tested in this experiment is the copper and graphite conductor. The dependent variable in this experiment is the pH. Our results supported our hypothesis. Through out the three trials we found that as time continued the cathode solutions pH got higher and the anode solutions pH decreased. The pH of the cathode solution was always over 9 after an hour. The pH of the anode solution was always under 7 at the end of an hour. This follows the Lewis theory of acid-base reactions, which states that bases will donate electrons and acids will accept electrons. The results were also supported by basic electrochemistry. Our experiment concluded that graphite conductors cause a greater gap between the pH of the anode and cathode solutions. Copper conductors caused a smaller gap between the pH of the anode and cathode solutions. Our experiment can benefit the world by generating environmentally friendly energy resources. Our experiment also raises awareness on how salt can affect the pH of fluids, and its impact on organisms.

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

CH

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- Yes No

CSEF Official Abstract and Certification

Word Count

227

Fair Category

PT

Project Number

4005

Title: Musical Hands; Prosthetic Components to Assist Disabled Musicians

Student Name(s): O. Gross, R. Berganross

Abstract:

For people who have a prosthetic hand, there are no options when it comes to playing an instrument that requires the use of both hands, such as the clarinet. There is not enough flexibility in the modern prosthetic hand to play an instrument and current prosthetic hand designs lack the necessary plugs on the fingers to cover the appropriate keys required to play certain instruments.

The objective of this project was to innovate a prosthetic hand to provide the necessary finger extension plugs to allow a disabled person to play the clarinet. To accomplish this objective, a clarinet, a 3-D printed prosthetic hand, and various materials to prototype finger plug extensions were utilized. Using these materials, finger plug extensions were designed, developed, and tested. The goal of each plug extension was to imitate the texture of a human finger so that the fingers on the prosthetic hand can adequately cover the holes on the keys of the instrument.

To test the prototypes, each of the plugs were attached to the prosthetic hand and one of the student researchers attempted to play the clarinet while wearing the prosthetic hand.

The prototype was successful as the researcher was able to successfully play the clarinet while wearing the prosthetic hand. The finger plug extensions have great potential to help those with a prosthetic hand to pursue their musical desires.

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

EN AT 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

233

Fair Category

PT

Project Number

4006

Title: How does changing the opening of the volcano affect the eruption?

Student Name(s): A. Chen, Z. Kurti

Abstract:

Abstract

The purpose of this project is to find out if the size of an opening affects an eruption. We chose this project because ever since 1st grade we were interested in volcanoes! It will help other people because it can help the scientists to figure out how far the eruption could be in real life.

We already knew that if you put Mentos in soda there will be an eruption. We also predicted that the smaller opening would have a bigger eruption. To test this we decided to use Mentos and Pepsi. First we opened the soda and added in the Mentos, recorded the data and took pictures. Then we carefully cut 5 cm above the label with a scissors and added Mentos, recorded the data and took pictures.

We found out that the smaller the opening the bigger and stronger the eruption. Our data show that the soda with the smallest opening had a far higher height than the one with the larger opening. The one with the bigger opening barely made its way out of the soda bottle. Our hypothesis was supported by our data.

Based on this experiment we now know that the smaller the volcanoes' opening is, the stronger the eruption will be. An extension of this investigation would be to test if changing the viscosity of the liquid has an effect on the size of the eruption.

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

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

248

Fair Category

PT

Project Number

4007

Title: MAGNETISM- Maglev Train

Student Name(s): G. Kane, B. Divincenzo

Abstract:

Our project is about how much weight a model maglev train can hold before touching the tracks. It is important because maglev trains are a faster transportation method compared to regular trains. These trains hover above the tracks and we wanted to see if there is a possibility of the trains falling of its track and is it safe. We will do this by using a model maglev train and will put a plastic cup on top. Then we will slowly pour water into the cup and measure the amount of water it takes to make the train touch the track. Our hypothesis is that if we put twenty grams of water into the cup, it will touch the track. We think that it will take twenty grams of water because when we looked at the cup and the water, and the gap between the train and the track, twenty grams seemed to be a reasonable amount. When we did the experiment we found out that it took forty-eight grams of water for the train to hit the track. Our hypothesis was wrong and each time we poured the water it was a different amount needed to make the train stop levitating. After doing this project, we found out that a maglev train can hold a decent amount of weight but not nearly as much compared to a normal train and there is not a big chance for the train to stop levitating and hitting the tracks.

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

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

211

Fair Category

PT

Project Number

4008

Title: So Much Blood

Student Name(s): J. Acevedo, D. Perez

Abstract:

The purpose of our project is to learn about how blood spatter varies at different distances and different surfaces. Our hypothesis is that if we drop simulated blood on different surfaces, then the napkin will have the widest diameter because the material is thinner than any other surface. Our procedure was to drop a single drop of blood on multiple surfaces from different heights. Each trial was replicated 5 times. The drop diameters were measured and averaged for each height. The napkin had the largest overall diameter across all heights tested. We believe this is because the napkin is thinner and allows the blood to go through and spread quicker before it dries. A forensic scientist can use these results to help them figure out what happened at a crime scene by noticing that the diameter of the blood is wider on one object than it is on another, which would help them draw the conclusion that maybe a person got injured on one spot and tried to fight back with the criminal, but then got injured again and more blood was released. The width of the blood's diameter may help draw conclusions as to how far away from the ground they got injured at and how much blood was shed.

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

247

Fair Category

PT

Project Number

4009

Title: The TempBot

Student Name(s): A. Boccanfuso, S. Saffran

Abstract:

According to the Department of Meteorology and Climate Science, since 1998, 660 adolescents have died in overheated cars. Every year, children and animals are put at risk when they are accidentally left in unattended, overheated cars. This can lead to deaths and has become an issue.

The objective of this project was to create a product that alerts parents and pet owners when their car is overheating. This device has detected when a car reaches an unhealthy temperature and alerts a parent/pet owner, and this could save the lives of many children and pets. To achieve this, a temperature sensor, an Arduino, a GSM shield, and a SIM card were used. The temperature sensor was connected to an Arduino and programmed to detect the temperature of the area. The Arduino and temperature sensor were then connected to a GSM shield, which had to be programmed to send a message when the temperature reached the threshold test level.. The Arduino served as the main control of this prototype, and the shield served as the communication vehicle to send an alert message to the owner's phone. The prototype was covered by a portable 3D-printed box that was designed via a CAD program. To test the device, the temperature sensor was heated to the set threshold, and it was successful in transmitting a warning alert to the cell phone.

This device has the potential to save the lives of children and animals from the dangers of overheated cars.

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

CS EE 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

231

Fair Category

PT

Project Number

4010

Title: The Thermoelectric Trivet: a Device for Converting Waste Heat From Cooking into DC Current

Student Name(s): B. Clark, A. Clark

Abstract:

1.3 billion people do not have reliable access to electricity. Despite lacking electricity, almost everyone generates heat energy during a simple, daily activity: cooking food. This engineering project has developed a Thermoelectric Trivet (TE-Triv) that captures waste heat from cooking and provides energy through a 5V USB port. The TE-Triv is a device made of a copper sheet, nine individual thermo-electric generators (TEGs), nine aluminum heatsinks, and a shallow pan that holds water. During use, a heat source is placed on the copper top, then the heat flows through the copper and the TEGs and into the heatsinks, then out into the water in the pan, which cools via evaporation. As heat flows through the TEGs, they generate electricity from heat using the Seebeck Effect. The Seebeck Effect is a phenomenon in which a temperature difference between the two sides of two dissimilar electrical semiconductors produces a voltage difference. Through the Seebeck Effect, a heat differential generates a flow of electrical current. The TEGs could not produce sufficient voltage to be useful by themselves, so a Boost Module was added to the TE-Triv. The Boost Module can take in 0.4 to 5 Volts DC from the TEGs and boost it into 5 V via a USB connection. Several devices, such as batteries, lights, fans, small refrigerators, and small heaters, can be powered/charged by the TE-Triv.

**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

137

Fair Category

PT

Project Number

4011

Title: Reflected Light: What Materials Reflect the Most Light?

Student Name(s): C. Constantine, A. Setzler

Abstract:

Dr. Nicolas Cowan, worked with NASA, using reflected starlight to see distant planets and map out their surfaces. To do this he created a computer program that read the light reflection off a planet and translated it into oceans, land masses or mountains. This research will lead to the development of the next generation telescopes which will see farther into space and aide in the search for new inhabitable planets.

Light reflection can be used to see yourself in a mirror, watch images on the television or, at a more advanced level, to create a high-powered telescope to see other distant planets. This reflection of light is currently being used in high-powered cameras, that have taken pictures of asteroids and planets in space, as can be seen in this image from NASA's Deep Impact Spacecraft.

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):

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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

188

Fair Category

PT

Project
Number

4012

Title: Do All Liquids Evaporate At The Same Rate?

Student Name(s): G. Fanelli, S. Suarez

Abstract:

Have you ever wondered which liquid evaporates the fastest? The answer has been found for some substances. In this experiment, many different liquids were tested. Gasoline, distilled water, rubbing alcohol, ammonia, vodka, nail polish remover, orange juice, lemon juice, soda (Coca-Cola), vegetable oil, motor oil, syrup, peroxide and white vinegar were the liquids tested on during this experiment. It was believed that the distilled water would evaporate the quickest because it is pure and there is nothing mixed in with it. The procedure is to first pour the same amount of liquid (250 ml) into each graduated cylinder. Then set the graduated cylinder in a climatically controlled room which always has the same temperature, nearly the same daily humidity level and no external factors such as wind, excess humidity, light, etc. Finally monitor the levels of the liquids every twenty-four hours for two weeks and note any differences. Overall, the nail polish remover evaporated the most because it has alcohol in it and it had a lighter consistency (it was a thinner liquid). The motor oil evaporated the least because it is a very heavy liquid.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

239

Fair Category

PT

Project
Number

4013

Title: The Enermill

Student Name(s): L. Marin, R. Dey

Abstract:

Obesity and the need for clean energy are major challenges in today's society. According to the Mayo Clinic, approximately 3 million U.S. cases of obesity are reported each year. The need for alternative energy sources is also a major challenge today. According to the U.S. Energy Information Administration in 2014, 67% of the electricity generated was from fossil fuels like coal, natural gas, and petroleum, so the need for alternate sources of energy is critical.

The objective of this project was to create an exercise device that will allow the user to get a workout while collecting and utilizing the otherwise wasted kinetic energy in order to charge an electronic appliance. Essentially, it is a treadmill adapted to accommodate energy converting technology. Materials needed to build our device (called The Enermill) included all materials needed to construct a manually run wood and carpet treadmill, a gear, diode, motor, battery, inverter, and a charging cord for the electronic device.

The Enermill was tested by having student researchers run on the Enermill for 3.5 minutes. After a few trials, it was clear that the Enermill did produce significant voltage. The Enermill took the circular movement from the rollers and used the energy to charge the battery, which then charged the ipad. This project indicates that this energy converting technology could be applied to more devices in which the wasted kinetic energy could be transformed into a usable, clean source of energy.

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

ET 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

233

Fair Category

PT

Project
Number

4014

Title: How does temperature affect the recrystallization process?

Student Name(s): D. Bustillo, A. Reyes

Abstract:

Our topic for this Project is how temperature affects the re-crystallization process. We chose this project because it was something that interested us both and was the best one to pick for our experiment. This project is important because we will be able to understand what the recrystallization process and what it is all about. We needed to research questions that would help us learn about re-crystallization.

We hypothesized that If the borax is dissolved in an ice bath then bigger crystals will grow in the ice bath because there's more moisture in the ice bath and crystals usually grow in caves that have a lot of moisture. Additionally, the cold temperature may affect a reaction with the borax.

We recrystallized borax under three different temperature conditions: in a refrigerator, room temperature, and an ice bath.

We started by preparing the ice bath and recording the temperatures in all three conditions. Next we prepared the jars by attaching string to the pencils allowing them to sit freely into solutions. Then we boiled water and added borax one tablespoon at a time until no more borax is left. Next we poured the solutions into each jar and placed one in each temperature condition. After 5 hours, we measured the number of crystals, size of each crystal, and the differences between them. As we predicted the ice bath produced the larger crystals.

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

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

244

Fair Category

PT

Project Number

4016

Title: The Assister Bot

Student Name(s): K. Morgan, G. Dalakas

Abstract:

Children with mental and physical disabilities often struggle to get around school easily. Carrying school materials is often a challenge for these students. They have been accompanied by school teachers in the day to help them get around.

The goal of this project was to create a robot that can assist disabled children with carrying school materials and making their way around school. The design for this robot utilized an arduino board, a motor shield, a robot base made out of metal, wires, battery pack, motors, and a power switch. The top of the base was designed to hold books and a slot was also created to store an iPad. Installing an area to put an iPad and books will make it easier for the child to navigate around school because there will be less to carry. The arduino micro computer and motor shield were wired and installed and then programmed to control the robot.

After designing, building, and programming the robot, it was tested. The robot was successful in carrying books and an iPad as it assisted with navigation. Future enhancements would target increased navigational ability such as the ability for the robot to follow along-side the user by following a line while carrying their books and materials. With a robot like this by their side, students that have difficulty carrying their class items and navigating school hallways will feel more in control and comfortable in what they can do at school.

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

CS AT 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

190

Fair Category

PT

Project
Number

4017

Title: Leaf Chromatography

Student Name(s): H. Siegel, E. Lopes, E. Cruz

Abstract:

The purpose of this leaf chromatography experiment was to find the hidden pigment inside different leaves--dill, romaine lettuce hearts, red cabbage, mint, and spinach. The procedure consisted of cutting up the leaves with a pair of scissors and mixing it with a tablespoon of isopropyl alcohol in a drinking glass. Then, the leaves were crushed up some more (using the blunt end of a wooden spoon) and let to sit in a dark place for 30 minutes. After letting it sit, chunks of leaves were removed from the solution so it was just liquid. The red cabbage created a fuchsia-colored solution, the mint a dark green/brown solution, the spinach and lettuce a yellow-green solution, the dill a grass green-colored solution. Later, one-inch thick paper towels were dipped into the solutions. The red cabbage's paper towel came out purple and pink, with a hint of red. The spinach, dill, lettuce, and mint all created paper towels that were a dull, lime green--though, the mint did have a hint of red. To conclude, the experiment showed that both mint and red cabbage had hidden colors.

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

CH 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

231

Fair Category

PT

Project Number

4018

Title: Does Age Affect Your Reflexes

Student Name(s): N. Kincheloe, A. DeLaura

Abstract:

We decided to study and research how a person's age affects the speed of their reflexes. We wanted to know if younger peoples react quicker to certain reflex tests.

We think that most scientist and doctors believe that as we age our reflexes do slow down. Our project did show that the older volunteers whom we tested did prove to be slower at responding to our reflex tests.

In order to see if age affects a person's reflexes, we researched to see what tests would work best and to measure a person's age and reflex speed. We also gave each person three tries and recorded the average of each test. We also tested everyone in the afternoon because we learned that people's reflexes can be faster or slower in the morning and others might be faster or slower in the evening.

We conducted six tests. Two tests were computerized (x test and color test), one test involved listening and reacting (Bop It test), and three other tests used moving objects (ruler, hand slap, and ball drop tests). We tested peoples from age twelve to eighty years old.

The key impact of our research is that reflexes do slow down with age. From our research we believe that if a person tries to take care of their body and mind, they may slow the deterioration of sensory neurons and maintain quicker reflexes.

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

BE BE BE

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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

200

Fair Category

PT

Project
Number

4019

Title: Truss Bridge Design

Student Name(s): M. Beerbaum, K. Hourigan

Abstract:

The purpose of our experiment was to determine which model truss bridge that we built could withstand the most amount of force. Now you may be asking, how might this be important in the real world? The answer is simple. If a heavily populated area were to build a truss bridge for transportation, they would want one that could have the most amount of vehicles to be on it at once. Our hypothesis was that if we were to make 4 model bridges with the same size base (including just the base) out of popsicle sticks and super glue, then add weights to the tray attached, the bridge with the most intricate design on the truss will be able to hold the most amount of weight before breaking, because it would distribute the compression and tension the best. Just the base held 28lbs, The Bowstring Truss held 84lbs, the Waddell A Truss held 93lbs and the K Truss held 124lbs before breaking. Trusses definitely affect weight it can hold and we later realized there was a major design flaw in the bowstring Truss, having the popsicle sticks being placed in a spot that would not distribute any forces at all.

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

EE PH 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

PT

Project Number

4020

Title: Desalinating Seawater for Various Survival Uses

Student Name(s): S. Rastkhane, G. Weaver, T. Narain

Abstract:

What would you do if you were stranded in the wilderness with no water? Even though a human can go for days without water, it is something vital you need to survive. Desalination is a simple way to get the water you need to survive. This project involved the desalination of water with sunlight. This project can be useful for survival purposes. The hypothesis was "If we put a bowl of saltwater in sunlight for a certain amount of time, then the bowl put out for the longest amount of time will produce the most freshwater." The investigation was conducted by putting saltwater in a large bowl, and putting a smaller, empty bowl in the middle of it. Also, the top of the larger bowl was covered with plastic wrap so that the saltwater would evaporate into the smaller bowl. The key results were that the less time the bowls were put in the sunlight, the less water was evaporated into the smaller bowl. The more time the bowls were put in the sunlight, the more water was evaporated into the smaller bowl. The one hour trials made the least amount of water, and the nine hour trials made the most amount of water. Through this experiment, it was concluded that you need a lot of time to get a decent amount of water. It was also concluded that this is a beneficial way to obtain freshwater if you are stranded in the wilderness and in desperate need of water.

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

EM 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

244

Fair Category

PT

Project Number

4021

Title: What shape is your Chute?

Student Name(s): K. Tor, S. Glick

Abstract:

My partner and I were quite Intrigued due to the fact we had similar experiments in the past. Due to the new releases of robots from Boston dynamics and other technologies the launching of this machinery would most likely be discussed in the future. We ended up creating the basic idea of parachutes and using the basics of shape due to this interest. My partner and I hypothesized that a medium amount of sides would be greatly accurate compared to others due to the sharp sides and the semi closeness to the circle but not exactly the same. Our team to complete this had to measure so our test parachutes had the same volume as each other and the same weights for the trip down. During the tests each parachute was dropped 10 times from a 20 foot drop with a controlled area (no wind or weather). Throughout we took notes on how we dropped the parachute and the difference's made due to it. With results we conclude that my partner was right. The exact shape he choose was the most accurate throughout the tests. Even with similarities in parachutes a little change can make a big difference. In conclusion we would defiantly find more ways to extend this project for it could be quite useful in the future. Coming up with this brought a simpler frame of mind but defiantly made us think about the small things and how much it could change.

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

EN

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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

134

Fair Category

PT

Project Number

4022

Title: Is Sharpie Extreme Really Permanent?

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

Abstract:

We are doing an experiment to see if Blue Sharpie Extreme Marker can be erased. We are testing this experiment on a 100% cotton t-shirt. We chose 3 solutions we think would work best to erase the Sharpie Extreme Stain. We chose Dish liquid, Acetone, and Rubbing Alcohol. In our hypothesis we predicted that the Acetone or the rubbing alcohol will take the stain out. Our educated guess was wrong. In the results none of them took out the stain. The dish liquid didn't really affect the brightness of the blue. The rubbing alcohol made the color bleed through the other side and it caused a small amount of spreading. Lastly the acetone made the ink spread across the cloth square a lot. The acetone also spread when we poured it on the square.

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):

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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

97

Fair Category

PT

Project
Number

4024

Title: Dancing Oobleck

Student Name(s): M. Williams, I. Ray

Abstract:

The purpose of our experiment is to visually observe the effect of the oobleck at different audio frequencies. Our hypothesis thought the oobleck would move faster at higher audio frequencies. Through our research, this was not the case. Our oobleck danced faster at lower audio frequencies. In this experiment we also learned how applying force to a substance takes the property of a solid. When little or no force is applied, it takes the property of a liquid. Oobleck reacts to lower audio frequencies because they cause motion in the speaker even though lower frequency causes less vibrations.

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

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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

247

Fair Category

PT

Project Number

4025

Title: Blown Away

Student Name(s): D. Mabes, A. Lencyk

Abstract:

The purpose of our engineering goal was to construct a prototype of a wind turbine and design an energy-producing blade.

We learned from our research that the amount of electricity generated from wind has grown significantly in recent years. In 2014, wind turbines in the United States generated about 4% of total U.S. electricity generation.

Our model used a simple design to construct the base of the wind turbine. This design could be used for residential scale for homes, schools, farms and small businesses. We wanted a design that was easy to construct, cost efficient, and one that would produce energy.

The main focus of our project was to design the blades for the turbine. We tried many different designs. We attempted to keep other variables constant such as the type of material used, the length of the blades, and the wind speed. However, we came to the conclusion that we had to manipulate the angles of the blade. Also, even though the length of our blades was consistent, the area of the blades was different.

Our results showed that the efficiency of a wind turbine blade greatly depends on factors of drag and lift. The Teardrop Blade design performed the best at a 15 degree angle because it had less drag and more lift. We concluded that it is a difficult task for designers to identify which elements will make a better blade design because of the amount of variables involved in building the blades.

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

ET MA 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

220

Fair Category

PT

Project Number

4026

Title: The Note Glove

Student Name(s): G. Mower, A. Obrzut

Abstract:

The purpose of my project is solely for recreation. We started off by wondering whether or not we could create an original instrument. We realized we could achieve this with an Arduino Uno and some other materials. The first, we had to find a way to make the finger tips of the glove conductive. After that, we had to wire the finger tips to the Arduino Uno. Finally we soldered on the accelerometer. With a bit of code, your glove should be up and running! You should be able to play different tones with different combinations of fingers and bend pitch. For example, if you press your index finger against your thumb, it should be a C# in concert pitch. If you rotate your hand left or right, it also makes a pitch bend. One piece of this project that we didn't have time for, but would really be great to apply, was using a Bluetooth module to separate the glove from the computer it is connected to. That would increase the point of having a portable instrument. This glove could apply to everyday life like any other instrument does. It is like a very portable keyboard. You can change sounds and it isn't very hard to figure out. It is time for music to technologically advance like everything else.

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

244

Fair Category

PT

Project Number

4027

Title: Catch Me If You Can

Student Name(s): D. Allman, H. Day

Abstract:

Abstract

Boomerangs are very interesting; they can be used for multiple purposes such as entertainment and hunting. A boomerang is a piece of wood that is typically crescent shaped and flies through the air in a circular path to return back to the thrower. The wings of a boomerang are designed to generate lift as they spin through the air. The difference in the lift between the top and the bottom creates a torque which ends up tilting the plane of rotation so that the boomerang flies in a curved path through the air, this is known as torque-induced precession. The wings' airfoil shape, the angle of it being thrown through the air, and the possible addition of beveling on the underside of the wings make it spin and come back to you. There are many different ways to make a boomerang, but not all of them work. After trying several different angles, we were successful in creating boomerangs that made a full flight back to us in a circular path. There are 3 key parts to making a boomerang, the angle of the boomerang when made, how much the boomerang weighs, and the amount of shavings on the two sides of the boomerang. In conclusion, we learned a lot about boomerangs, how to throw them, and how to make them. Making a boomerang takes a lot of hard work and effort with precision cut and sanding, but we got the job done.

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

231

Fair Category

PT

Project Number

4028

Title: Investigating novel methods of generating electricity by using a Fibonacci wind-turbine with piezoelectric generators versus a regular wind-turbine with piezoelectric-generators

Student Name(s): i. moghul, y. zoghol, a. mohammed

Abstract:

Pollution has been a concern for several years, currently wind energy makes 61,110 MW in the USA. The common design for a wind turbines in the USA is very inefficient. The purpose of the experiment was to create a more efficient type of wind turbine that would generate a greater amount of electricity in a less amount of time. This was compared to various experimental groups. A regular wind turbine facing horizontally with piezo discs (Experimental group A). A regular wind turbine facing vertically with piezo discs (Experimental group B) A Fibonacci wind turbine facing vertically with piezo discs (Experimental Group C). A Fibonacci wind turbine facing horizontally with piezo discs (Experimental group D). The results indicated that the Fibonacci horizontal wind turbine with the piezo discs made the most volts with .56993 volts in 5 minutes. Then the Regular vertical wind turbine with piezo discs made .124 volts in 5 minutes. Then the Fibonacci vertical wind turbine with piezo discs made .118 volts in 5 minutes. The least volts were made by the regular horizontal with turbine with piezo discs made .092 volts in 5 minutes. In 5 minutes the common wind turbine makes 229,116,666.66 volts. After extrapolation we concluded that the Fibonacci wind turbine facing horizontally with piezo discs would make 1, 105, 455,555.55555 volts. This concludes that our new design of the Fibonacci wind turbine is more efficient

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

EE EM MA

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

216

Fair Category

PT

Project Number

4029

Title: Litter Bot

Student Name(s): T. Lu, N. Cohen

Abstract:

According to "Litter It Costs You", \$11.5 billion is spent cleaning up litter, and over nine billion tons of litter end up in oceans annually. Littering pollutes the Earth, and damages communities and the environment. This is an issue that can be solved by having something to pick up litter and dispose of it.

The goal of this project was to create a prototype robot that can pick up objects (litter), and place them into a bucket. A bucket, arm, claw, battery pack, three wheels, an arduino board, a motor shield, two servo motors, and base were used for construction of the robot. The arm, claw, platforms, and bucket were all designed via a CAD program and 3D printed.

The design of the robot consists of two platforms stacked above each other, one for holding the arduino board and one for the bucket and battery. The arm and claw were positioned at the front of the robot and controlled by servo motors.

The robot was then programmed and successfully tested so that it moved to an object and then the arm and claw work together to pick up and deposit the object into the robot's on-board trash bucket.

The results indicate that this type of robot has the potential to assist with various cleanup efforts.

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

CS AT 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

237

Fair Category

PT

Project
Number

4031

Title: Talking vs Texting

Student Name(s): G. De Jesus, A. Rivera, B. Ozoria

Abstract:

Gloryann DeJesus
Brianna Ozoria
Angoline Rivera

Talking VS Texting

Our project is "Talking Vs Texting." We are doing this project to support the "No Text No Drive" campaign and no cellphone usage while driving. We got the idea of our project by the question "Which affects humans more? Texting or talking?" We took the question further and also got the question "Which gender does it affect more? Boys or girls?"

We thought it through and came up with a hypothesis for both questions. Both of our hypothesis were that texting would affect more than talking and girls would be affected more than boys. We got our second hypothesis based on the study that girls mature more than males. What we did to prove out our hypothesis was testing 8 volunteer who own phones, we used a meter stick in order to measure the distance, and a pen and paper to write down the results. When done with the experiment, we got a conclusion for both hypothesis. Our first hypothesis was correct, texting does affect humans more than talking. Our second hypothesis was proven wrong, since boys were more affected than the girls by a 1.4 positive difference.

This experiment answered our questions on the cell phone usage while driving. We would expand or research by testing different age groups of both genders and try to find more questions on the same subject to continue the study more.

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

BE 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

250

Fair Category

PT

Project Number

4032

Title: Chef Bots

Student Name(s): A. Gagliardi, J. Tajmajer

Abstract:

Cooking can be a big problem for many people, whether it is a time management problem, a difficulty understanding the recipes, or just being uninterested in using a cookbook. Having a “chef” friend would be much more fun and interesting than cooking with a cookbook, and would also provide an opportunity for people to learn cooking at any time of day and at any skill level or pace.

The objective of this project is to program a humanoid robot to teach others to cook that makes following recipes easier to understand, easier to replicate, and more fun and enjoyable. To accomplish this, two humanoid robots will be used. The advanced humanoid robots, NAO and Meccanoid, will be programmed to say the recipe the participants will be cooking and then provide step by step instructions on how to cook the recipe correctly. It will be patient, friendly, and very specific when speaking to an individual. It will also be able to repeat the step in case the participants didn't hear or understand it, as well as wait until the participants are ready to move on.

The results showed that all the participants enjoyed cooking with the robots and they all left positive reviews on the friendliness of the robots. The participants were all able to replicate their recipes to a satisfactory degree. The robot caught the attention of the participants and the simplicity of the robot was appreciated with not one of them having ever experienced using a robot for anything.

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

AT CS BE

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 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

221

Fair Category

PT

Project Number

4033

Title: The Fantastic Fluorescent Minerals

Student Name(s): C. Truman, A. Tyszka

Abstract:

For Saint James School's Science Fair, we decided to learn the difference between a fluorescent mineral and a fluorescent mineral under a UV lamp. Our key research question is whether or not the majority of our minerals from our mineral kit light up under the UV light. The reason why nobody really wants to learn about Fluorescent minerals and research is because fluorescent minerals aren't something people would come up with. Usually, students want to make volcanoes and put wires in potatoes but we thought that was too casual. All of our class mates thought of really cool projects. We wanted to do something very cool and very fascinating as well. Our overall view on our hypothesis was wrong. Many of the rocks were dull and plain but only four of them really got our attention. So, out of the ten rocks in our mineral kit only four of them were glowing bright and six of the minerals were dull. The key impact on our research is that people should learn about fluorescent minerals because they are very fascinating. When we first started this project, we thought only about how long this would take but actually we had a blast doing this experiment. Other young scientists can look at our information because we worked so hard and we had a blast!

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

EA

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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

250

Fair Category

PT

Project Number

4034

Title: Are Southington's Ponds Safe? Or Not Safe?

Student Name(s): B. Pearson, M. Perschy

Abstract:

In our project, Are Southington's Ponds Safe? Or Not Safe? We tested the water quality of four ponds in Southington and tap water at DePaolo Middle School. The four ponds were Recreational, Panthorn, Memorial, and Spring Lake. We tested the ponds testing, turbidity, nitrate, phosphate, pH, and Total Dissolved Solids. The ponds looked disgusting based on physical appearance and how they smelt. But over all the ponds tested healthy and are safe for living organisms in the environment. Before being able to test all of these ponds using the test tabs, the tds meter, and the turbidity bucket we had to do a lot of research. Starting this project we had no knowledge about when we found the results how to know if they were good or bad. After finding all of research we began testing. Our hypothesis was if we test the water quality of five different water samples from different locations in Southington, then we think that Spring Lake will be the healthiest for animals because of the environment around it and how clear the water looked. In the end, we were correct and we found out that the physical appearance of the pond related to the results or outcome of the tests. After the whole experiment we learned that Southington's ponds are safe, physical appearance relates to the results, locations of the ponds have affect, and the more people interact around the pond the cleaner it is. In the end, we were happy Southington ponds are safe.

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

EA EV 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

246

Fair Category

PT

Project Number

4035

Title: A Salty Solution for Clean Energy

Student Name(s): B. Zafar, R. Lu

Abstract:

All over the world, people worry about running out of energy sources. Saltwater is abundant and everywhere. If this can be harnessed into a reliable source, we will finally have a solution to our energy dilemma. Our experiment was to discover which salt can produce the most electricity. We chose four salts to test: Sodium chloride, ammonium chloride, lithium chloride, and calcium chloride. We had hypothesized that the different salts would produce different amounts of electricity. To test this hypothesis, we had put 25 grams of the chosen salt into 250 milliliters of hot, distilled water. Distilled water does not have additives. We mixed the salt until it had completely dissolved into the water, and using a digital multi-meter, zinc strip, and copper wire, we measured the voltage. The zinc strip was the negative electrode and the copper wire was the positive electrode. We had repeated this with the other 3 salts using clean beakers, stirrers, and zinc strips and copper wire. After the experiment had concluded, lithium chloride had produced 0.95 volts, ammonium chloride had produced 1 volt, and both calcium chloride and sodium chloride produced 1.1 volts. The results had shown that calcium chloride and sodium chloride produced the most voltage of the salts, but only by a little. Sodium chloride is a strong electrolyte and completely dissociates into water. This provides for a stronger electrical current which produces more electricity. Most types of salt did this which is what the experiment showed.

Technical Disciplines Selected by the Student
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EE 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

250

Fair Category

PT

Project
Number

4036

Title: Effective Use of Membranes on Evaporation

Student Name(s): L. Young, S. Stachurski, A. Clifford

Abstract:

Evaporation is the change of state from a liquid to a gas. This is the liquid's reaction to a change in temperature. We took this natural process and asked the question; can we alter or even stop evaporation completely? We considered the California Drought, the teams in California were already searching for a way to effectively conserve water. So taking inspiration from the cells in plants and animals we decided to create a "membrane" to conserve water in a plastic cup. When our trials began we decided to leave one cup empty to serve as a model for the general amount of time it took for a 350 milliliters cup to evaporate. For our "membranes" we chose plastic wrap, parchment paper, and wax paper. We covered sets of two cups with each of our materials. Every week (and the days in between) we checked the cups to see how they were progressing. After the first week the uncovered cup had gone down by 35 milliliters. The cup had been covered with wax paper did not evaporate at all. Both the plastic wrap and parchment paper had gone down by 5 milliliters. This trend continued throughout the following weeks; the uncovered cup would decrease drastically and the wax paper remained the same. Even the plastic wrap and parchment paper did not decrease anymore. In conclusion, we found we can slow down and even stop the process of evaporation temporarily by using common items as a "membrane" for a cup of water.

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

EM

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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

PT

Project Number

4037

Title: Nitrates and pH and Rain, Oh My!

Student Name(s): P. Campbell, K. Bergherr-Hall

Abstract:

We examined the effects of rainwater on pH and nitrates of a freshwater lake. We took samples from a 42.39-acre natural lake, Lake Wintergreen, in Hamden, Connecticut. Surrounding the lake is a forest composed of oak and pine trees. Because oak leaves and pine needles are acidic, we hypothesized that the runoff of rainwater would lower the pH of the lake. Rainfall leads to an influx of arthropods and insects in particular areas of the lake, which serve as the diet for native fish. Fish migrate within bodies of water based on the location of their food. They produce nitrogenous waste, so nitrate levels would be expected to be higher in more populated areas.

Our hypothesis was that water samples taken from different locations on a rainy day would demonstrate a more acidic pH and increased nitrate levels compared with samples collected on a sunny day. Our independent variable was weather condition, and the dependent variables were pH and nitrate levels. The sample sites, procedure, and time of day were constant. We took samples from 12 sites and tested the pH and nitrate levels of those samples. Results showed that on a rainy day, the pH levels became more neutral, and the nitrate levels decreased compared to on a sunny day. When oak leaves break down, their pH neutralizes, which may explain why runoff from leaves that are acidic led to a more neutral pH of the lake water. The sample sites' locations may account for the lower nitrate levels.

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

EA EV CH

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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

205

Fair Category

PT

Project
Number

4038

Title: Hitting the Slopes

Student Name(s): A. Aponte, M. Adnane

Abstract:

Abstract

We wanted to study which material slides faster on ice to figure out what material was better for making a sled. Our question was which material would slide faster on ice. Our hypothesis was "If we have a metal sled then its speed will be faster because metal is smoother than plastic or wood". Our procedure was that we froze water in a bowl overnight. Next we took out the ice and placed our selected material on the top flat part of the ice. Then we got out our timer and ruler ready and pushed the material down the ice hill. We timed how long it took it to go down and how far it went. We did this 3 times for each material which were wood, plastic, and metal. We found out that our hypothesis was inaccurate. The plastic sled was the fastest going down the ice hill at 12.4 in./ sec. Then wood was the 2nd fastest time at 15.1 in./sec. The metal was the slowest at 20.9 in./sec. We concluded from all of our research and our experiment that if you are looking for a thrill ride out of your sledding experience we would suggest getting a plastic sled.

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

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

175

Fair Category

PT

Project Number

4039

Title: BullyCheck - Designing Anti-bullying Software

Student Name(s): S. Hemingway, S. Burdick

Abstract:

As smartphones and tablets have become more popular, cyberbullying has become a more and more prominent issue, especially among children and teenagers. We designed a software program, BullyCheck, to help stop cyberbullying and make users more mindful of their word choice.

The algorithm - the set of steps for how we want the code for BullyCheck to work - went through five phases in total. After each version of our algorithm, we consulted a mentor. He helped us make our proof of concept according to our algorithm and gave us feedback about anything that might be improved, helped to fix unclear or impossible instructions, and added steps to our algorithm to make sure BullyCheck worked as accurately as possible.

We put our software through several tests, using real-life examples of text messages taken from Google Images. We tested how accurately BullyCheck could catch and flag words and phrases it “knew” were being used with malicious intent. It took us several tries, but on our last try BullyCheck recognized all the phrases correctly and flagged everything accurately.

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

CS AT BE

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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

250

Fair Category

PT

Project Number

4040

Title: Kings of Slings: The Effect of Sling Length on a Trebuchet

Student Name(s): S. Simmons, D. Echavarria

Abstract:

Trebuchets were an amazing work of machinery for their time. Created in the medieval 12th century by the French, it was used to launch large projectiles over castle walls, destroying enemy defenses. This heavy artillery weapon was known for its range and accuracy. For our project we wanted to investigate what gives the trebuchet such great launching range. Our experiment was to find the effect of sling length on the distance of the trebuchets' launched projectile. For our hypothesis, we thought that the five foot sling would launch the projectile the furthest. We believed the three and four foot slings would release the projectile insufficiently due to the height of the pivot, weight of the counterweight, and angle of the release pin. The five foot sling would have been the best choice because of the dimensions of the trebuchet. To conduct this experiment, we designed and built a trebuchet with three interchangeable slings at lengths of three, four, and five feet. We decided to use a larger scale trebuchet so results would be more conclusive than a scale model. In order to test, we went set up the trebuchet on a football field, launched it three times each for every sling, and recorded the distance. After testing we took our data and found an average distance for each trial. As a result the five foot sling launched the farthest where the three foot launched the shortest distance. In the end, the results of our testing showed our hypothesis was correct.

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

PH 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

248

Fair Category

P7

Project Number

5001

Title: The Effect of Different Substances on Shells

Student Name(s): K. Tokar

Abstract:

The purpose of this experiment was to determine the effect of different substances on the mass of a slipper shell. It was predicted that vinegar will have the greatest impact on the mass of the shells. The hypothesis was correct. The procedure was letting slipper shells sit in different substances (water, vinegar, and baking soda) for three hours. The mass was measured before and after the slipper shells soaked in water for a few hours. The data proved that the vinegar broke down the shells the fastest and the most. The baking soda and regular water made the mass of the shells increase by .1g each. The vinegar reduced shell mass up to 85%. There were many observations that were made. The baking started to bubble after a while. The vinegar was breaking down the shells so quickly that the time had to be reduced from 4 hours to 3 hours. It completely changed the appearance of the shell. Also, the remnants of the shell were left behind in the vinegar changing the color of it from a clear transparent color to a yellow tinted color. Another observation was that the vinegar was creating so much pressure under the shell that the shell popped and flipped over many times. There are some ways that this experiment could be improved. One is by diluting the vinegar so it doesn't have such a rapid effect. This would not happen in nature. This experiment suggests that acid is destroying sea life.

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

CH 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

183

Fair Category

P7

Project Number

5002

Title: The Effects of Radioactivity in Japanese Knot-weed

Student Name(s): E. Heaphy

Abstract:

Could radioactivity around nuclear power plants stunt plant growth? The Japanese Knot-weed plant is one of the toughest invasive plants around the world. It comes from Japan, certain parts of Asia, and it came to the United States in the early 1800s. This means that it is very hard to kill so, if radioactivity can stunt its growth imagine what it could do to native plants and crops. I thought if the radioactivity levels increased then the height of the Japanese Knot-weed will decrease, because the radioactivity around the plants will effect the height. After my field tests I graphed my data to find a trend line. My results showed the radioactivity levels in the area can effect the height of Japanese knot-weed. For example we tested a sight with levels in the 25-30 range of cpm(clicks per minute) and it measures an average of 90 inches. We also measured a sight with lower than 20cpm, it measured an average of 158 inches. This data and this trend prove that radioactivity levels effects the growth in Japanese Knot-weed.

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

EV EM PS

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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

249

Fair Category

P7

Project Number

5003

Title: Temperature of Different Color Clothing

Student Name(s): J. Kutz

Abstract:

Purpose of experiment

Different color clothing can feel cooler or warmer in the sun. Sun produces light, which is energy in the form of photons that will vibrate air molecules to create heat. These photons group together by energy level with different sized wavelengths and form the visible spectrum of white light. Light with shorter wavelengths has more energy. When light shines on a colored object, then that color's wavelength reflects back to our eyes, and the rest of the light and heat is absorbed. The hypothesis of this experiment is that when light is shown on different color clothing, then the temperature will be cooler for the colors with shorter wavelengths and warmer for the colors with longer wavelengths.

Procedure

A light was shown on different color clothing (Black, White, Red, Blue, Yellow, Orange, Green, Purple) and the temperature was measured. Black and white were the controls. The independent variable is the colors and the dependent variable is the temperature.

Data

The data demonstrated that there were no significant temperature differences between colors. The colors with shorter wavelengths were not necessarily cooler and the colors with longer wavelengths were not necessarily warmer. This data is reliable because the temperature of the controls were as predicted. Black was warmer and white was cooler.

Conclusion

The data showed that the temperature did not correlate with the wavelengths; therefore, the hypothesis was rejected. These findings are important because it may not matter what color to wear to stay warm or cool.

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

EA PH ET

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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

P7

Project
Number

5004

Title: Efficient Low Energy Salt Water Desalination

Student Name(s): E. Haddad

Abstract:

Freshwater resources are scarce in many parts of the world. Desalination, the removing of salt ions from water, allows access to sea water as a proper source for fresh water. Capacitive Deionization, based on passing salt water through two charged electrodes using a low voltage, is emerging as a cost effective technology for supplying large quantities of desalinated water at low cost.

It was hypothesized that conductive carbon cloth, as electrode, would desalinate water faster and more efficiently than an aluminum electrode due to its large surface area. A calibration curve for the resistance of different amounts of NaCl in distilled water indicated a sharp reduction in the resistance between 0-0.5 g/100 mL. The concentration of 0.11 g/100 mL was selected in this project for desalination experiments. The carbon cloth electrodes reached the desired desalination level of 3 MΩ resistance in 10 min using a 1.5V D Type battery. The process was reversed by flipping the charges on the electrodes showing its multiple uses. The comparison to aluminum electrodes indicated a slightly faster (C: 5.5 min. vs. Al: 9 min.) and more efficient desalination rate with carbon (3 MΩ vs. 2.5 MΩ). A fast desalination rate was observed in both types of electrodes. While a large surface in the carbon electrode accounts for higher desalination, strong conductivity of aluminum accounts for effective desalination.

The results of this project provide evidence for conductive carbon cloth as effective electrode using Capacitive Deionization, while using a low source of energy in the process.

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

AT CH 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

236

Fair Category

P7

Project Number

5005

Title: Natural Plastic: Which milk makes the best plastic?

Student Name(s): M. Lee

Abstract:

About 15 billion tons of plastic is produced globally every year. Unfortunately, plastic takes a while to biodegrade, which causes ecological problems. Plastic waste contributes 90% of all waste and releases noxious chemicals. The purpose of my experiment is to make an environmentally friendly plastic substitute using milk, a natural material. I tested whole, soy, skim, coconut, and almond milks to see which produces the best plastic material. My experiment included two trials of three phases. In phase 1, I constructed the plastic substitute by combining heated milk and vinegar; I then weighed and observed each plastic substitute. In phase 2, I tested each plastic substitute's durability by measuring how much water it absorbed in 12 hours in 70 degrees Fahrenheit; plastic substitutes that absorbed less water were more durable. Whole milk had the lowest average percentage of water absorption, 16.55%. Skim milk had the highest average percentage of water absorption, 37.35%. In phase 3, I performed a tensile test with a luggage weight to gauge the strength of each milk plastic substitute. Whole milk required the greatest tensile strength, an average of 70 kg to break the plastic substitute. In conclusion, whole milk made the best plastic substitute among the group because it had the lowest percentage of water absorption and required the greatest tensile strength to break. By utilizing this plastic substitute, we could improve the world by solving one of its ecological problems.

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

125

Fair Category

P7

Project Number

5006

Title: Make the Wind Work for You

Student Name(s): W. Luoma-Blagys

Abstract:

Many renewable resources are very useful, but the one that won't run out is wind. But which type of turbine blade is the best? This experiment shows what shape of turbine blade - large triangle, small triangle, square, rectangle and parallelogram can lift up nuts and washers the fastest. The objects that were used in the testing were a large nut, a small nut, a large washer, a medium washer, a small washer and also nothing on the paper clip. The hypothesis was that if the blade was a large triangle, the object will go the fastest. The results showed that the large triangle was the most powerful and efficient blade of any. It also showed that the small triangle was the slowest and least efficient.

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

ET EE

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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

244

Fair Category

P7

Project Number

5007

Title: THE EFFECT OF REFLECTIVE LIGHT ON SOLAR PRODUCTION

Student Name(s): P. McKenzie

Abstract:

The purpose of this experiment was to test how reflecting light multiple times on a solar panel will affect electrical production. It is predicted that solar energy (electricity) will increase as more incandescent light is reflected on the panel. To make this experiment happen, four small mirrors had to be glued to makeshift stands. The mirrors will then reflect light onto a solar panel connected to a voltmeter, one at a time. Observations are recorded and averaged for each. An increase in solar production was proven in the experiment. For every trial, the solar panel was moved slightly but did not change the overall result. Although the numbers went up or down as the solar panel moved, the final outcome was an increase in voltage as more reflective light was added. Some things that affected the experiment were the height of the mirror stands, the way the mirrors were bent (because they were made out of a metal clothes hanger), and the position of the stands. These stands were made in order to keep human hands from having to hold up the mirrors, which would have made the experiment much more difficult to conduct. This experiment could have been improved if the mirror stands were made in equal lengths. Additional improvements could have been made if a solar panel with a higher voltage maximum was used. The hypothesis was confirmed and may prove that putting large mirrors into solar farms, could increase production incrementally.

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):

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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

P7

Project Number

5008

Title: Battle of the Loops

Student Name(s): F. Kosior

Abstract:

Ever wonder why a roller coaster loop looks like a teardrop and not a circle? The purpose of my project was to determine how much height and velocity you need to successfully make it around each type of loop and identify which loop requires less height than the other to successfully make it around.

For my experiment I used foam pipe insulation as the track and then curved them making a circle and clothoid (teardrop) loop. I started the marble at 7 different heights (80cm-170cm) and performed ten test runs at each height.

The results showed that the marble started making it around the clothoid loop at a height of 110cm and started to make it around the circle at a height of 140cm. My hypothesis was supported because the starting height for both loops were higher than the top of the loop. In comparing the two loops, the marble needed a lower height to make it around the clothoid. This is because of the clothoid's shape. The larger radius at the bottom of the clothoid, where velocity is the highest, results in lower centripetal acceleration and a smaller radius at the top, where velocity is low, results in high enough centripetal acceleration for the marble to make it around successfully.

In my research, loops that were circular were extremely dangerous from high g's at the entrance and exit of the loop. Clothoid shaped loops result in a much safer and fun ride as the results in my experiment showed.

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

PH MA 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

140

Fair Category

P7

Project Number

5009

Title: How Does Angle and Distance Affect Splatter?

Student Name(s): C. Barrigas

Abstract:

The reason to do my experiment is to learn about CSI (Crime Scene Investigation) using splatter of paintballs. What I am testing is how angle and distance effects splatter of a paintball, my hypothesis is that the closer and less angle the larger the splatter will be. My goal is to learn what affects splatter the most (distance or angle). My experiment uses a paintball marker and paintballs. I am launching paintballs at a board from 3 different distances and 3 different angles. I launched two paintballs per spot and averaged both splatters together to get my data. My results show that at the shortest distance the paintballs splatter the most. At the furthest distance the paintballs splatter the least. However, it also showed that angle has a different effect on splatter too. This proves that my claim is correct.

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

PH MA 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

238

Fair Category

P7

Project Number

5011

Title: How Running Shoe design Effects Runners

Student Name(s): R. Scarpa

Abstract:

My goal is to design a running shoe that is built for speed, yet also comfortable and safe to wear, based on the elements that “fast” animals possess that enable them to be fast. I studied how animals move to determine which characteristics help faster animals to be fast and slower animals to be slow. My design tried to replicate what I learned from this research. Some of the components I used come from cheetahs. For example, I used the concept of cheetahs’ claws. In the front of the shoe I designed cleats that are able to grip, and because they are located on the front of the shoe, they also maintain stability on pavement, thereby making the shoe safer.

I also used the idea of how energy is transferred from the ground to the foot and leg as an animal moves, keeping the momentum and helping gain speed so the animal runs more smoothly. Accordingly, the heel in the design of my running shoe is higher in the back than the front.

For comfort, the design would also include a breathable, cushioned fabric making the shoe feel better when one is using it.

Since I do not have the required time or materials to construct the actual shoe, I am planning to do so at a later time; I will use this research and my design to construct a model that could be tested in the future.

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

EN AS 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

P7

Project Number

5012

Title: Acing the Wing

Student Name(s): A. Northrup

Abstract:

Airplanes are amazing machines, but many people take them for granted. There is much to them, though. How do they fly? How is the flight affected by the ailerons on the wings? This project looks at which angle of the aileron (independent variable) there is the most amount of lift force (dependent variable), as measured by the wind speed (ft/s) acting on the wing. Using a homemade model of an airfoil (shape of the wing), I created a simulation in which I measured the speed of wind from a fan around the airfoil. I tested the wind speed when the aileron was 45° up on the wing, 45° down on the wing, and flat along the airfoil (control). From my background research, I learned that when the wind speed is high on the top of the wing, the force of lift on the wing increases because the pressure on the bottom of the wing is greater. I hypothesized that when the aileron was 45° down, there would be the most amount of lift force. That is because when the airflow under the wing encounters the aileron, it will hit with high velocity, and the aileron will redirect the airflow by pushing back with equal force. This will cause the overall velocity of wind under the wing to slow down. The results of my experiment supported my hypothesis because the average speed under 45° Down aileron (pushing back) was the highest, compared to both Control and 45° Up Angle.

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

PH 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

223

Fair Category

P7

Project Number

5013

Title: Strength of Bridges: Which bridge will deflect the least?

Student Name(s): A. Meehan

Abstract:

The purpose of this experiment is to see if different types of bridges have different strengths. While there are different aspects that make a bridge strong, I measured it by how much it deflects when it holds weight. There are various ways that bridges are built. The type of bridge that needs to be built would depend on the various situations of the land. One of the simplest forms of bridges is an unsupported deck bridge. It is simply a plank held on each end and does not have additional support. I made this bridge so I can compare how other bridges with more supports can be stronger. I also made a beam bridge, a truss bridge, and an arch bridge. Afterwards, I put the bridges on wooden stands and strung a piece of string across each of them. I then filled plastic bags with five pounds of sand in each and put two sand bags on each bridge. I then measured how much it deflected right away. I continued to measure the deflection of all bridges once a day for seven days and recorded my results. My results did not support my hypothesis. The truss bridge deflected the least. Although it would be more expensive to build, if engineers needed to make a strong bridge, a truss bridge is a good choice.

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

227

Fair Category

P7

Project Number

5014

Title: Ice, Ice Baby!

Student Name(s): D. Gomes

Abstract:

When it snows during the winter, there tends to be sheets of ice on our streets, sidewalks, and stairs. To melt away the ice, people will typically use Ice Melt or Rock Salt. As a State of Connecticut Department of Transportation employee, my father was the motivation for my study of the rate at which various types of salt melt ice. My purpose for this project was to find out which type of salt works the best on ice. I began my experiment with six different types of salt: Himalayan Pink Salt, Rock Salt, Rock Salt with Magnesium, Fine Crystals Sea Salt, Morton Iodized Salt, and Cypriot Pyramid Salt. Two tablespoons of each kind of salt were sprinkled onto separate ½ inch deep sheets of ice. The rate of ice melt was determined by measuring ice thickness in fifteen minute intervals. Rock Salt proved to be the best salt because it left no ice after 60 minutes. Also Rock Salt was the superior salt in this experiment because it is better than the rock salt with magnesium environmentally. The magnesium can soak into the ground and into our watersheds, poisoning the water. This makes the water dangerous for humans to drink. Not only did Rock Salt melt the ice the fastest it is safer for the environment, making it the best option to use on our roads.

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

EM CH 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

118

Fair Category

P7

Project Number

5015

Title: Pounds Per Square Inch (PSI) of a Basketball

Student Name(s): M. Prior

Abstract:

This experiment was designed to test which amount of pound force per square inch, also called psi, would make a basketball bounce the highest. The materials included in this experiment were a basketball, air pump, pressure gauge, tape measure and people to drop the ball and watch the bounce height. The data shows that the higher the psi was, the higher the ball bounced. The hypothesis that the ball with the highest psi would make the basketball bounce the highest was supported. The results of this experiment are correct, however, it would be helpful to find a more accurate way to measure the bounce height than having a person stare at the tape measure to measure bounce height.

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

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

166

Fair Category

P7

Project Number

5016

Title: Corked?

Student Name(s): K. Braunwart

Abstract:

Throughout the years there have been many MLB scandals involving corked bats. Some MLB players have used corked bats, even though they could be fined or suspended if caught. Was it really worth the risk? Would a corked bat really make that much of a difference in their hitting performance? In this experiment, I compared the sweet spot and performance of a corked bat to 3 uncorked bats: a wooden, hybrid, and a full composite bat. By building a mechanical swinging machine, designed to swing the bat the same way every time, I was able to test each bat in a controlled environment. My data shows that the corked bat performed 66% better than the uncorked wooden bat similar to those used in the MLB. However, full composite bats (which are illegal in the MLB) were far more consistent. Even with these results, I do not believe this is a risk worth taking. I agree with the MLB rule banning corked bats, which keeps play fair.

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

EE MA 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

123

Fair Category

P7

Project Number

5017

Title: Hot Plop Fizz. Hotter Plop fizz. Hottest Plop Fizz.

Student Name(s): C. Homann

Abstract:

If you raised the temperature of water, how will that affect the time it would take for Alka-Seltzer® to fizz? It's a simple experiment but it can teach a lot about chemical reactions. I predicted if I raised the temperature of the water then the Alka-seltzer would fizz faster. The Alka-seltzer tablet was dropped in 3 different temperatures of water, 10°C, 20°C, and 35°C. The average reaction time, for the 10°C trial was 69 seconds. For the 20°C trial, the average reaction time, was 33 seconds. For the 35°C trial, the average reaction time, was 22 seconds. In the end, the results supported my hypothesis, the tablet took a shorter amount of time to dissolve when the temperature was higher.

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

213

Fair Category

P7

Project Number

5018

Title: The Effect of Bridge Design on Weight Bearing Capacity

Student Name(s): A. Zaleski

Abstract:

The purpose of my project is to determine if the type of bridge and material used, will affect how much weight it can hold. What I did was I built two of the same bridges, but out of different materials. One out of wood and one out of straws. I made ten triangles of each material, the same length. Then I put five on each side and make a base around it so they would all stay together. After this I did the same exact thing with the other side. Then I took two boxes and taped one side to each box. Then I lined them up the same length. After that I put that material all across the top of the bridge. Next I removed the tape the sides from the box and flipped it over so I could do the same thing across the bottom. After the bridges were complete I used two 8lb weights, two 3lb weights, and one 5lb weight, and did my experiment. The straw bridge didn't even hold 5lbs but the wooden one held 27lbs and did not collapse. After this experiment I found out that wood is a much better material to use for a bridge because it is the sturdiest and is not very malleable.

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

EN

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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

232

Fair Category

P7

Project Number

5019

Title: How Does Height Affect Structure Stability?

Student Name(s): K. Cook

Abstract:

Abstract

By Kaya Cook

My experiment tests the stability of homemade LEGO structures, to see if height is a factor in its strength against a simulated earthquake. By doing this experiment, I want to learn more about what architects and engineers have to think about when designing a building in a high earthquake zones.

In the experiment, I created different heights of LEGO structures, all with the same width and length of a 12 by 12 stud base. I built structures that were ten, twenty, and thirty bricks high, and placed them on a shake table with a LEGO base plate on top of it. My hypothesis was based on the fact that as height increases, stability decreases, so I thought that the ten brick high structure would be the most stable.

After I conducted the experiment, I saw that the 10 brick high structure was the most stable. I was correct in thinking that the 10 brick high tower would be the most stable. Its average amount of time before it collapsed, 60 seconds, was longer than the other two buildings. The 20 brick high tower had an average of 22.38 seconds, and the 30 brick high tower had an average of 2.94 seconds.

After studying the data and considering all uncontrolled variables, I have concluded that my data was accurate, and proves that height does play a role in stability.

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

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

250

Fair Category

P7

Project Number

5020

Title: Natural Water Filters

Student Name(s): J. Dayton

Abstract:

My question is “What is the best natural water filter for PH, chlorine, hardness, bacteria and nitrates?” I hypothesized that charcoal would turn out to be the best overall filter out of moss, dirt, stones, charcoal, twigs or leaves. This is due to its naturally large surface area/pore structure, creating more space for the chemicals to stick on to. My independent variable was the type of natural material used (moss, dirt, stones, charcoal, twigs or leaves). The dependent variable was the amount by which the factor being tested (PH, chlorine, etc.) was changed. I used plastic water bottles to create filters for the water and partially filled them with the first testing material. I then took 30 ml of dirty water, tested the PH, chlorine, hardness, bacteria and nitrates and put it into the filter. After letting it work for one minute, I checked the results of the test and put it into the table. Finally, I emptied the materials, rest the test, and repeated with the other testing materials. For the bacteria, since the original sample had no bacteria, I tested to see if the water would become contaminated by the material in question. I followed the same procedures as above, but I left the results for two days, as the bacteria growth powder needed two days to settle. The results showed that my hypothesis was correct. Charcoal was the best water filter for PH, chlorine, nitrates and hardness, and tied with the all of others for bacteria.

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

EA

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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

249

Fair Category

P7

Project Number

5022

Title: Stretchy Science

Student Name(s): O. Halas

Abstract:

Do your rubber bands keep snapping when you stretch them? There is a solution! This experiment was testing to see if hot or cold air increases the stretch of a rubber band. The hypothesis was that the rubber band would stretch more if it was in cold air. This experiment was performed to test the effects of entropy on a rubber band. A rubber band's molecules are tightly compact, and all lined up in rows. But, when the cold air gets to them, they relax, and spread out. This is the opposite of other materials reaction to the cold air. In hot air, the rubber band's molecules get very excited and jumbled up in a mess, making the rubber band hard to stretch and making it look smaller. For this experiment, two different, brand new rubber bands were hung from the inside of a box with a washer tied on the end. After being stretched at room temperature for three minutes and being measured, the cold test subject was placed in a refrigerator at 33°F for 10 minutes. The hot test subject was blown on directly by a hot hair dryer on the HIGH setting. The hot rubber band's length after being heated up was 3.8725 inches and hard to stretch. The cold rubber band's length was 4.5 inches after and easy to stretch with little tension. In conclusion, rubber bands will last much longer and will not break as easy if they are exposed to cold air.

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

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

P7

Project Number

5023

Title: Building a Better Battery

Student Name(s): N. Ferrucci

Abstract:

From cell phones to electric cars, battery technology is becoming more and more important in our modern world. The smaller and more powerful the battery, the more applications are possible. In this engineering experiment, I investigate building a simple battery from raw materials. The primary goal is that my battery should generate enough electricity to power a small fan. The design goals are that the battery should be: 1) based on the design of the very first battery ever made in 1800: The Voltaic Pile by Alessandro Volta; 2) made of non-toxic materials; 3) generate at least 1.5v and 75 mA; 4) mobile, compact and lightweight. I created 4 prototypes and then built a final prototype. Baking soda was used as the electrolyte in all prototypes. In my first prototype, The Single Cell Battery, I used 1" copper and aluminum discs. In my second prototype, The 4 Cell Battery, I used the concept of batteries in serial to increase voltage by stacking 4 single cell batteries. In my third prototype, Parallel Piles, I increased current by putting the 4 cell batteries in parallel. In my fourth prototype, Zinc and Graphite Battery, I increased surface area and used materials with higher electric potential – zinc and graphite. Although this prototype powered the fan, it was large and heavy. My final prototype, Magnesium and Graphite Battery, used magnesium instead of zinc enabling me to significantly reduce the size and weight of the design. The final prototype generated 3.75v and 107mA of current.

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

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

62

Fair Category

P7

Project Number

5024

Title: How does the shape of a wind turbine blade affect the amount of voltage produced?

Student Name(s): E. West

Abstract:

Abstract:

The purpose is to test the shape of the blade and measure the number of volts that are produced by the wind turbine. How does the shape of the blade affect the amount of volts produced? If a curved blade is tested, then more volts will be produced because the wind will be caught in the curve and create more energy.

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

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

253

Fair Category

P7

Project Number

5025

Title: Wind Power

Student Name(s): J. Fleischer

Abstract:

The purpose of this project is to determine whether the pitch, the number of blades, and the length of blades on a wind turbine affect how much energy the turbine is able to generate. The first step is to assemble the turbine. Parts include a dc motor connected to a shaft, mounted on a mast and wired to a load (consisting of a resistor and a small dc motor). Next, build multiple sets of blades with different pitches, numbers of blades, and lengths. Position an electric fan facing the turbine. Measure voltage output for each blade- set at low, medium, and high wind speeds, with and without load. Compare and contrast the results.

The results were that with no load, one blade with a lower pitch generated the most voltage without a load. Under load, however, that blade set stalled at all but the highest wind speed. Under load, it was the three-blade high-pitch set that did the best at all speeds. This is because the three blade set provides more blade surface area to catch wind and extract kinetic energy, and convert that energy to mechanical energy. Therefore, under load the three-blade design was able to continue spinning, even at low wind speeds whereas the one-blade designs, with less surface area, weren't able to continue providing energy at low wind speed. The one blade designs were able to spin fastest without load because they have the least amount of drag, but they cannot sustain sufficient speed under load.

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

252

Fair Category

P7

Project Number

5026

Title: Hydropower Tiles: A Novel Approach to Harvesting Energy from Human Locomotion

Student Name(s): J. Oei

Abstract:

This project explores the use of a hydro pump in conjunction with a hydro turbine to design floor tiles that can be used to harvest energy caused by people walking in large public spaces. These tiles could also harvest energy from mechanical structures, such as roads and bridges that are subjected to repetitive downward force from automobile, train or other mass transportation traffic.

A prototype of such a tile was designed and built and generates 6.04 Volts, .695 A and 4.2 Watts. This is comparable to the theoretical power value of 5.15 Watts. Therefore, the efficiency of the prototype hydro power tile is 81%. The power density of the tile is .268 W/sq. in.

Although the power generated for each hydro power tile is small, many tiles put together can produce significant power. Based on the power density of the tile, an average energy usage of a home of 1.5kW, and a 10% capacity factor, Grand Central Station, The George Washington Bridge and the Sears Tower equipped with hydro power tiles can produce enough energy to power 259, 140 and 558 homes respectively. The cost of a hydro power tile system is comparable to a solar and wind power generation (5.8 cents per kWp-hr vs. 5.0 for wind and 20.0 for solar).

The hydropower tile is a scalable form of energy. The energy output is predictable (not subject to weather conditions like wind or sun). The tiles produce zero emissions and is ideal for use in high population density applications.

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

ET 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

127

Fair Category

P7

Project Number

5027

Title: Biofuels

Student Name(s): Z. LaCava, K. McDonald

Abstract:

Today we use fossil fuels for almost everything. Fossil fuels are quickly leaving the earth and hurting our atmosphere. We need to use an alternative to solve this world wide problem. Biofuels are fuels derived from living or once living matter. To solve this problem I heated 3 biofuels with adult supervision to test for temperature, residue, quantity, and odor. My Results proved my hypothesis correct with a few surprises. I learned that out of coconut oil, lard, and vegetable oil coconut oil was the most efficient biofuel. It not have a strong odor unlike the vegetable oil. It had little residue unlike lard. Finally after it melted it created more fuel. I learned that plant fibers burn the best and will get the hottest when burned.

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):

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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

151

Fair Category

P7

Project Number

5028

Title: Renewable Energy

Student Name(s): N. Anderson

Abstract:

Abstract:

This project is to demonstrate how to get the most renewable energy with a wind turbine lift. What kind of energy would a two blade wind turbine produce compared to a three or a four blade turbine? If I use more blades at a forty five degree angle then more energy will be produced therefore lifting more weight faster. The wind turbine model consists of three different numbers of blades that are going to be tested to lift a certain amount of weight. My results showed that the four blade wind turbine lifted the weights in twenty five seconds, the three blade wind turbine lifted the weight in twenty six seconds, and the two blade turbine lifted the weight in forty four seconds. Through my research and experimentation, my results show that my hypothesis was correct .By adding more fan blades to the hub the turbine lifted the weight faster.

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

EE 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

253

Fair Category

P7

Project Number

5029

Title: MAKING CHEESE AT HOME, AS EASY AS 1-2-3?

Student Name(s): A. Simpson

Abstract:

A foodie at heart, I've made sorbet from homegrown strawberries, muffins from blueberries picked in my backyard. I've even made granola, apple sauce and cranberry chutney. I'm interested in the process of making/preserving food. Continuing my food fancy, I wanted to know if it was easy to make cheese at home. With so many milk types, I wondered if the type of milk used affected the cheese made. Hence the project was born: I would test high, low and no fat milks, dairy/non dairy to see which one produced fraiche chervre or farmer's cheese. I hypothesized that higher fat content milk would produce a more solid cheese and that the lower fat content milk would make a less binding cheese.

Lemon juice added to heated milk forms curds/whey. Curds were strained through muslin cloth, pressed and left to harden. Whey was canned separately. After testing 4 dairy and 2 non-dairy milks I found the dairy buttermilk produced largest curds and the thickest whey. The 2% milk curds passed through the muslin cloth. Of the non-dairy milks, evaporated milk curds did not hold form after being removed from draining tray. They stayed clumpy. Non-fat powdered milk produced a smooth cheese (ie gummy and translucent like glycerin soap). After taking a class at the local Farmer's Market and speaking with the farmer I feel that substituting vinegar and adding rennet can take me to 2nd level cheese making, ripened cheese, and maybe the 3rd, aged cheese with a rind.

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

CH 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

144

Fair Category

P7

Project Number

5030

Title: Propensity of Density

Student Name(s): J. Akin

Abstract:

My project's purpose was to compare the density of various liquids and I wanted to determine if liquids would be affected by factors such as heat/cold and by adding substances to create new solutions.

The first of four experiments I performed was to see if small objects would sink or swim in water, corn syrup and vegetable oil.

For the second experiment, I layered the different liquids used in the first experiment to see which liquid was the densest based on how they settled in a cylinder.

Next, I layered hot and cold water to determine if temperature would affect the water's density.

Finally, I added sugar and salt to fresh water to determine which of these solutions had the highest density.

I determined that temperature is a factor and creating different solutions does in fact change the density of the original liquid.

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

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

242

Fair Category

P7

Project Number

5031

Title: How does the anti-gas drug simethicone affect the amount of trapped gas in a system.

Student Name(s): A. Jiminian

Abstract:

In the study of the gastroenterology, which means the branch of medicine that deals with disorders of the stomach and intestines, it's long been understood that every person's digestive system is affected by trapped gases differently potentially resulting in pain or discomfort. But, there is no known general knowledge about how the anti gas drug simethicone affects getting rid of trapped gas. The literature describes that simethicone moves trapped gas but does not necessarily affect the amount in a system. In this science project, a common method was used to create trapped gas in a system, but instead of looking at moving the trapped gas the focus was to measure the amount of trapped gas affected by simethicone. During this experiment trials were run with simethicone, dish soap, and water in order to compare the amount of trapped in a system when using simethicone and when not using simethicone. The following results were obtained: on average when simethicone was used there was 0 cm of trapped gas while there was 1.6 cm of trapped gas when simethicone was not used. In conclusion, it was discovered that simethicone decreases the amount of trapped gas therefore people who have gas problems may benefit from taking simethicone as a treatment while understanding that the more trapped gas there is the longer it takes simethicone to work. Next steps include using a probiotic in addition to the simethicone to see if it affect the amount of gas.

**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):

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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

200

Fair Category

P7

Project Number

5032

Title: Do plants effect soil erosion

Student Name(s): R. Vipparla

Abstract:

Can plants really prevent soil erosion? My hypothesis was, if we grow more plants then we can prevent erosion because the roots hold in ti the soil. For this, I took scissors, tin trays, string, soil, plants and water. I took 6 trays, Put three of them, I put the plants and soil in the other other three. After labeling the plant, I put them by the window sill so each tray would be exposed to sun light, and daily I watered them. After four weeks I cut two large holes from the top of the tray then the bottom(so that there were four sides remaining, since it came without a top). I tied the string around the tray attached it to another small tray, that tray was hanging off the table. I then tilted the dirt tray so the altitude was 2 inches tall. I took a watering can and poured 1 quart of water into the big tray which then fell into the tall one. After that I drained out the water and weighed it. Each set ended up with the dirt tray having a lot more than the small one. There for my hypothesis was partially correct.

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

PS EM 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

150

Fair Category

P7

Project Number

5033

Title: How Do Surfaces Affect the Speed of A Car?

Student Name(s): P. Smith

Abstract:

A "race track" was laid out using measuring tape. The race track was twenty feet long and 3 feet wide. Masking tape was used to form a starting line and a finishing line. This was repeated on four surfaces: grass, asphalt, dirt, and gravel. There was five test runs on each surface, for a total of twenty tests. The surfaces were felt before the tests to make observations, such as smooth or hard. The notes and observations were written in a notebook. The radio controlled car (or r/c car) was prepared by turning the engine on and placing it at the starting line. The helper readied the stopwatch. Each test started by hitting the throttle. As soon as the car started moving, the helper started the stopwatch. The helper immediately stopped the stopwatch when the car crossed the finish line. The times were written and reviewed in a notebook.

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

ET EN 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

219

Fair Category

P7

Project Number

5034

Title: Do plants grow faster with sugar water?

Student Name(s): L. Steinberg

Abstract:

Photosynthesis is a process wherein plants use energy from the sun to make glucose, which is the plant's source of food. Since sucrose is one glucose molecule doubled, I tested whether using sugar water when sprouting beans will make the beans grow faster. For this experiment I sprouted beans with different amounts of sugar to one cup of water. Six cotton pads were soaked in each of the 5 concentrations. The concentrations included: the control group, which was plain water; $\frac{1}{4}$ teaspoon of sugar; $\frac{1}{2}$ teaspoon; $\frac{3}{4}$ teaspoon; and one teaspoon. After each day, measurements were taken of the sprouted beans. What I found was that most of the beans began sprouting at the same time, but the beans that grew the tallest were those in the control group, with no sugar. The beans in the full teaspoon and $\frac{3}{4}$ teaspoon solutions never grew over 1 inch and most got moldy. If I were to repeat this project, I would include a group that used a solution of $\frac{1}{8}$ teaspoon of sugar to one cup of water. This lesser amount of sugar should attract fewer bacteria and might be just the right amount of sugar to attain faster growth than the plain water. Overall, growing beans in such high concentrations of sugar water does not help them grow faster.

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

PS 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

241

Fair Category

P7

Project Number

5035

Title: Testing Nozzle Size with Compressed Air Water Rockets

Student Name(s): G. Syme

Abstract:

The purpose of my experiment was to figure out how the two nozzle sizes commonly used with compressed air water rockets affect performance. Soda bottles have 22mm openings and can be launched using launchers made from common 1/2-inch PVC tubing. Quick release garden hose fittings can also be adapted to make nozzles and launchers. These fittings have 9mm openings. I wanted to see which nozzle would give the best performance on rockets made from single 1-liter soda bottles, and rockets made with two bottles coupled together.

My initial hypothesis was that 22mm nozzles will launch 2-liter rockets the highest, because they are heavier and need more initial thrust, while the 9mm nozzle would be more efficient with lighter 1-liter rockets, which need less initial thrust to start moving. The smaller nozzles let out a longer, steady stream of water, pushing rockets longer.

My tests comprised of 20 launches using precisely measured water volumes and regulated air pressure. I launched each of the rockets five times with each nozzle. For every launch the rockets carried an electronic altimeter to track the maximum altitude and all launches peaked between 250 and 350 feet.

Despite my initial hypothesis, the smaller 9mm nozzle resulted in lower altitudes with both 1-liter and 2-liter rockets. Therefore, I concluded that while the 9mm launcher may be easier to make and use, 22mm nozzles are the best to use for maximum launch height.

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

PH ET

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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

225

Fair Category

P7

Project Number

5036

Title: Water Water Everywhere But Not A Drop To Drink.

Student Name(s): A. Boudreau

Abstract:

I am doing this experiment because when I was 2 years old my brother and I fell into our pond. The next day we were sick with vomiting and diarrhea. I wanted to find out why this happened. Also 2,000 people die everyday due to unclean drinking water. My hypothesis is that river/pond water will be drinkable after it is filtered and chlorinated with a DIY filter and chlorinator. I built a sand filter and chlorinator unit from PVC pipe and other materials. I took water from my pond, the Housatonic River and Mill River, tested its water quality and tested for coliform bacteria and then filtered it. Then I took 200 ml of the filtered water, added 1 teaspoon of salt and passed it through my chlorinator. I added that water to the filtered water and let it sit for 24 hours. I retested its quality and for coliform bacteria. My results proved my hypothesis. The filtered and chlorinated water did not have coliform bacteria present and it did not have nitrates either. I improved the water quality of the Housatonic River and Mill River samples from bad quality to good quality. The pond water stayed at medium quality. My DIY filter and chlorinator made the polluted water drinkable. Further testing will be needed to check for other bacteria types and for protists.

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

EE EM 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

251

Fair Category

P7

Project Number

5037

Title: Productive Oil Spill Surface-Cleaning Method

Student Name(s): C. Meeks

Abstract:

My interest is to find an effective method to clean oil spills quickly. I tested two methods, absorption and suction, to determine which method holds the best likelihood of efficient oil spill clean-up.

I used a 3-½ foot tub with 15 gallons of water, filling the tub to 5 inches. I poured 100 mL of 10W-30 engine oil into the tub, added green food coloring to the water to note the difference between the water and oil. I measured the height of the oil above the water. I put a 6-inch diameter circular sponge onto the surface of the oil for exactly thirty seconds, then removed it. I measured, using a ruler, the difference in height of amount of oil in the tub. The sponge had absorbed about 1/4th the total amount of oil in the tub. I then applied suction to the surface of the water by using a turkey baster to extract oil from the surface. The baster did not remove as much of the oil as the sponge did.

I have concluded that absorption with a sponge to be the quicker and more efficient way to clean an oil spill on the surface of the water compared to a suction device. If I were to conduct this experiment again, I would use a siphon with the same surface area as the sponge so that the results could be equally compared.

I would like to design a machine that uses absorbency to help clean oil spills.

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

AT EM 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

124

Fair Category

P7

Project Number

5038

Title: Which brand of popcorn has the least amount of kernels after you pop it?

Student Name(s): S. McIntosh

Abstract:

The purpose of this project is to show which brand of popcorn has the least amount of kernels after you pop. people should care about this project because it tells you which brand of popcorn your getting the most for your money.in this project the hypothesis was if somebody pops a bag of

Orville popcorn, Stop and Shop brand popcorn, Act II popcorn, Jolly time popcorn, Pop Secret popcorn, Then Orville will have the least amount of kernels after you pop it. in the results it showed that jolly time was the best popcorn to buy. in conclusion the hypothesis in the project was wrong when it said Orville would have the least amount of kernels after you pop it. it was jolly time.

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

251

Fair Category

P7

Project
Number

5039

Title: Induced Magnetism Applying Lenz's Law

Student Name(s): M. Luzzio

Abstract:

The purpose of my experiment is to use induced magnetism, applying Lenz's Law, by dropping a magnet through non-magnetic pipes made of copper, aluminum and plastic to determine if there is a difference in the way Lenz's Law is observed. A neodymium magnet was dropped through different pipes to determine if the magnet will drop at different speeds. I showed that Lenz's Law behaves differently depending on what material the pipe is made of. When a magnet is dropped down a 2-foot length of PVC plastic pipe, it takes an average of 0.486 seconds for the magnet to travel 2 feet. With an aluminum pipe it took 2.862 seconds, and with copper it took 5.075 seconds. This data showed that there is a difference between the drop times of the magnet between plastic, aluminum and copper pipes. As the magnet drops down the different pipes, it is attracted differently to the materials because of the different properties of the pipes. The better the conductor of electricity, the faster electrons circle in the pipe, causing a stronger magnetic field making the magnet fall slower. Copper is a better conductor of electricity than aluminum and this is why the magnet dropped the slowest in copper. Aluminum is a poorer conductor of electricity than copper, this is why the magnet dropped faster. Plastic is a nonmetal and does not conduct electricity and dropped the fastest. In summary, my experiment showed that there is a difference when applying Lenz's Law to different metals.

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

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

184

Fair Category

P7

Project Number

5040

Title: Nuttin But A Calorie

Student Name(s): G. Garvey

Abstract:

Calories affect people's lives in many ways. This project tests and compares the caloric output of a peanut and an almond. My hypothesis is that the peanut will have an overall higher caloric output than the almond will. Three tests were run on each, peanuts and almonds, to determine the average caloric output of each. I tested this by igniting both a peanut and an almond under a test tube containing ten mL of water. The peanut boiled away more water than the almond did, so the peanut had a higher caloric output. One big calorie or food calorie is equal to one thousand small calories or scientific calories. The average caloric output of a one gram peanut is 1772 small calories and 1.772 big calories or food calories. The caloric output of an almond equal to one gram is 1178 calories or 1.178 food calories. The hypothesis of the peanut having more calories was proven correct. The peanut has a higher caloric output than the almond, which means that you can receive more energy by digesting a peanut than by digesting an almond.

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

BI CH 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

233

Fair Category

P7

Project Number

5041

Title: The Filament Factor

Student Name(s): W. Goodenough

Abstract:

Walter Goodenough

The Filament Factor

In the last three years the technology of 3D printing has accelerated. Thousands of libraries and schools across the country have invested in 3D printers. So being fortunate to own a 3D printer I decided to test its filament. A standard 3D printer uses PLA filament but after change its setting a little you can effectively print ABS filament as well. These two filaments have different characteristics and are made differently. What I did was test these filaments to their limits. First I tested their resistance to pressure in a vise. I printed three balls of each filament type. After this I inserted them into a vise and next to them was a pressure gauge. I turned the vice until the filament ball cracked. then recorded the data from the gauge. After this, I tested the resistance to scraping. I used 400 grit sandpaper to sand down three more of each filament balls. I sanded as hard as I could for 60 seconds on each ball; each session an hour apart. During both of these tests different things happened. The PLA was more resistant to scratching but less to pressure. In the end though the PLA won because of the fact that most 3D printed objects do not undergo much pressure. In this I learned that when 3D printing it is better to use PLA filament over ABS.

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

CH EN MA

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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

121

Fair Category

P8

Project Number

5501

Title: What Substance Melts Ice the Fastest?

Student Name(s): M. Chappell

Abstract:

The student filled 32-3 ounce cups with 1.5 ounces of water and froze them for over 24 hours. The process of ice melting when other substances are introduced causes different rates of melting depending on the substance used. The student performed the experiment 4 different times using 7 different substances with one control cup for each timed experiment. The melted ice was extracted and measured in milliliters (ml) and recorded on the results table. The different substances used can cause the ice to melt based on the chemical reaction it has with the ice. The student learned that all substances with chemical properties increased the melting of the ice. Calcium chloride was the proven substance that melted the ice the fastest.

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

CH 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

250

Fair Category

P8

Project Number

5502

Title: Graffiti Removal

Student Name(s): E. Terry

Abstract:

Sculptures, buildings, etc. get vandalized by graffiti all over the world. Graffiti is a drawing/ scribble on something in a public area. Sometimes it is difficult to remove the spray paint or any other form of material. Some ways to remove the material can be with acetone, rubbing alcohol, dish soap with water, or Goof Off which is a stain remover. These are some examples of solvents to remove graffiti. In this project I wanted to find out which solvent worked best for which material (graffiti). To conduct my experiment, I got a white foam board, cut it into 4 rectangles then divided the rectangles into fourths. The first quarter had black crayola marker, the next one would be black sharpie, then black acrylic paint, and lastly black spray paint (all for 4 coats.) I repeated this for the next 3 rectangles. The order of the rectangles for solvents would be acetone, rubbing alcohol, water with dish soap, and Goof Off. Next, I swiped the sponge with the solvent on the material once every 5 minutes. I believed that if I used 1 coat of Goof Off or acetone every 5 minutes for 4 times, then it'll remove the spray paint and permanent marker a bit faster than water with dish soap or rubbing alcohol with crayola marker and acrylic paint, because the molecules/chemicals in Goof Off and acetone are meant to dissolve plastics/resins faster than water or rubbing alcohol. In conclusion, I was correct with my hypothesis.

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

256

Fair Category

P8

Project Number

5503

Title: Why Do DVDs Have More Storage Space Than CDs?

Student Name(s): K. Newman

Abstract:

This experiment explored reasons why different storage discs have different storage capacities. Because DVDs have greater distance between pits, they should have a larger distance between the pits. In this project a laser is used to refract light and then the formula $d=m\lambda/\sin\theta$ to track the amount of space between the pits. The measurements from the CD were $0.233\ \mu\text{m}$. The measurements for the DVD were $-2.44\ \mu\text{m}$. I picked this project because I'm interested in digital media and electronics as well as hands on activities. This experiment ties in all of those things. CDs and DVDs are both types of storage for media. Data storage consists of millions of slits/notches on the reflective metallic surface. Optical storage media is read with a laser beam. When the laser is aimed at metallic surface the laser is diffracted off of the disc. The diffracted beams can be measured and used to read the disc or find out how much storage is on the disc. The procedure of this project is the following. Shine a laser pointer towards the disc at a 70 degree angle to create diffraction beams on the paper. Mark where the beams occur. You will also need to number the diffraction beams. After all the measurements are done you need to plug the numbers into the, $d=m\lambda/\sin\theta$, to find the distance between the pits. The distance of the pits from each other determines the amount of space is on that disc. My results showed DVD having a larger storage capacity.

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

175

Fair Category

P8

Project Number

5504

Title: Oobleck Reduces G-Force to the Head

Student Name(s): H. Westgard

Abstract:

Oobleck or a non-Newtonian fluid is made from 2 parts cornstarch and 1 part water. The fluid is known to behave as if it were both a solid and a liquid. When you apply force to the fluid it hardens quickly into and absorbs some of the force that it has taken. Once the impact dissipates, it goes back into the form of a liquid. This experiment tested whether or not the substance of Oobleck can be applied to reducing sports injuries to the head. In the experiment, a series of drop tests were conducted and recorded using a surrogate head (mannequin head) with different forms of head gear: One uncovered, one with Oobleck, and one with a bike helmet. Oobleck reduced the most amount of impact of the three head gears. The Oobleck reduced 59% g's of raw data to 60% g's normalized data compared to the helmet when the force was dropped at 3 feet. With this innovation, head injuries in various sports will be reduced due to this new head gear.

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

ME 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

240

Fair Category

P8

Project Number

5505

Title: De-icing: Identification of Materials with the Capability to Lessen the Impact of Ice Formation on Roadways

Student Name(s): E. Lior

Abstract:

Every year during the winter season, ice forms on the roadways. The ice that forms on the roads creates dangerous conditions for cars, which leads to around 480 deaths a year in America. Icing on the roadway has become a large issue since the creation of asphalt roadways in 1870. The solution that is currently being used and that has been used since 1938 is chloride salts. These chloride salts are applied to the roadways as they are very cheap and lower the freezing temperature of water. Over the last few years, it has been noticed that these chloride salts have a major impact on adjacent groundwater and soil. This project tested alternative de-icing techniques that are more environmentally safe and possess ice removal capabilities. The use of a hydrophobic coating, rock salt, rock salt brine, and beet juice represented the de-icing capabilities of certain materials. The de-icing potential for each of these substances was simulated by using a freezer set at 0 degrees Celsius. Each of the substances was placed in the freezer for 24 hours after 140 mL of water was poured on them except for the salt brine and beet juice because the solution was made using water. After all the tests were completed, it was noticed that the best performing substance was clearly the hydrophobic coating. It is the most costly out of the four options, but offered the best de-icing properties.

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

EM CH 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

227

Fair Category

P8

Project Number

5506

Title: Spherification

Student Name(s): S. DiCocco

Abstract:

The objectives of this experiment are to see if the variables of sodium citrate, calcium, pH or dropper size affect sphere formation. Based on the chemistry of this process, solutions with higher levels of sodium citrate and lower levels of calcium will form stiffer spheres; more calcium and less sodium citrate should make weaker spheres, and the pH level and dropper size will change the sizes of the spheres.

To test the hypothesis, solutions were created with liquids that had different amounts of sodium citrate, calcium, pH, and dropper size, and then spheres were measured for size and durability. Results of testing the different variables were mixed. The liquids and foods with more calcium created weaker spheres; foods with less calcium created more stable spheres. pH tests with addition of vinegar produced increasingly flattened spheres as pH became more acidic. Larger dropper sizes produce slightly larger spheres but as size increased, so did the tendency towards sphere deformities.

Some variables that may have affected the results include liquid drop heights and measurement inaccuracy. The drop height may have changed while testing, and that may have changed the outcome of the sphere's shape and size. Smaller increment graph measurements were used in later trials to improve the accuracy of sphere measurements. To extend this experiment, I would investigate reverse spherification to make spheres with liquids that contain calcium.

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

AT 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

221

Fair Category

P8

Project Number

5507

Title: What Color Light Shines Brightest Through Fog?

Student Name(s): A. Padilla

Abstract:

For the 2015-2016 Science Fair, I decided to investigate what color light shines the brightest through the fog. I came across this topic while browsing the internet for possible topics. I finally decided on this one because I found it fascinating. The Independent Variable of this experiment was the different colors of light, and the dependent variable was the brightness of the different color lights when shone through the fog. With this experiment, I hoped to determine which of the color light would shine the brightest through the fog. And based on some research I did I hypothesized that the brightness of the yellow light would be greater than that of the green, blue, and violet when shone through the fog. A brief explanation of the procedure is as follows: Make a jar of fog and setup the other items. Cut a cellophane square and place it on the flashlight, then turn it on and shine it through the fog into the light meter. Do all the colors, and calculate the results for all the tests. The results of my experiment did support my hypothesis as the yellow light shone the brightest through the fog with 8.8 lumens, followed by the green light with 7.5 lumens, followed by the blue light with 6.8 lumens, and ending with the violet light with 6.3.

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

PH PH 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

216

Fair Category

P8

Project Number

5508

Title: Cat Bot

Student Name(s): M. Boynton

Abstract:

Cats often scratch or damage furniture. Cats damaging furniture can cost people hundreds of dollars. There are not many options to stop a cat from doing this. You can try to occupy your cat with cat toys but this will take time away from your day. You can also get a scratching board to occupy your cat but it will take up a lot of room and are not always effective.

The goal of this project was to create an easy way to occupy cat's attention and time to reduce a cat's tendency to scratch and damage furniture. To achieve this objective, a robot prototype capable of dragging a cat toy and pointing a laser in the ground was designed, constructed, and programmed. The robot prototype was designed so that it moved around a room dragging a cat toy and shining a laser pointer. To build the robot prototype a base was constructed, and then an Arduino board and motor shield were added. The necessary code for the Arduino board was then written. Finally, the cat toys were attached to the robot.

The prototype was successful because it dragged a mouse toy and pointed a laser pointer, and moved around a room. This robot has the potential to occupy cats so they do not damage furniture.

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

P8

Project Number

5509

Title: Different Quantities of Blades Used for Producing the Most Power

Student Name(s): S. Guiry

Abstract:

For my project, I wanted to find out if different amount of blades used for a wind turbine would produce various amounts of power (mechanical and electrical power). I wanted to conduct this experiment to find the easiest way to generate more power. My hypothesis stated that if different amounts of blades are used, then the amount of power produced will vary. I built a mini wind turbine and created four airfoil blades out of chipboard wood for the turbine. For electrical power, I connected the generator wires and a resistance board to an energy sensor that connected to the laptop to create the graphs of power during the experiment. I had to switch the nacelle to one that made it possible to test mechanical power by lifting a bucket with a certain amount of washers in it. My hypothesis was proved correct. The amount of blades used does affect the amount of power a wind turbine can produce. For electrical power, two blades created the most power because it has less mass for more speed to generate more power, four blades came in second, and three blades came in last. For mechanical power, four blades produced the most because it has the most mass for more torque to generate more mechanical power, three blades came in second, and two blades produced the least amount. If I could do this experiment again, I'd change some things such as a stronger blade material and stronger turbine for more accurate results.

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

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

248

Fair Category

P8

Project Number

5510

Title: Water Wizard: Incorporating the Simplicity of Water Testing Strips with the Complexity and Sophistication of a Smartphone Application While Utilizing Mathematics

Student Name(s): K. Legnard

Abstract:

Water quality is essential for all living things and continues to be a high priority throughout our nation and the world. Clean and healthy water is essential for life and is often difficult or cumbersome to test and treat. It seems, given our local and national news lately, that water testing procedures and testing tools could be improved. The intention of my engineering project was to design, build and program an app that would help determine the results of a water testing strip quickly and effectively by using your smartphone. Before actually developing the application I first researched different water testing methods and kits in order to determine what contaminants I was going to focus on for this project. At the same time, I continued to research and familiarize myself with the Swift programming language and began building my prototype. My initial testing included pH, Alkalinity, Total Hardness, Free Chlorine, Total Chlorine, Nitrate and Ammonia. After testing the water sample, using the strips, I started building the application for two contaminants, pH and Ammonia. After programming the initial application I then ran the application on the iOS simulator, debugged, revised and repeated these steps. I am currently working on expanding my application's abilities to include other contaminants. My ultimate goal is to develop an application that will analyze water for Lead and other contaminants on its own. Eventually, I want my application to be able to hold and test the water in one step, directly on the device.

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

CS EV MA

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

247

Fair Category

P8

Project Number

5511

Title: What Type of Cup keeps Coffee the Hottest the Longest?

Student Name(s): M. Sirois

Abstract:

People seem to love their coffee. The purpose of this experiment is to see what type of cup keeps the coffee the hottest for the longest amount of time. This experiment can help people so that they know what cup could keep their coffee at a comfortable temperature for the longest time. The hypothesis is, if coffee was to be poured into three separate styles of cups then the Styrofoam cup will keep the coffee the hottest and take the longest to get below 80 degrees Fahrenheit. 1. Pour hot coffee into three different cups 2. Take temperature every five minutes until all three cups are below 80 degrees F 3. Record temperature results 4. Perform test three times indoor, three times outdoor. All the test, both indoor and outdoor, conclude that the Styrofoam cup was the last cup to reach 80 degrees F. The Styrofoam cup kept the coffee the hottest for the longest. In every experiment, the Styrofoam kept the coffee the hottest for the longest. The first five minutes showed the greatest decrease in temperature in all three cup styles, however Styrofoam still lost the least amount of temperature. As time increased, the decrease in temperature was less and less. A factor that could not be controlled during the experiment was the starting temperature of the coffee in each cup. Also the ceramic cup seemed cooler to the touch than the Styrofoam or paper cup so its starting temperature was on average 13 degrees cooler.

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

AT 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

149

Fair Category

P8

Project Number

5512

Title: Does Increasing Bass Frequencies on a Loudspeaker Also Increase its Overall Output?

Student Name(s): S. Baker

Abstract:

The question that I posed for my project was “Does increasing bass frequencies on a loudspeaker also increase its overall output?” I was curious as to whether low-range frequencies contributed to the overall volume on a speaker. When you boost bass frequencies, you can feel the vibrations more so than you can with higher range frequencies. I wondered whether or not larger vibrations correlated with higher volume.

I hypothesized that, yes, increasing bass frequencies on speaker will increase its overall output. In testing, I played a section of a song on repeat, and measured the volume using a decibel reader. I then repeated the process with increasing levels of bass frequencies at two (2) decibel intervals. Upon testing, I discovered that increasing bass frequencies by six (6) decibels increases the master output by an average of one and one half (1.5) decibels. My results agreed with my hypothesis.

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

221

Fair Category

P8

Project Number

5513

Title: Spinning Shots

Student Name(s): R. Egea

Abstract:

In my project, I tested how the ears can affect doing something you do in your everyday life. I used five girls and five boys. All of them spun in a circle five times, then ten times, then fifteen times. I did the project in the gym of my school. One boy and one girl went first. They lined up on the foul line and spun around in a circle. It depended on the tests too. The first test was five times. The second test was ten times and the third test was fifteen times. After they spun around in a circle, they had one minute to see how many shots can be made. The other students there helped out by being the rebound to the person shooting. Once all ten students did the first test, we moved on to the second test, then the third. I took notes while the experiment was going on. I examined how each student had different reactions to the dizziness and how they dealt with it, how their bodies got accustomed to the dizziness and how their focus wasn't on one spot. Then I graphed all the information gathered to see the differences. To conclude, in this project, I used students in my eight grade class to help me out and got interesting results.

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

248

Fair Category

P8

Project Number

5515

Title: Can't Stand the Heat?

Student Name(s): C. Chaplinsky

Abstract:

People's cars are always getting hot in the summer. Manufacturers have created the aluminum foil sun shade to keep heat and light out of the cars so they don't get too hot when parked for long periods of time. I conducted my experiment to see if aluminum foil window shades are the best material to keep heat and light out of cars. My hypothesis was if I test to see which material keeps the most heat out of cars between aluminum foil, gold foil, wood, paper, black garbage bag, white garbage bag, plastic bake tray, thick clear acrylic plastic and uncovered glass window then the aluminum foil will keep the most heat out of the car because it is the most reflective material of heat and light. My independent variable was the material keeping the heat and light out, my dependent variable was the heat of the car and my constants were the container, the heat source and the distance from heat source. For this experiment, I used a paint can as my car covered with a glass piece to act as the window. I then put a heat/light shielder (light reflection material) under the glass and turned on the light for 1/2 hour. A device called a PicoLogger translated resistance to temperature on the computer and when the results came out for each test, I learned that the aluminum foil was the best heat/light shielder and the control (the plain glass window) was the worst.

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

EN ET CH

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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

139

Fair Category

P8

Project Number

5516

Title: coastal Engineering

Student Name(s): K. Spells

Abstract:

In this science project I am testing what type coastal engineering prevents erosion on beaches. To determine this I will construct a beach model example showing erosion, using only a plastic bin sand, popsicle sticks, clay, and a journal to record your information. When the beach model is put together test each coastal wall separately. The two types of coastal walls were groynes and seawalls. To test the first wall, measure the level of sand at the shoreline then added one of the coastal walls and poured 2 cups of water each time up to the maximum number of 10 cups. This is observe how the walls help the erosion at low and high tide. After you have all your testing information recorded into a journal for both coastal walls, transfer your information into a graph and data chart.

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

EM EV 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

248

Fair Category

P8

Project Number

5517

Title: Melting Ice with Sand and Salt

Student Name(s): B. Hoth

Abstract:

I have wondered why there is so much sand left on the roads after all the snow has melted. I thought salt would be better to melt snow and ice on the roads. I wanted to know if salt, sand, or a combination of both melt ice fastest? As expected, ice with only salt melted the fastest. As sand amount was increased and salt amount was decreased, the rate of ice melting slowed down. Ice with nothing added even melted faster than sand alone. I learned as I researched for this science project that a combination of salt and sand would be the best. Salt is put on roads to melt ice because it lowers the freezing point of water. The more salt you have the lower the freezing point is. Salt causes cars and bridges to rust and wears away asphalt and concrete over time. It can be harmful to animals, plants, waterways and soil. Sand helps give cars better traction so that they do not slip on ice but it does not melt ice by itself. It also leaves a mess on roads that they later have to clean up. Having a combination of salt and sand may not melt ice the fastest but sand will help give traction. It would be less harmful on roads, bridges, vehicles, living things and our natural resources. It ends up cheaper for towns during the winter. Living things stay healthier, soil and water are preserved, and roads are safer.

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

CH EM 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

248

Fair Category

P8

Project Number

5518

Title: Producing Renewable Energy Using Piezoelectric Walking Surfaces

Student Name(s): D. Okoney

Abstract:

This topic demonstrates the ability to produce renewable energy utilizing embedded piezoelectric elements within everyday walking surfaces to harvest energy through mechanical stresses. The result is converting zero-cost human generated mechanical energy to useable electrical energy. This would provide an alternative energy option using an environmentally friendly energy source reducing the world's dependency on fossil fuels.

A prototype "piezo-tile" was designed, engineered, and constructed to determine if this engineering problem could be proven. In addition, an energy harvesting circuit was also engineered and attached to the "piezo-tile" to capture potential electrical energy produced. This prototype models an actual walking surface, like a sidewalk, floor, stairs, etc connected to an LED to imitate a real world scenario. Once the feasibility of the prototype project was confirmed, other testing was initiated to further expand the understanding of the selected variables to enhance overall performance of the unit. The objective was to determine which method created peak performance producing the highest energy storage. This information could then be used in designing an actual piezoelectric walking surface.

Practical applications include using piezoelectric tiles in various high traffic walking and driving surfaces to enable the production of renewable energy from normal daily activity. This piezoelectric walking surface prototype suggests this technology could be useful for producing energy to power common locations such as buildings, airports, cities and more. To maximize the benefit of this renewable energy, it could be installed in any area with high pedestrian traffic or driving impact.

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):

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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

97

Fair Category

P8

Project Number

5519

Title: The effect of menu labeling with calories on food selection and consumption

Student Name(s): I. McClure

Abstract:

In this experiment, I studied how often people use the calorie information posted on a menu to make their selection. I created a survey that I used to collect my information. The number of participants in each age group averaged 10 and ranged from 7-12 subjects. A total of 60 subjects were surveyed. More females participated than males by a margin of nearly two to one. The participants were mainly family and friends, which was a limitation of my experiment. The survey results showed that most of the participants don't use the calorie information provided on menus.

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

238

Fair Category

P8

Project Number

5520

Title: Fast Food... Or is it Slow?

Student Name(s): T. Courts

Abstract:

I tested which food group dissolves fastest. My hypothesis was that grains would fastest in the "stomach acid". I did this experiment because the food group you digest may increase or lessen your chance of feeling pain when doing physical activity after eating. Pepsin Powder and HCl was used to create stomach acid. The various food items were cut into 1x1 cm pieces, weighed and placed into individual test tubes for 24 hours. I removed the mock stomach acid and weighed each food again to compare the initial weight to the final weight. The bread slice (grains) completely dissolved. The bread went from 0.8 grams to 0.0 grams. The chicken (protein) also completely dissolved, going from 0.5 to 0.0 grams. The carrot slice (vegetable) had an initial weight of 1.6 grams and a final weight of 1.2. The apple (fruit) started off at 0.8 grams and stayed at that weight. The cheese had initial weight of 2.1 and its weight decreased to 1.9 grams. My hypothesis was proven because grains dissolved the fastest and my research question was answered. The amount of time you wait before swimming after you eat may be determined by which food group(s) you ate, rather than the amount of food you ate. If I were to redo my experiment, I would mimic real life conditions. I could mash the food up and/or shake the food once it is in the mixture.

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

BI AS 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

P8

Project
Number

5521

Title: Electrons...A Pet's Best Friend

Student Name(s): E. Flaherty

Abstract:

Many people in today's society own at least one pet. Though this is a positive addition to a person's life, there is a big problem with owning a pet. Their fur sheds and clings to clothing and furniture. This scientific experiment was designed to discover materials that could possibly be used to create a static electricity based tool to remove this pet hair. A balloon was rubbed against four different materials; acrylic, keratin, wool, and aluminum. The thought was to transfer electrons onto the balloon. This would create a static charge on the surface of the balloon and create a way to attract pet hair. Pieces of paper were used to simulate pet hair in this experiment. Each material was rubbed against the balloon five times. Then the materials were rubbed 10 times, 15 times, and 20 times. Between each test cycle, a ground had to be used to eliminate any left over electrical charge. After performing these steps, the process was repeated two more times to validate the results. This provides accurate answers for each material and number of times rubbed. It was proven that when the acrylic was rubbed 20 times, the most pieces of paper were stuck to the balloon. The average pieces of paper attracted to the balloon using acrylic was 6.8 while 7.9 was the average for rubbing 20 times. The results of this experiment indicate the acrylic and rubber would be good candidates to put into consideration for designing a pet hair removal tool.

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

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

150

Fair Category

P8

Project Number

5522

Title: How Bridge Design Impacts Weight Bearing Capacity

Student Name(s): B. Fournier

Abstract:

I chose to investigate which type of bridge design will hold the most weight. I came up with this project because I always wondered why all bridges aren't the same. I predicted that the suspension bridge will hold the most weight because it has the most support in the center of the bridge, the weakest part. Once I made my guess, I went to work making scale model bridges out of popsicle sticks. I made a truss, plank, arch, and suspension bridge but only made one bridge for each type because they take very long to make and it would be very hard to make each type exactly the same. At the end of my experiment, I found out that the suspension bridge held the most weight and my hypothesis was proven correct. I also proved to myself why all bridges aren't the same because they all manage loads differently.

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

EE 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

190

Fair Category

P8

Project Number

5523

Title: Investigate the Use of Mesoporous Insulations to Increase Survival Duration in Extreme Cold

Student Name(s): B. Toth

Abstract:

The purpose of this experiment was to measure the ability of a tent insulated with Pyrogel to extend the length of survival in extreme cold as compared to a typical nylon tent. Three small model tents with the same shape were created out of silicon impregnated nylon, wooden dowels for the frame, and Pyrogel. (no Pyrogel, 5mm layer or 10 mm layer). It was hypothesized that the 10mm Pyrogel would provide optimum performance but might be too heavy to function as a practical tent.

A piece of tofu heated to 37⁰C represented the human body, and a freezer simulated extreme cold. A thermometer support apparatus was designed out of cardboard and masking tape. This unit also held the tofu. Temperature measurements were collected with a sensor connected to a computer.

My hypothesis proved to be correct, with the nylon tent performing little better than a piece of tofu sitting in the freezer. The 10mm Pyrogel performed significantly better, lasting over 2 times as long as the nylon tent. Practical applications for this project include emergency shelter for recreational mountaineering, geological surveys and scientific expeditions. Future testing would investigate heat resistance.

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

EN AT 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

146

Fair Category

P8

Project
Number

5524

Title: Electrolytes and Health

Student Name(s): A. Warmus

Abstract:

I am an athlete that regularly consumes sports drinks that will soon be playing at the high school level. I am trying to find the healthiest and most effective sports drink. My hypothesis is that if I test distilled water, orange juice, coconut water, Sprite, Mountain Dew, Gatorade, and Powerade, then Gatorade will have the highest electrical conductance because Gatorade is a performance sports drink designed to hydrate and replenish electrolytes. My project involved a multimeter, internet research, and a variety of liquids including distilled water, Sprite, Mountain Dew, Gatorade, Powerade, orange juice, and coconut water. I tested the strength of the electrical conductance of each substance to find out how effective it is at replenishing electrolytes. I also did extensive nutritional research for basic nutritional data, molecular density, and glycemic load. In conclusion, coconut water had the strongest electrical conductance and was the healthiest option.

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

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

173

Fair Category

P8

Project Number

5525

Title: Which Sail Can Make A Boat Move Faster?

Student Name(s): A. Simon

Abstract:

ABSTRACT

The main purpose for my project was to determine Which Sail Can Make A Boat move faster. For my project I gathered information on all the different types of sails. There are four different types of sails: Gunter Sail, Lugsail, Gaff Rig, and Bermudan Rig. I selected the Lugsail and Bermudan Rig to test. First, I made a boat out of styrofoam and a mast from a 1/4 inch wooden dowel. I used heavy tissue paper for the sails and calculated the area of each sail, a five foot water trough, a box fan, and a stop watch.

If I install the Lugsail to the mast of the boat I constructed and test its speed in a trough and then compare its speed to the Bermudan rig, which I will install on the same boat, then the Lugsail will prove to be the sail that makes the boat move faster. My hypothesis after testing both sails was proven correct, the Bermudan Rig was 32.26 and the Lugsail was 31.25 cm per sec.

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

EN AT 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

245

Fair Category

P8

Project
Number

5526

Title: Li-Fi: How bright should LEDs be to accurately transmit data?

Student Name(s): A. Ahilan

Abstract:

Can every LED light bulb act as a wireless hotspot? The emerging technology known as “Li-Fi” (Light Fidelity), makes this possible by using LEDs not only to illuminate, but also to communicate. Li-Fi provides transmission of data using visible light through an LED light bulb by switching the LED off and on at a very high rate too quick to be noticed by the human eye. At what light intensity level does the LED accurately transmit data? The goal was to determine the lowest intensity of light at which data can be transmitted with 100% accuracy. This project implemented a Li-Fi system using Arduinos (open-source electronic prototyping platform) to transfer data from a transmitting computer to a receiving computer using an LED panel as the communication source. Characters were input on the transmitting computer and observed on the receiving computer at different LED light intensities. With very low intensity no data was transmitted. As the intensity increased, the accuracy of data increased until a threshold was reached at which 100% accuracy was achieved. An unexpected result was achieved when on an additional trial of this experiment the ambient light conditions had changed. The addition of ambient light affected the results. Further tests were done which confirmed that the accuracy of the data transmitted is not only dependent on the intensity of the LED light, but also on ambient light conditions. This experiment has implications for future Li-Fi data transmission design.

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

PH CS 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

252

Fair Category

P8

Project Number

5527

Title: Designing a Cost-Efficient Energy Solution Utilizing Solar and Wind Energy for Small Scale Use

Student Name(s): S. Khan

Abstract:

In some areas of the world, people do not have access to electricity. The purpose of this project was to provide light to the people who need it, and to power low powered electronics. To conduct this experiment, a device was constructed. The experiment varied materials to achieve a cost-efficient design. Materials included light-emitting diodes, small light bulbs, solar panels, wind belts, coils, wooden blocks and magnets. A cheap wind belt was built between two blocks on which solar panels were placed. The wind belt's purpose was to make an attached ribbon vibrate, thus causing magnets to oscillate between two electric coils producing electricity. Diodes and bulbs were included in the design in order to incorporate potential light sources for off-grid use. Multiple trials were conducted to determine the best configuration. After the variables were optimized, a maximum consistent voltage of 2.1 V was achieved. This was enough to power the lights, but did not have the capability to charge normal 3-5V appliances. To solve this, solar panels were added to the circuit in series. However, such a system would not reliably be able to provide a consistent voltage. The next step was to try adding magnets and coils. This design was not cost-efficient. Finally, a cheap 5V boost converter was added to the circuit, thus resulting in the proper voltage and a lower current output. With this design, a functional windbelt had been created that could power light and small appliances in areas with no electric grid.

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

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

186

Fair Category

P8

Project Number

5528

Title: Investigation of Surface area on Solar Panels

Student Name(s): D. Yu

Abstract:

Solar panels produce energy by allowing photons (particles of light) to come in contact with atoms and free electrons to generate a flow of electricity. My experiment was designed and conducted to see if there is a relationship between the surface area of a solar panel exposed to the sun (independent variable) and its energy output (dependent variable). My hypothesis was, "If surface area (exposed to light) decreases/increases, then the energy output will increase or decrease accordingly because there is less/more exposure to the light source." A solar panel was exposed to a room light to ensure constant light source. Then it was gradually covered by tinfoil and the energy output was measured using a multimeter and recorded. The measurements were performed three times at each surface area. The average energy outputs (y) were then graphed as a function of the surface area exposed to the light (x). Through curve fitting the relationship between the surface area exposed to light and the energy output was $y = -0.0036x^3 + 0.0573x^2 - 0.0475x + 0.0279$ $R^2 = 0.9979$. These findings could help engineers design solar panels for desired energy outputs.

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

EE PH MA

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

P8

Project Number

5529

Title: Light Propagation

Student Name(s): A. Liang

Abstract:

It is hypothesized that the red light can result in an object to have a relatively smaller refractive index than the other colored lights; a convex mirror can make an image looks larger than its real size, and a concave mirror can make an image looks smaller than its real size. The procedure for the first experiment is to make different colored lights go through a plastic medium; then calculate the refractive index of each light and compare the indexes and conclude. The procedure for the second experiment is to make a laser box straight toward a curved mirror to see the direction of the mirror's reflection.

In the first experiment, red light, green light and purple light were used. The incidence angles were 20° , 30° and 45° . The red, green and purple lights' average refractive index of plastic was 1.54, 1.60 and 1.68. So it is proved that the hypothesis is correct that red light has a smaller refractive index than other colored lights. In the second experiment, when lights were reflected by convex mirror, the direction of the lights spread out were wider than the direction of incoming lights; when lights were reflected by concave mirror, a focus point was created in front of the mirror. Since convex mirror spread the light, it can be determined that convex mirror can make an image looks larger than its real size; since concave mirror created a focus point, concave mirror can make an image looks smaller than its real size.

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):

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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

208

Fair Category

P8

Project Number

5530

Title: Harvesting Wind From Street Canyons Using a Double Helix Wind Turbine

Student Name(s): J. Osborne

Abstract:

Abstract

My project was built upon a theory or principle that when wind is blown down a city block, it ends up accelerating because wind pours off of buildings and into the main wind stream, accelerating the wind. With little energy resources left, I hope to harness this in a wind turbine that can be placed on stoplights or attached to buildings and many other areas. I designed and built a working model of a double helix "aeroturbine" based off of the double helix wind blade concept, allowing for multi-directional use. This is a necessity in an urban environment. The result of cheap materials and an inventive concept was a surprisingly well functioning wind turbine that harnessed wind from multiple directions and was highly efficient for such a low budget. I had expected to make multiple models and plenty of revisions in order to make a great model but the aeroturbine concept is so effective that hardly any editing was necessary to the original design. The only action I wish I could have taken (and may in the future) was to test this on a real street with real wind, or in other words to test everything as it would be rather than small models and estimations.

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

246

Fair Category

P8

Project Number

5531

Title: Using Solar Energy To Power Devices

Student Name(s): V. Smith

Abstract:

This multi-phase project involved building a small vehicle from spare parts to be powered by solar energy and used as a test vehicle to collect performance data. Data collection focused on comparing energy outputs of the solar cells, their ability to power a vehicle with different solar engine circuits (SEC) using two different light sources. Initially a vehicle and two SEC (using different timing and power capacitors) were constructed. Operation of the circuits were tested using three light sources and two motors for troubleshooting purposes. The expected result was that sunlight and incandescent light would produce similar results and changing timing and power capacitors would affect charge and burst times. While building the circuits and vehicle, multiple problems were experienced. The recommended instructions were outdated, not all parts were included and the mechanism used for the body only had one large wheel. An additional wheel of the same size was designed and printed via 3D printer. Test results conclude that the SEC with the larger power capacitor, paired with the incandescent light and the modified mechanism was most effective for troubleshooting. Powering the vehicle outdoors in sunlight proved easier than using incandescent light, which required the bulb to be near the vehicle, making it difficult for the vehicle to run freely. The quick charge, short burst circuit proved best at powering the vehicle, providing nearly continuous power. The long charge, long burst circuit moved the vehicle quickly with a longer distance, however power was intermittent.

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

EE AT ET

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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

109

Fair Category

P8

Project Number

5532

Title: Wind Turbine Efficiency

Student Name(s): D. Kallberg

Abstract:

For my science fair project I am trying to design a more efficient wind turbine. I am trying to do this so that more electricity can be from the wind. To do this I must design the turbine then test it using a fan and count the rotations. By doing this I found that models 1 and 3 did much better than models 2 and 4. I also found that my results were very consistent. These results mean that there may be a new way to get energy from the wind. This means that the world can be a cleaner place, if the most efficient turbine design is used.

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

EE PH 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

253

Fair Category

P8

Project Number

5533

Title: Which Sport Drinks Helps the Body the Most After An Endurance Workout?

Student Name(s): B. Gage

Abstract:

Electrolytes are electrically charged ions. In the body, electrolytes are necessary for digestive, cardiac, muscular and our nervous systems. Sodium, potassium, calcium and magnesium are the four major electrolytes that help keep the body's fluids in balance. Athletes participating in an endurance sport lose electrolytes that need to be replaced if exercising for long periods of time. This experiment explores the question, which sport drinks help the body the most after an endurance workout?

My hypothesis stated that if I were to test various sport drinks for their electrolyte content, then the one with the greatest amount of sodium and potassium would contain the most electrolytes. To test my hypothesis, I tested the electrolyte content of five different sport drinks. I did this in three separate phases. First, I build a conductance sensor. Secondly, I set up the test solutions making sure all of the controlled variables were constant. Lastly, I measured the current of each solution using a digital multi-meter, a conductance sensor and a nine-volt battery. I repeated the process three times and calculated an average current reading. I then was able to calculate the average conductance level of each solution using the equation, $G = I/V$.

My results showed that yes, the sport drink with the greatest amount of sodium and potassium did have the greatest conductance; however, the sport drinks that contained similar amounts of sodium and potassium did not rank in the correct order of their conductance levels. Given that, I feel my results were inconclusive.

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

CH 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

224

Fair Category

P8

Project Number

5534

Title: Engineering a Prototype Turntable

Student Name(s): M. Salinas

Abstract:

The objective of the project was to build a working prototype turntable. The criteria was that the turntable had to be safe to engineer and cost affordable as well as being able to support 5 or more pounds. This project was conducted by first calculating the formulas necessary to successfully engineer the prototype, such as the torque and friction and loading involved. Then using SolidWorks, a software program, to design the turntable, it was modeled in a three dimensional form. Materials were then ordered and the building process began. The turntable was powered by a 12 volt lead-acid battery. The lead-acid battery is connected to the turntable controller. The turntable controller has a VSD or known as a variable speed drive. The VSD has an on/off switch, as well as a potentiometer, to control the speed and rpm (revolutions per minute) of the table. This is connected to a 12 volt, gear motor. The gear motor has a friction wheel that is spring loaded to the outside diameter of the turntable, transferring power. The outside diameter of the turntable was knurled to provide a non-slip driving surface. The turntable is supported by a cage bearing which supports the turntable structure. The turntable rotates about a center-post. The finished turntable supports 5 pounds and rotates at a maximum speed of 2 RPM's.

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

EE AT CS

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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

P8

Project Number

5535

Title: Integrity of Structural Members Based on Shape

Student Name(s): Y. Vinnikov

Abstract:

For my research project, I wanted to test the effect of a horizontal structural member's shape on its integrity. To test this, I used a model bridge testing apparatus to test several wooden beams with various shapes. I added mass, and recorded each amount of mass as I added it. I did this until the beam that was rested upon the apparatus broke. Here are the results:

The beam that held up the most mass was the upside down U shaped beam. It held up a maximum of 19.5 Lbs. It broke within 30 seconds of being put under 22.5 Lbs.

Next was the vertical laminated beam. It held up 16.5 Lbs, and broke within 15 seconds of being put under 19.5 Lbs.

Next was the horizontal laminated beam. It held up exactly 16.5 pounds and broke immediately after being put under 19.5 Lbs.

Next was the right-side up U shaped beam. Holding up 13.5 Lbs, it broke within 30 seconds of being put under 16.5 Lbs.

Next was the upside down triangle. Holding up 13.5 Lbs, it broke immediately after being put under 16.5 Lbs.

Then, there was the vertical I beam. Holding up 12.5 Lbs, it broke immediately after being put under 14.5 Lbs.

Next was the right-side up triangle. Holding up 11.5 Lbs, it broke within 30 seconds of being put under 13.5 Lbs.

Lastly, there was the horizontal I beam. Holding up 8.5 Lbs, it broke immediately after being put under 12.5 Lbs.

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

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

171

Fair Category

P8

Project Number

5536

Title: measuring the strength of selected origami structures in order to build useful configurations like furniture.

Student Name(s): J. Estacion

Abstract:

Origami is the folding of paper to create structures such as animals or patterned boxes. These folded structures hold their shape and seem stronger than just paper. This study evaluated the strength of three origami shapes, the swan, the fortune teller and an origami box. The strength was tested by measuring how many washers the structures could support before failing. The origami swan could only hold 23 grams making it the least sound. Next would be the fortune teller at an average 203.9 grams. Now the most sound was the box. The box could hold 6,700 grams or 6.7 kilograms. The swan held 10 times its own weight. The fortune teller held 88 times its own weight. The box held 482 times its own weight. This is surprising because the strength to weight ratio of steels is 200 times its own weight. Now with what I learned I can theoretically build a chair or table. Future applications of this study are to make furniture with easy to get and cheap materials.

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

EE MA

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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

P8

Project Number

5537

Title: Which Soda Erodes Tooth Enamel Faster?

Student Name(s): E. Struzik

Abstract:

It is hypothesized that dark soda will erode tooth enamel faster than light soda. This experiment was conducted to validate this hypothesis, and to determine which sodas decay teeth faster. Eggs were used to represent teeth, as egg shells are similar in composition to teeth. Six types of soda were chosen for experimentation: Dr. Pepper, Root Beer, Mountain Dew, Ginger Ale, Coke, and Sprite. One egg was submerged in water as the Control. The eggs were hard-boiled, cooled, then submerged in plastic cups containing 1 Liquid Cup of fluid, for a period of 6 days. Before submerging, and every 24 hours thereafter, the eggs were weighed and the data logged.

This procedure was followed for three trials, after which all results were averaged to determine which soda type caused the egg to lose the most weight. After completion of each trial, more variation in weight was observed than expected, as some eggs actually gained weight, while others lost. In fact, in Trial 1, even the control egg gained weight over the 6 days. This was likely due to invisible cracks in the egg that developed during hard-boiling, that negatively impacted the results for certain fluids during certain trials. In the end, the hypothesis was incorrect, as the eggs submerged in Sprite lost more weight, on average, across all three trials than any other fluid. This proves the color of the soda is not the primary catalyst for decay, but is likely caused by other materials present in the soda.

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

236

Fair Category

P8

Project Number

5538

Title: The Effect Temperature Has on UV Beads

Student Name(s): G. Quinn

Abstract:

The Sun's ultraviolet rays are deadly. However, the Earth has a protective layer called the ozone layer. Though the ozone layer absorbs 97-99% of the Sun's UV rays, some UV rays can pierce through. My experiment shows the effect temperature has on UV beads, which display UV rays through changing color. I hypothesized that the greater the temperature of the water, the quicker the reaction rate in the UV Beads. In my experiment, I took 10 UV beads and placed them in 250 mL of water at 4 different temperatures (measured in Celsius), and exposed them to the sunlight for one minute. What I discovered was that the UV beads reacted instantly to the sun, but hotter temperatures slowed the reaction, and the color was faint.

I did the same experiment twice more, except I added 1 tablespoon of tan accelerator, and 1 tablespoon of sunblock. I added the tan accelerator and sunblock into the water because I thought each would affect the reaction. Sunblock would slow the reaction, while the tan accelerator would speed up the reaction. The results were surprising: the sunblock didn't affect the reaction rate at all! In fact, it seemed to accelerate the reaction! This was because the sunblock had enough time to dissolve in the water before the experiment began. My hypothesis was disproved, because the greater the temperature of water, the slower the reaction rate in the UV Beads.

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

256

Fair Category

P8

Project Number

5539

Title: Snap!

Student Name(s): C. Grillo

Abstract:

I got the Idea for my project when I was in my grandfather's workshop cutting wood. Some wood was easily cut and glided through the saw blade, but some I had to use more force. I thought that determining the strongest type of wood would be a good science fair project, so I did some research on different types of wood. For testing, I used Poplar, Oak, Cedar, Pine, Ipe, Mahogany and Cherry woods, which are all readily available species I could find locally.

To complete my testing, I gathered the materials, cut wood samples to size, labeled samples, measured and marked 2 1/2" on a vice, clamped a piece of wood on a workbench and marked 4" on it as a reference where to place the scale being used to measure pounds needed to snap samples, placed samples in the vice 2 1/2", lined up the scale with the reference mark, pulled scale until sample snapped, recorded the data, repeated steps on each sample five times then took an average of the results of each sample determining the strongest type of wood tested.

I originally thought if I tested Ipe, it would be the strongest because it looked the densest and felt the heaviest. My hypothesis was supported because Ipe had an average break point much higher than tests on the other species of wood. Ipe took an average of 24.1lbs to brake as opposed to Oak(18.5 lbs.), Pine(12.3 lbs.), Poplar(11.9 lbs.), Cherry(10.7 lbs.), Mahogany(9.5 lbs.) and Cedar(5.5 lbs.).

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

238

Fair Category

P8

Project Number

5540

Title: Need To Charge Your Cell Phone? Leave It To The Wind!

Student Name(s): Q. Ioime

Abstract:

Often I find myself needing to charge my cellphone in a car with only one car charger. For my project, I built a wind turbine that can be mounted on the front of a car. I am testing to see if you can charge a cell phone using this wind turbine. I hypothesize that if the car goes faster, then the amount of power produced will increase, but the amount of power will even out at about 30 volts because of limitations of the electric motor, the charger, and the maximum speed limit. I tested the voltage that the turbine produced while driving around a parking lot at different speeds for a couple of hours. I got the results that the faster the car went the more power that the turbine produced. I was not able to see if my turbine could charge a cell phone because at the speed of 25 MPH it blew off the car and broke when it hit the ground. This makes my results inconclusive and it requires further testing. My hypothesis was partially correct. I concluded that it is possible to charge a cell phone with a wind turbine but not logical due to the size of the turbine and how it can fall over past speeds of 25 MPH. In the future, I will test to see if the length of propellers or their tilt affect the charging of the phone.

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

ET EE 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

237

Fair Category

P8

Project Number

5541

Title: The Eco-Charge

Student Name(s): S. Wang

Abstract:

According to The National Academies of Sciences, Engineering, and Medicine, 84% of the energy Americans use comes from fossil fuels, and some experts believe that we only have forty two years worth of fossil fuels left. Moreover, according to the EPA, 39% of the energy used in America is used to generate electricity. There is, therefore, a need to develop additional renewable sources of energy capable of generating electricity.

The objective of this project was to design and create a prototype of a small portable charger that utilizes vibration energy.

To accomplish this goal, a small piezo element, which produces energy upon vibration was used to construct the prototype. Springs were attached to both sides of the piezo, which was embedded inside a small box that was designed and constructed to produce vibration upon movement. To test if vibration energy was produced by the prototype (and this spring method), a multimeter was used to measure the results.

The prototype was tested by first using a drained out battery and then hooking that battery into the prototype. Afterwards, a multimeter was used to measure the results. There was a low amount of voltage. The prototype was successful in generating voltage via the vibration energy produced by the prototype.

The results of this project indicates that a piezo utilizing the “spring” method has great potential to be used in portable devices as a clean and 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

250

Fair Category

P8

Project Number

5542

Title: Colored Candles vs. White Candles

Student Name(s): E. Cruz

Abstract:

I did this project because I was curious to find out what kind of candles would burn faster, white candles or colored candles. If you ever want to buy a candle, and you want it to last a long time, this project can help you figure out what kind of candle would burn slower. This does not change a person's daily business, it is merely to see what kind of candle would be best to use. The problem was figuring out if colored candles burn faster or slower than white candles. My hypothesis was that the colored candles would burn quicker. The procedure was 20 steps, but in summary, first you prepare the materials. Then cut the wax, put it in a container, then place the container in a pot filled with water. Once the wax is ready, add the colors, dyes, and scents. Mix it and when the wax is at the necessary temperature, turn off the stove. Place a wick into the candle container and make sure it is secure. Then pour in the wax and let it cool. Once it is cool, light your candles and let them burn. Check the candles from time to time and when you think they've had enough time, blow them out and check which one melted more wax. When I finished, I found out that one of the colored candles burned faster than the white, but the other burned slower. My project included a lot of research and objectives were met.

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):

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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

5543

Title: Drum Pitch and Music Education

Student Name(s): C. Espinal

Abstract:

In the study of Music and Sound, Which means how music is created and how the brain interprets it, it's long been understood that music is an important part of human culture, it is traditional, instrumental, and students academically benefit from exposure to instruments. But, there is no known general knowledge about how the size of a drum affects its pitch at our school because we don't have a formalized band class. The literature describes that a drum's pitch depends on the size or type of drum. For example, the bigger the drums head, the lower the pitch and the smaller the drum head the higher the pitch. In this science project, typical methods were used to analyzed pitch however, due to a lack of a formal band class (learning takes place by ear not with formalized lessons) there is no student knowledge about pitch despite the availability of drums. During this experiment I used an app to measure the pitch of the drums. The following results were obtained: average bass drum pitches were 161.1 HZ, average floor tom drum pitches were 183.8 Hz, average snare drum pitches were 220.3 HZ. In conclusion, snares had the highest pitch and bass had the lowest pitch, which allows us to create a music lesson to share with the students about drums. Next steps include, testing different drums and having students test different drums so they can hear the different pitch in the drums to more fully participate in a music program.

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

161

Fair Category

P8

Project Number

5544

Title: Soil Conductivity

Student Name(s): A. Andrade

Abstract:

The demand for energy in today's society is increasing. As we deplete fossil fuels, we need to find alternative forms of energy that are not intermediate like solar and wind. Soil can be used as an alternative form of energy. In this experiment, the different pH levels in soil was tested to see how it affected the amount of electricity the soil generated. Six soil samples were created: two alkaline, two acidic, and two neutral. A Voltmeter was used to measure the soil's (AC) alternating current and (DC) direct current. Results from the experiment showed that all three types of soil produced higher amounts of AC than DC, and alkaline soils produced the most current out of all three types. Knowing what soil produces higher AC currents will help us create a device that can harness the current and transfer it to an appliance. This would decrease our need for fossil fuels and intermediate sources of energy like solar and wind.

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

EV EM 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

250

Fair Category

P8

Project Number

5545

Title: Polyurethane as acoustic insulation material relating with aviation technology

Student Name(s): A. Bairat

Abstract:

The purpose of this project is determine if polyurethane foam is an more efficient acoustic insulator, than the acoustic insulation for numerous airplanes; fiberglass, for uses in aviation technology. I also used polystyrene as a neutral insulation, and to get a better feel for the experiment. My hypothesis states the polyurethane foam is a more feasible acoustic insulation, due to its effectiveness at attenuating high frequency sound waves, and its high porosity. I conducted the experiment with a SPF (spray polyurethane foam), Styrofoam sheets (polystyrene), and fiberglass insulation. The insulation was placed on the base and 4 rectangular sides of a cardboard box(3); each identical. The thickness (of approx. 1.13 inches) and dimensions of the insulation were constant and the ambient room noise was recorded. A speaker emitting a constant sound of 86 dB is placed inside the respective insulation. A decibel meter is placed 15" from the speaker with the insulation upward(12.125") of a table and is 5.375" of a table. The polyurethane foam impeded the noise to 63.9 dB and polystyrene impeded to 69.8 dB whereas the fiberglass induced to 66-68 dB. The experiment was repeated with a non-consistent 104.8 dB alarm (from 12") and the polyurethane foam (each insulation recorded in 5 second time-span [graphs overlapped]) was again triumphant. The results show polyurethane foam is a feasible alternative to fiberglass insulation. In conclusion, a polymer like polyurethane foam, is a substantial method of acoustic insulation, and can benefit aviation technology in many ways.

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

230

Fair Category

P8

Project Number

5547

Title: What Generates More Electricity?

Student Name(s): V. Kumar

Abstract:

Copper coils generate electricity when they are moved in a magnetic field, but what generates more electricity? This project investigates if more copper coils generate more electricity. The number of copper coils used in this experiment varies from ten to one-hundred forty. The hypothesis for this experiment is that if more coils are used, more electricity is generated.

The investigation was conducted by constructing a generator that uses water driven turbine to move copper coils in a magnetic field. Turbine is connected to a faucet using a pipe that pushes water through it resulting in rotation of the turbine wheel. Another pipe is connected to the turbine to let water flow out to a bucket. The turbine wheel is connected to the generator using a rubber band that makes the copper coils spin in a magnetic field.

To find out if more copper coils generate more electricity, 5 different copper cylinders were created each with different number of copper coils. The electricity generated was measured in micro amps using a multi-meter. After every 3 tests the number of coils was changed and the electricity generated was measured each time. The experimental results supported my hypothesis that more copper coils generate more electricity and vice versa. So the number of copper coils really does matter in generating electricity, if there aren't too many, not much electricity will be generated !

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

180

Fair Category

P8

Project Number

5548

Title: Mirrors, Mirrors, Reflecting On the Wall

Student Name(s): V. Hannaford

Abstract:

How does the temperature and curvature of each mirror reflect light differently and how does temperature affect this? My hypothesis is that the concave mirror will reflect the light opposite to where the laser is pointed at room temperature. The convex mirror will do the same, but the light will reflect higher at room temperature. The plane mirror will reflect the light in line with where I point the laser at room temperature. When the temperature changes, the plane mirror will reflect light the same way. The concave and convex mirrors will do the opposite of what occurred when light was reflected at room temperature.

Mirrors are smooth surfaces that reflect most of the light striking it. I tested the reflection of each mirror by pointing a laser beam at the mirror from five different angles. I also froze and heated each mirror while following the same procedure. I found that temperature does affect the reflection of light off a mirror. My hypothesis was not supported by my results. I learned that certain mirrors reflect light differently at different temperatures.

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

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

256

Fair Category

P8

Project Number

5549

Title: Power From Potatoes

Student Name(s): M. Smith

Abstract:

My name is Mark Smith, and I am an 8th grade student at Sacred Heart School in Groton. I designed my project as a reference to show that many conventional crops can be used as bio-fuels and as renewable energy. I have noticed that fuels like bio-diesel are made from oils and greases that can be found in restaurants. This gave me the idea, that a crop like the potato could be used for its starches and acids that when come in contact with two dissimilar metals, create electricity through the process of electrolysis. After researching this interesting topic, I came up with a way to harness the energy within the potato. To start, I sliced five medium-sized potatoes in half. I then took 10 zinc-coated steel nails and ten shiny pennies, and inserted one of each into one potato half. After, I took small, alligator-style test leads and connected the potatoes in a Series configuration. This configuration meant that each lead went from the copper on one potato to the steel on the next potato. After wiring each potato, I connected the end of two leads to a LED light bulb. Once I did this, the LED lit up, yet it was extremely dim. To fix this problem, I tried using tarnished pennies and to my amazement, it lit up, yet even brighter this time. I was proud of my achievements. With a little bit of engineering, this could help give electricity to the poverty-stricken countries around the world.

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

EE CH 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

133

Fair Category

P8

Project Number

5550

Title: Sustainable Wireless Powered House

Student Name(s): S. Liu

Abstract:

The purpose of this project is to look at current technology and use of wireless power, understand the possibilities of building a wireless power residential home, and explore the constraints as well as challenges of building a wireless powered house. Building a wireless powered house would change the world in how we live and how we build homes. The benefits would be great, however we would need to understand the various challenges and concerns of constructing a wireless powered house. The experiments conducted 1) show how different building materials interfere or shield the transmission of wireless power, and 2) show how the distance between the transmitter and receivers impact the consistency of wireless power transmission. The vision is proving the possibility of building a Sustainable Wireless Powered House, which is solar and wireless.

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

EE AT 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

240

Fair Category

P8

Project Number

5551

Title: Mirror Mirror
How does a kaleidoscope work?

Student Name(s): K. Blatchley

Abstract:

How does the kaleidoscope work? How does the number of mirrors affect the outcome of the image? These are the questions I sought to answer in my science project.

I hypothesized that a kaleidoscope works because of mirrors reflecting off of each other.

In this project, I built three model kaleidoscopes. I used a combination of mirrors and black strips in the kaleidoscope mirror chambers to investigate how reflection was impacted by the number of mirrors in the kaleidoscope. I then experimented with the three different kaleidoscopes. The first kaleidoscope has only one mirror, the second kaleidoscope has two mirrors, and the third kaleidoscope has three mirrors. I observed and took photographs of each kaleidoscope with the eight different attachments that I made. I carefully observed each kaleidoscope and concluded that the kaleidoscope with three mirrors worked the best.

The kaleidoscope with three mirrors worked much better than the kaleidoscopes with two mirrors and one mirror because the reflection was more effective due to the wider option of reflection caused by more mirrors and the brighter image caused by there being no black strip in one section of triangle. The other two kaleidoscopes still worked very well, but they were darker due to there being a black strip in place of where a mirror would be. Thus blocking out some light resulted in a lack of reflection because of only having one or two mirrors as opposed to three mirrors.

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

PH AT 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

244

Fair Category

P8

Project Number

5552

Title: Are "Environmentally Friendly" Sprays Worth It?

Student Name(s): J. Rodrigues

Abstract:

The purpose of this experiment was to investigate the effects of different bug sprays and sunscreens on everyday items in nature that you may be using or that come into contact during application of the sprays. I tested grass, distilled water, and nylon which was used to symbolize camp chairs, as they may be in the presence of someone applying bug spray. The hypothesis in this experiment was; "If I test the bug spray and sunscreen I think the "Environmentally Friendly" bug spray will negatively effect the materials less because the companies claim they contain less harmful chemicals. The "Environmentally Friendly" sunscreen said, "All-natural sport continuous spray sunscreen that is 100% biodegradable" and "Free of chemical sunscreens; Made in a recyclable container" The "Environmentally Friendly" bug spray said, "DEET-Free Formula" and "Natural". In order to insure that the plants were similar, I grew the plants. The "Environmentally Friendly" sunscreen was more expensive but effected the materials less therefore better for the environment. On the other hand, the "Environmentally Friendly" bug spray preformed just as good as the other bug spray. I sprayed the materials from 1-14-16 to 2-11-16. I sprayed every 3 days, and measured flaking, color, and dimensions of the plants and nylon. I also measured pH of the distilled water and soil. I found at the end of the four weeks the sprays definitely did effect the materials quite a lot and the sprays effected the materials more over time.

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

CH EV 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

79

Fair Category

P8

Project
Number

5553

Title: Drop Test

Student Name(s): A. Lewoc

Abstract:

Drop Test is an experiment to find out if when using a parachute, if you increase the weight of an object, will the object fall faster. I first built a parachute. Then, I hung varying weights from it, dropped it and timed and recorded the data. I found that the object does fall faster if it is heavier because it overcomes the friction in the air. The parachute helped slow the objects down, but heavier objects still fell faster.

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

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

202

Fair Category

P8

Project Number

5554

Title: Testing the Efficiency of Materials that Lower the Freezing Point of Water

Student Name(s): C. Blanchette

Abstract:

My project investigates the efficiency of three different materials that lower the freezing point of water. Some deicers were said to cause problems on the road, such as corroding metal, so I wanted to test the efficiency of different options as a first step. My hypothesis was that calcium chloride would melt the snow the fastest. In my experiment I took 90 grams of the three different materials and tested them each on 500 grams of snow. I then tested to see how long it would take the snow to melt in a 2.3 degree Celsius area. I did three trials for each material. In my experiment, the calcium chloride did melt the snow the fastest, while the sugar did the slowest. The salt was in the middle of the two. My conclusion was that the calcium chloride was the most effective of the three materials. The process of my experiment could have been better if the snow had been in a more controlled environment. Possible extensions of this project would be to test different materials on plants to see if it will negatively affect them, or how these materials affect something like paint on a car or if it corrodes metal.

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

CH

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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

251

Fair Category

P8

Project Number

5555

Title: Propeller Power

Student Name(s): L. Bamgboye

Abstract:

How does propeller blade shape effect the wind created? This lab report is focused on the aerodynamics of a propeller. The purpose of this experiment is to test different propeller blade shapes and determine which is more efficient through observation. I have built model propellers out of 2-liter soda bottles to depict the force of the wind. I have tested three blades: Rectangular, Knife-like, and Concave. The wind produced will be the function of the type of blade used. But we have to keep the following the same: Length, Material, and Person observing. I believe the concave design will generate the strongest wind because of it's scoop design. This is an aerodynamic engineering experiment. The point of this experiment is to determine which propeller design will generate the strongest and most useful type of wind. The most important data we will get out of this is which design will produce the most wind. I used a candle, a homemade wind catcher, a bowl of water, and human feeling to observe the water. The efficiency of the design will be determined with these observations. With my father's help I have constructed models to replicate the force of a propeller. We hope that through this study, we will be able to learn more about aerodynamics. We discovered that that the knife like blade design was superior to the other designs. This experiment will further our knowledge of propellers and develop more efficient ways to convert and use the power of air.

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

ET 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

253

Fair Category

P8

Project Number

5556

Title: Building Fire-Resistant Homes

Student Name(s): V. Subramanian

Abstract:

Purpose: To test which wood, oak or pine, works best to suppress flame when combined with borax, a flame retardant, and To test whether NaHCO_3 powder (sodium bicarbonate), KHCO_3 (potassium bicarbonate), or both improved household paint's fire-extinguishing characteristics.

Procedure: Wood preparation: The thin pine and oak woods were being coated with borax to the point where each stick was completely covered. Large oak woods were painted with household paint. Solution preparation: 20 grams of ash, 20 grams of baking soda, and mixture of 10 grams of baking soda and 10 grams of ash were placed in bowls. Then, three milliliters of water were added to each, and solutions were mixed. Large oak sticks were coated with solutions.

Experimentation: Lighter was held to end of vertically-held thin pine wood stick and flame was kept lit until stick caught fire. Stopwatch was started at two intervals: 1) when lighter was activated, and 2) when stick caught fire. Test was conducted for all remaining sticks.

Drawn Data: From first test: Pine was moderately damaged, had faster flame movement, and took longer to extinguish the flame. Oak was barely damaged, with slow flame movement and little time taken to extinguish flame. From second test: Ash-covered wood was barely damaged, with slow flame movement and little time taken to extinguish flame. Baking soda-coated wood was heavily damaged, with faster flame movement and longer flame extinguishing time.

Conclusion: Oak wood works best with flame retardant, while ash works best with paint by preventing fire flashback.

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

PH CH 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

226

Fair Category

P8

Project Number

5557

Title: Salt Bridge

Student Name(s): W. Marks

Abstract:

In my project I decided to track and measure the changes of pH of three salt bridges to figure out if electrifying each of them at different voltages would strike a change in the pH of the salt solutions. If the solutions were shocked at higher voltages, there would be a higher change in pH. I used Epsom salt, graphite, 9V, AA batteries, and a pH meter for my study. I electrified each of the salt bridges and tracked the changes every 10 minutes for 30 minutes for each bridge: 1 9V bridge, 1 AA bridge, and a 18V bridge. The main findings revealed a large downfall of the pH particularly in the 18V bridge, suspecting it had a larger voltage than the other two bridges. In conclusion my study did in fact answered my research question and I found a drastic spike in pH in the salt solutions of each salt bridge. The findings show that the when the electricity reacted with the saltwater or (salt solutions) it changed the pH. Also the voltage of electricity changed the pH because of constant downfall of the pH in all of the salt bridges. The findings have the ability to highlight the need for further research and the experiment has the possibility to offer more. The research can continue if the experiment is repeated more than once.

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

CH 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

246

Fair Category

P8

Project Number

5558

Title: Oil Spills: Which Sorbent is Most Absorbent?

Student Name(s): O. Casino

Abstract:

Oil spills can devastate wildlife and damage our precious water resources. Oil spills occur naturally, through accidents, intentionally through terrorist acts or acts of war. It is important to try to clean spilled oil quickly and thoroughly. Cleaning spills can be challenging and scientists are often looking for new and different substances that will absorb oil. This experiment tested four materials to see which would absorb the greatest amount of oil.

Four materials, called sorbents, were chosen because they are common and readily available. These sorbents were cat litter, newspapers, dog fur and cotton balls. Vegetable oil was chosen as a substitute for liquid petroleum hydrocarbon. For each trial, one cup of oil was added to three cups of distilled water. The sorbents were immersed in the water/vegetable mixture for one minute and then allowed to drain for one minute. The remaining total water/oil mixture was measured as well as the remaining water. Three trials were run and the data was collected in a lab notebook. The most absorbent material was determined by averaging the results of the three trials.

This experiment asked the question which chosen sorbent absorbs the most oil? The hypothesis of this experiment states if you test the oil absorbency of four different materials including: cat litter, newspapers, dog fur, and cotton balls, then cat litter will absorb the most oil. In testing, the sorbent which absorbed the most oil was cotton balls. This experiment did not support the hypothesis.

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):

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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

177

Fair Category

P8

Project Number

5559

Title: Keeping It Cool!

Student Name(s): N. Nascimento

Abstract:

As the seriousness of global warming is causing more concern for the Earth's inhabitants, scientists must design new techniques for humans to effectively and quickly control temperature. This experiment tested different types of insulation. The best insulation can possibly stop the rapid rate of melting glaciers or the deadly rise of sea levels that can flood and drown small cities. With better insulation, humans are less likely to suffer dehydration due to the possible risk of droughts diminishing clean water access living things depend on for survival. Temperature plays an important role since about 72% of water makes up human bodies and 71% covers Earth's surface. Scientifically, insulated cups containing ice is the best way to test a hypothesis on a miniature scale. Out of Styrofoam, Aluminum, Plastic, and Thermal Cup insulation, the top results came from the Thermo Cup. An average of 11.84 mL of ice melted because the Thermo Cup guards against heat travel. By taking advantage of a Thermo Cup's characteristics, scientists can hopefully develop a way to stop the dangers of global warming.

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

CH 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

228

Fair Category

P8

Project Number

5560

Title: Rainbow Fire

Student Name(s): E. Kief

Abstract:

In my project, Rainbow Fire, my goal is to use quantum mechanics to explain why different elements affect the color of a flame differently. I used my research to hypothesize each color of each substance used during a flame test. I used 8 grams of 4 different substances to coat the tip of a bamboo skewer after being rolled in liquid glue. I wore safety goggles and gloves during this step and all steps listed below. After these skewers were fully dried, I took them outside when it was dark along with a solid fuel tablet, a square of aluminum foil, matches, and a glass of water. Next I placed the fuel tablet on top of the aluminum foil and lit it on fire. I then held each skewer in the flame while my mother took a picture of the color the flame had turned. After each skewer was held in the flame, I placed it in the glass of water to ensure it was fully put out. When all of the skewers were put in the flame, I poured the water over the fuel tablet to put that fire out. The results were that the sodium chloride burned an intense yellow, the boric acid burned a yellow flame with blue-green tips, the strontium chloride burned a deep red, and the copper sulfate burned a blueish green.

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

PH 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

158

Fair Category

P8

Project Number

5562

Title: The Rainbow Connection

Student Name(s): C. Codner

Abstract:

Which of the colors of the rainbow will attract the most heat? My hypothesis is that red will attract the most amount of heat and yellow will attract the least amount of heat. To conduct this experiment, you need a piece of construction paper from every color of the rainbow, a thermometer, and a lamp. During this experiment, I placed the different colored construction paper under the lamp for two minutes, and then I used the thermometer to see which color attracted the most heat. I found that the colors of the rainbow, in this order, from least to greatest heat: There was a three way tie between red, green, and purple, blue and orange were next, and yellow conducted the least heat. I can use these results to stay warm in the summer. I would wear colors such as red, green, and purple and if I wanted to stay cool in the summer, I would wear yellow.

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

ET 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

208

Fair Category

P8

Project Number

5563

Title: Green Alternatives to Pesticide

Student Name(s): J. Liu

Abstract:

Herbicides, commonly known as weed killers, are chemicals used to kill unwanted weeds. While effective, they are expensive and harmful for you and your entire garden. Research by the International Agency for Research on Cancer (IARC) has linked Glyphosate, the active ingredient in Roundup -- the most widely used herbicide in the United States -- to cancer. Very recently, studies have discovered that the inert ingredients of Roundup are toxic and lethal to human cells. Therefore, this experiment aimed to determine a viable green alternative weed killer by testing which household ingredient was the most effective. Eight pots of chia plants were grown. First, I created liquid mixtures by adding 400 mL of water to saturated salt and saturated baking soda. Afterwards, I added a tablespoon of the salt, vinegar, baking soda mixtures to two pots each. Water was used as a control. After only one hour, the stems of plants that had been treated with salt began to limp. After two hours, all the stems of plants receiving a treatment had fallen. After four hours, the stems had dehydrated, and the plants died. Consistently with all repeated trials, the plants with saturated salt had killed the chia plants earliest, concluding that salt was the best alternative to weed killer.

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

PS 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

102

Fair Category

P8

Project Number

5564

Title: Frozen

Student Name(s): E. Esposito

Abstract:

Ever wonder if hot water freezes faster than cold water? Well, I solved this question by doing an experiment; What freezes faster, hot or cold water? I put equal amounts of water into measuring cups, made sure one was hot and the other cold, and put them in the freezer. Since hot water evaporated which left less water to freeze. In result, 3 out of 4 times hot water froze faster. This experiment showed me how evaporation works and I got to learn about the original experiment too. Also, I learned how you have to be specific your procedure has to be.

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

EA CH 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

78

Fair Category

P8

Project Number

5565

Title: Paws to Consider

Student Name(s): A. Nemergut

Abstract:

The purpose of my experiment was to find out if cats, like humans are right handed, left handed, or ambidextrous. My hypotheses was that I believed most cats were ambidextrous.

I played with 10 house cats in their own home using the same three objects. I recorded each cat's paw preference for each object, then compiled the data to find the number of right, left and ambidextrous cats.

I found that most cats, like humans are right handed.

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

AS AS AS

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

157

Fair Category

P8

Project Number

5566

Title: FUEL UP -THE ELECTROLYTE CHALLENGE

Student Name(s): M. Walker

Abstract:

Fuel Up- The Electrolyte Challenge

What drink is really the best when it comes to hydrating while working out? I automatically that it would be Gatorade. I was surprised when I realized I was incorrect while doing this project. To accurately determine what beverage really works the best you have to measure the electrolytes in the drink! What is an electrolyte? An electrolyte is a substance that dissociates into ions and is present present in sweat. Our bodies lose electrolytes as we sweat, With the help of a mult-imeter I was able to measure the amount of electrolytes in various drinks. Some drinks I used were orange juice, Propel water, distilled water, Gatorade and ZICO (pineapple flavored coconut water. Surprisingly the winner of the most electrolytes was ZICO almost doubling the runner-up orange juice. Throughout this project I learned what drink can provide you with the best hydration and how to determine what drink does.

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

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

252

Fair Category

P8

Project Number

5567

Title: The Hand-Writer Helper

Student Name(s): M. Baitch

Abstract:

Handwriting is difficult to learn and there are not many easy ways of learning this necessary skill. When a teacher is teaching a handwriting lesson one child could be making mistakes, and by the time the teacher gets to that student they may have made many more. Having to constantly check each student's letter formation is a tedious process.

The objective of the Hand-Writer Helper was to design and create a device capable of helping children learn how to write accurately. A prototype was designed and created to accomplish this objective using an arduino uno, infrared sensor, vibration motor, and a motor shield. The prototype works by providing physical feedback when a mistake in forming the letter is made, all in real-time. When using the device the user can practice writing on a special template. When tracing a letter on the template, if the tip deviates from the line, the device will vibrate indicating to the user that an error has been made.

To test this, several letters were traced correctly and incorrectly using the device's special pen. If an error was made the pen vibrated indicating to the user that a mistake was made and that the pen needed to go back on the lines. A prototype was successfully made and works as intended. The results show that this device can be utilized to help people learn how to write correctly. It also has great potential for those who are challenged in that area to develop fine motor skills.

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):

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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

149

Fair Category

P8

Project Number

5568

Title: Testing to Improve the Performance of a Magnetic Linear Accelerator

Student Name(s): A. Purcell

Abstract:

The student wanted to determine if the performance of a magnetic linear accelerator can be improved by changing a number of factors in each experiment. The student learned that there are several issues that can be encountered when trying to run this experiment.

The neodymium magnets (also known as “rare earth magnets”) needed to be kept away from ferrous metals (such as iron, nickel, cobalt, certain steels) because of the strength of the magnets. The experiments had to be performed on the basement floor because the magnets had a strong attraction to the nails and brackets in the workbench. The magnets also have a very strong attraction to each other and were difficult to separate.

Accurately measuring the performance of each test was difficult and a method of measurement had to be created. It was also found that when working with such powerful magnets there were several safety risks.

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

PH EE MA

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

119

Fair Category

P8

Project Number

5569

Title: Calibrating the speed of light with a microwave oven using eggs

Student Name(s): R. Senanu

Abstract:

The speed of light is very important in the name of science and it is used around the world for multiple reasons. For example, in astronomy, the speed of light is used to measure distance in light years. One light year is the distance light travels in one year, and in order to know that, the speed of light must be known first. This research was sought out to prove that there are other ways to use the speed of light to determine the behavior of atoms, which help scientists understand things they can't even see. This is just a couple of examples that the speed of light is involved from the tiniest of particles to the great galaxy.

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

ET 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

121

Fair Category

P8

Project Number

5570

Title: Electromagnet Electricity

Student Name(s): J. Naeem

Abstract:

Electromagnet is a magnet that can be turn on and off. When the electromagnet is on it acts like a permanent magnet, the ones that are on your refrigerator. Electromagnets is an important part of electronic devices. Electromagnets I made four electromagnets using coil and iron bolt. There were four magnets with 50,100,150, and 200 coil turns. I tested the electromagnet's energy using paper clips, that the electromagnets picked up. I did five trails for each of the electromagnet and then found an average. According to the data the electromagnet with the least coil turns has the least amount of energy and the electromagnet with the highest number of coil turns has the greatest amount of energy out of those three.

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

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

202

Fair Category

PS

Project Number

6001

Title: The Design, Fabrication and Testing of a Helio-Tracker Sunflower Style Generator

Student Name(s): C. Hu

Abstract:

Inspired by the sunflower, I have an idea that a helio-tracker can be built. My science fair project is to build a self-powered mechanical sunflower-style generator which can turn with the sun. This project can also store the energy which it produces during the day and light the bulb for the nights. Most significantly, the helio-tracker can help the solar panels to always maintain the best position for sunlight to shine on it. In the other words, the solar panels can always have the best degree to absorb solar power and produce the most electricity. Therefore, solar power can be acquired most efficiently, more specifically, it can receive 95.8% more energy based on my experiment. Also, the electricity can be stored from the day time and used to turn the lights on for the night. In this project, by using the tracking system, the efficiency of solar power is almost doubled. I believe my project will help people to move their attention from gas or coals to new, more powerful and cleaner solar energy. Also, we can just imagine that a field of beautiful sunflowers will be much more beautiful than a field of ugly, black solar panels.

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

EE ET 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

204

Fair Category

PS

Project Number

6002

Title: Rhodamine 6G: A Study of Lasers

Student Name(s): J. Solomon

Abstract:

The purpose of this project was to design and construct an optical laser pumped by a xenon flash-lamp capable of stimulating the laser light emission of the chemical tracer and lasing dye, Rhodamine 6G. In designing the laser, the 2 different circuit aspect of the voltage amplifier/doubler and strobing component were designed to create an ample voltage source for the laser circuit to power the xenon flash-lamp. A "black box" designed casing eliminates stray light emission from interfering with the lasing components. After population inversion of the fluorescent dye, stimulated emission along a cross section of the lasing dye medium through reflective mirrors' reflection of light back through the solution creates the laser light from photons in the same phase, direction, and wavelength in a monochromatic and coherent laser beam. While the laser beam emitted wasn't of great enough coherence to take accurate measurements, the absorbance data for the dye indicated an emission wavelength of 703.40nm, in the red region of light, which corroborates with the observation of red light emitted. From this, further design considerations from more advance mirror systems for the reflection of light and improved focusing of the lased light were considered for future engineering of this laser.

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

PH AT 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

224

Fair Category

PS

Project Number

6003

Title: Star Type's Effect On Planetary Habitability

Student Name(s): N. Ames

Abstract:

This project's purpose is to see how star type can effect planetary habitability and to see whether or not this effect can be demonstrated. In order to test this, I created 4 simulations in a steam game called "Universe Sandbox2" I put a simulated Earth in the habitable zone of 4 different types of stars: White Dwarf, Yellow Dwarf, Red Dwarf, and Giant Star. The Yellow dwarf's planet was habitable, as it was orbiting the same type of star as the sun. The Giant star's planet was habitable at first, but after a few thousand years the Giant star exploded in a supernova and knocked the planet out of the solar system. The Red dwarf's planet became tidally locked so one side of the planet was always facing the star, and one side of the planet never faced the star. this caused one half of the planet to become extremely hot, and the other to form an ice cap. Life would only be able to survive on the edges of that ice cap. Finally, the White dwarf's planet was habitable, but the habitable zone slowly shrunk as the star aged. This means that after a few million years, the planet froze. I proved star type does effect planetary habitability, and demonstrated it by way of simulation. 3 out of the 4 planets were habitable.

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

PH

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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

110

Fair Category

PS

Project Number

6004

Title: Sudoku-Solving Algorithm Efficiency

Student Name(s): T. Westbrook

Abstract:

Computer scientists still lack knowledge on NP-completeness problems. Being able to categorize at least one NP-completeness problem, such as Sudoku, could solve many more NP-completeness problems and possibly solve much bigger problems in the world. By writing a C program using Crook's algorithm and the brute-force algorithm, there is a possibility of creating a more efficient way to solve Sudoku puzzles. To test its efficiency, computation time and amount of backtracking will be recorded. To go even further, much harder Sudoku puzzles, such as 10x10 or greater, will be tested to understand how difficulty of a problem affects the time used to solve a Sudoku puzzle.

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

245

Fair Category

PS

Project Number

6005

Title: Optimization of the Venturi Effect for Applications in Horizontal-Axis Hydroelectric Turbines and Other Sustainable Energy Opportunities

Student Name(s): S. Stone

Abstract:

A developing and favorable form of clean, alternative energy utilizes horizontal-axis turbines and the flow of water to generate electricity. As the amount of energy generated is dependent upon the velocity of the water, researches have begun to augment the flow of the water in order to boost energy production. To improve upon the energy output of hydrokinetic turbines, shrouds are often used to increase liquid velocity via the venturi effect, a phenomenon which states that the reduction in fluid pressure that results when a fluid flows through a constricted section of a pipe will directly increase the velocity of the fluid. However, there is no general accord as to how to maximize this effect, as a variety of shroud shapes exist. This experiment aims to determine which of the most commonly used shroud structures, as well as an original shape, yield the highest power coefficient. To do this, I constructed a hydraulic flume from wood that simulated a current, and 3D printed three distinct shrouds in order to test their performance on the small-scale. The flume also has the capacity to control flow rate, and so three different flow rates have been chosen. Before placing the turbine and motor into the water, the motor had to be water-sealed using electrical tape, a film canister, and hot wax. The results showed that energy output can be boosted up to 90% using a shroud, especially a diffuser shroud with a 25° half angle.

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

EE AT 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

237

Fair Category

PS

Project Number

6006

Title: A Novel Approach to Help Households Use Less Water

Student Name(s): K. Krawczuk

Abstract:

Excessive water usage is a large issue throughout the world, and one that has terrible environmental and economical impacts. One of the culprits of this incredibly large issue is the fact that we as a society do not realize how much water simple activities such as taking a shower, washing your hands, or even brushing your teeth uses. What I have created is a system that helps homeowners and tenants in apartment buildings be aware of the amount of water they have used by on their phones or personal computers. What makes this system different from the water meter that is installed on every building is that this system can show how much water is used in every room in a house, or every apartment in an apartment building. The beauty of this system is the fact that it is incredibly expandable, and is made from parts that are easily accessible such as multiple arduinos, a few water sensors, some transceivers, and an ethernet shield. Such a system could make a big difference. Even the system only caused a household to save a gallon of water a day, after a year that gallon of water a day adds up to more than enough water saved to fill a hot tub. While this system won't solve all of the problems we have regarding our wastefulness, it is without a doubt that this system would be highly beneficial environmentally.

Technical Disciplines Selected by the Student
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CS EE EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

230

Fair Category

PS

Project
Number

6007

Title: The Synthesis of Silica X-Aerogels through the sub critical process

Student Name(s): W. LeMay

Abstract:

X-aerogels are a low density material created through the drying of a liquid gel and polymerization of the resulting compounds surface. The issue with these aerogels is that when the polymerization occurs, the aerogel increases in density and thermal and electrical conductivity. While they also have dramatic increases in strength, the other property changes pose issues to the widespread use of X-aerogels over silica aerogels. The focus of this project is to create a X-aerogel using the sub critical process that will have strength on par with other X-aerogels without sacrificing density. To do this, materials required would be chemicals for the sol gel and sub critical process and a fume hood. A sol gel must be created through hydrolysis, the sub critical process must be used, and the sol gel must be dried to remove all liquid. While multiple forms of X-aerogels have been synthesized, this project would focus on optimizing the density of the X-aerogel without sacrificing the strength, since density is an issue in all X-aerogels currently being produced. Applications of lower density X-aerogels exist in equipment being sent into space. It costs ~\$10,000 per pound of material sent into space. This means that light weight materials that serve dual purposes are desired. Since X-aerogels can be used as support and insulation, low density versions are sought after.

Technical Disciplines Selected by the Student
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CH EN

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- Yes No

CSEF Official Abstract and Certification

Word Count

217

Fair Category

PS

Project Number

6008

Title: Development of a Controlled Deposition Process of Amalgamated Graphene Oxide and Iron Nitrate (Fe(NO₃)₃) Through Magnetic Field Control Environment

Student Name(s): S. Kreitler

Abstract:

Graphene oxide is a conductive and transparent material and is proposed to be the strongest compounds discovered. It is proposed that if by applying a magnetic force to the graphene oxide its deposition pattern can be manipulated within the magnetic field. If the graphene can be manipulated by a magnetic field, then there can be a broader scale application of this material, in such as processors and super capacitors. The magnetic manipulation is initiated by amalgamating the graphene oxide and iron nitrate. For this experiment, 4 grams of graphene oxide and .02 grams of iron nitrate were synthesized and diluted with 4 grams of distilled water. Two samples of graphene oxide (control), and two samples of synthesized graphene oxide/iron nitrate (GOFe test) were dried in a controlled environment within a magnetic field .6cm x .6cm. Experimentation was repeated in triplicate under identical environmental conditions. Results demonstrated the GOFe shifting within the magnetic field and developing rings following the magnetic field lines. Future research requires the determination of magnetic field's characteristics. And, to determine how to apply multiple magnetic fields to form directed graphene oxide structures. With this information there can be more applications such as replacing the silicon in processors with graphene oxide so that it will cause a faster delivery process with a smaller size.

**Technical Disciplines Selected by the Student
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EN AT ET

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CSEF Official Abstract and Certification

Word Count

230

Fair Category

PS

Project Number

6009

Title: The Pick Me Up Stander Walker: Designing A Device to Assist Disabled Patients with Sit to Stand Transfers and Ambulation.

Student Name(s): C. Waskowicz

Abstract:

After shadowing a physical therapist and witnessing treatment of severely impaired patients first hand, I made it my objective to design an assistive, physiotherapeutic device that could transfer patients from sit to stand and support them during ambulation. Walking is the one process that simultaneously stimulates circulation, prevents muscle atrophy, improves cardiovascular health, and contributes to a person's general well being. Because it is such an effective method of maintaining and improving health, walking is a crucial part of the recovery process for individuals suffering from a loss of function. However, those who cannot support their own weight or readily make their muscles comply usually cannot be walked. After researching devices on the market, and rendering multiple scaled models in Google SketchUp, I was able develop several prototypes which evolved into the Pick Me Up Stander Walker. Theoretically, a patient wearing a harness fastened around the hips, can be attached to the Pick Me Up, be lifted into the standing position, and either walk with the device supporting them or be transitioned safely back into a wheelchair. While the Pick Me Up was originally designed for exercise purposes, it could potentially be used as an interactive transport device allowing patients to get more involved in their everyday care. The Pick Me Up's wide base, variable speed lifting mechanism, and reinforced materials make it ideal for supporting patients during transfers and ambulation.

**Technical Disciplines Selected by the Student
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EN ME AT

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- Yes No

CSEF Official Abstract and Certification

Word Count

171

Fair Category

PS

Project Number

6010

Title: Magnetic Motor

Student Name(s): J. Day

Abstract:

The magnetic motor project is a research project based on clean energy using magnetics. In this project I researched all health problems that can come from using rare earth magnets as well as the places where most magnets are mined from. China produces most magnets of this caliber and the real problem with rare earth magnets is that they can affect pacemakers in people. With the qualities of magnets I would need an unattractive(to magnets) material to work with my project. With further research I realized that the only materials that I could use in a prototype that would not affect the magnetic fields would materials such as aluminium, wood, plastic, and carbon fiber. With the design of my project unaffected magnetic fields are the most important part so the prototype and system can run efficiently and correctly. Clean energy right now is on the rise and with government involvement these energies are becoming accessible to everyone. Green energy is the future and the magnetic motor falls in this category.

Technical Disciplines Selected by the Student
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ET EN AT

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CSEF Official Abstract and Certification

Word Count

239

Fair Category

PS

Project
Number

6011

Title: OptiEye - A Vision for the Future of Eye Care

Student Name(s): A. Agarwal

Abstract:

In modern day emergency rooms, there is not one, convenient resource/application that has all vision tests. Several eye diseases and eye situations bring patients into the emergency rooms (ERs), such as sudden loss of vision, corneal abrasions, dry eyes, open globe injuries, etc. After checking the vitals, medical professionals must administer a battery of vision tests and eye examinations. Currently, these eye examinations and the reporting of their results is being completed in a long and time-consuming manner. This is mostly due to the fact that the multitude of tests have scattered locations, and are not easily accessible. Doctors and health care workers are not able to open all these applications/tools at once when in haste, and therefore cannot easily and appropriately test the vision of a patient. In an emergency room, a patient's life is in danger. Vision can mean life or death, and there is currently no solution to this pressing issue. In the time that it takes for a doctor to accurately diagnose his/her patient's vision, that patient might not be living, or may have suffered irreversible damage. Time is clearly of the essence, and so OptiEye, an application, was developed to combat this problem. OptiEye was created using HTML5, CSS3, JavaScript, and jQuery. This program has both a web application and a local alternative, and combines a variety of vision tests into one simple, easy-to-use tool for medical practitioners.

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

CS AT MA

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- Yes No

CSEF Official Abstract and Certification

Word Count

189

Fair Category

PS

Project Number

6012

Title: Case of The Blues

Student Name(s): A. Barbosa

Abstract:

In real life, in order to find traces of blood splatter, luminol is used by crime scene investigators in the vicinity to locate if there is any present. The same concept is used in this experiment. The purpose of this experiment was to be able to determine how temperature affects the light luminol emits. In order to do this, I used two different cups. One is filled with hot water and the other is filled with cold water. I then measured the temperature of each cup and took pictures periodically. After that, I just compared which cup was brighter by using a scale of 1-10. By using different temperatures of the water and a mixture of luminol, copper sulfate, and perborate, I concluded that as temperature rises, then the glow of luminol is significantly increased. Throughout the experiment, I encountered a couple sources of error that made the reaction run faster as well as ways to improve my experiment such as adding new trials and lowering the amount of copper sulfate used. Overall, my data was supported by my hypothesis stating that luminol glows brighter in increased temperatures.

Technical Disciplines Selected by the Student
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CH

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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

249

Fair Category

PS

Project
Number

6014

Title: Succession Variations in Kenyan Scavenger Communities and the Importance of Wildebeest Carcasses

Student Name(s): K. Handler

Abstract:

Complex relationships exist between aquatic and terrestrial ecosystems in the Serengeti Mara Ecosystem of Kenya and Tanzania. Approximately 7000 wildebeest drown annually during seasonal migrations, resulting in large inputs of nutrient-rich carcasses into the river. Research is limited regarding the decomposition of carcasses and the turnover of nutrients to the aquatic and terrestrial ecosystems. This project studied the role scavengers have in the decomposition of wildebeest carcasses, and the role carcasses play in the survival of the scavengers. I investigated which scavengers consume the carcasses, what factors affect temporal trends within a scavenger community, and how the scavengers depend on the carcasses. I hypothesized that trends would be consistent in scavenger communities across different carcass sites. I analyzed 1802 photos taken in October 2013 by an automated game camera at a carcass site along the Mara River. Field research documented the date of the drowning event. I collected data on the number of carcasses, number and species of scavengers, and temperature. Data analysis shows a change in the composition of scavenger communities 17 days after the drowning. Dominant scavengers began to decline and smaller-bodied scavengers increased. Terrestrial scavengers also became more abundant as the number of days since the drowning event increased. I used metabolic modeling to determine that avian scavengers can consume their daily energy requirements from these carcasses, making the carcasses a vital resource. Results help determine the course of succession in a scavenger community and the energy dependence of avian scavengers on wildebeest carcasses.

**Technical Disciplines Selected by the Student
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EV AS

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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

267

Fair Category

PS

Project
Number

6015

Title: Self-Sustaining Biosynthesis of Methane from CO₂ via a Microbial & Electrochemical Hybrid System

Student Name(s): D. Zaminski

Abstract:

High levels of atmospheric CO₂ brought about by man-made activities has become a leading contributor to global warming. Researchers have continued to focus on anaerobic digesters (AD) as a means to sequester CO₂ by converting it into CH₄, a valuable fuel resource. To date, designs of these ADs require costly materials (platinum) to provide high CO₂ conversion performance. Separately, costly expenses associated with wastewater treatment have similarly provided incentive for innovation. Microbial fuel cells (MFCs) predominate these efforts, where wastewater is converted to CO₂, H₂O, and electricity, without energy input. This research attempts to converge the wastewater-driven CO₂/electricity production of MFC's with methanogen-driven conversion of CO₂-to-CH₄ in ADs, creating a newly-designed, self-sustaining integrated bioorganic cell (IBC). A dual-chamber IBC was designed, and separated by a Selemon proton exchange membrane (PEM). Primary influent wastewater (BOD 180mg/L) is inserted into the anodic chamber, where CO₂, electrons, and H⁺ are spontaneously produced. The opposing cathodic chamber is filled with a *Methanosarcina barkeri* liquid culture (OD₆₀₀=0.35, ~70mg-biomass/200ml). Using linked carbon cloth-based electrodes, anodic chamber generated CO₂, H⁺ (via PEM), and electrons act to fuel cathodic chamber *M.barkeri* reduction of CO₂ to CH₄. Upon experimentation, the newly designed, self-sustaining IBC produced two renewable fuels. GC analysis of the IBC headspace highlighted 1.2L-CH₄ production per gram *M.barkeri* biomass, in 12days reaction time. This is comparable to the most recent energy intensive AD designs, where external power was needed to create 1.5L-CH₄/g-*M.barkeri*. Concurrently, 0.21L-Syngas (reported as butane) was created in the same time period.

**Technical Disciplines Selected by the Student
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ET EN CH

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

PS

Project Number

6016

Title: Finding the Optimal Conditions for Energy Recovery in an Electric Car

Student Name(s): S. Chinitz

Abstract:

Recent innovations in the auto industry have led to advancements in the fuel economy of vehicles such as hypermiling and electric cars. As the demand for increased fuel efficiency of cars rises, automakers have advanced in the field in the form of electric cars. A key reason for the efficiency of electric cars is their ability to recover some of the energy that it loses through processes such as regenerative braking and there may be certain conditions in an electric car that could positively affect the effectiveness of the energy recovery processes. This project obtained data from a 2011 Ford Focus electric car running a simulated test as if it were driving in an urban environment. In order to collect the data, a Ford Focus electric car was placed on a dynamometer, an urban driving experience was simulated, and data was collected. This data was analyzed to determine the main factors that affect the energy recovery in an electric car and what the optimal conditions may be for an electric car to recover the most energy possible. In order to analyze the data, initial braking velocities as well as deceleration rates were compared to the instantaneous energy recovered at every point. This allowed for analysis and conformation of the hypothesis that the deceleration rates and initial velocities affect the effectiveness of the regenerative braking system in the 2011 Ford Focus. Ultimately, it was found that the initial braking velocity and deceleration rates both affect the effectiveness of regenerative braking.

Technical Disciplines Selected by the Student
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ET EE

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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

251

Fair Category

PS

Project Number

6017

Title: Dynamic Sound Localization for Mobile Devices

Student Name(s): J. Becker

Abstract:

Sound has long been used by both humans and animals alike to determine location of a given source; a combination of directional and distance information alone can yield a very clear picture of where a recorded sound originated from. A good deal of work has been done in the past developing algorithms and models to “localize” (determine the location of) a recorded sound. However, current methods are optimized and tested for larger, costly setups, so a need exists for a compact solution for sound localization. Thus, this research is aimed at developing efficient, cost-effective software that can be used on to localize sound on mobile device. In multiple waves of testing, a speaker was moved around an iPhone’s stereo microphones while the device recorded sound. The resulting audio files were then loaded onto a computer, and multiple factors regarding the sound (inter-aural time difference, inter-aural level difference, direct-to-reverberant ratio) were taken into account in creating a general algorithm that outputs an estimate of the direction and distance of an inputted sound. This program was then tested using recordings made in a number of different environments, which proved the hypothesis that analysis of mobile phone-recorded binaural audio should be able to estimate the position of a close-by sound source relative to the recording device within .5 square meters. A number of possible applications for this research include defense/surveillance, aiding vision-impaired users, and calibrating background noise reduction on a phone based on speaker position.

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- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

PS

Project Number

6018

Title: Is Connecticut's Water Quality Connected to its River Bank

Student Name(s): A. Brown

Abstract:

This experiment was designed to test what type of riverbank soil and its surrounding plants help the ecosystem of Connecticut's Long Island Sound best. Three different types of river banks were tested for dissolved oxygen and turbidity: a marshy/sandy vegetation at Short Beach, Stratford, a loamy and shrub riverbank at O'Sullivan's Island, Derby and a typical green plant riverbank at Sunnyside Boat Launch. Dissolved oxygen is the amount of oxygen present in a given area of water and helps determine the amount of life that can be sustained. Turbidity measures the cloudiness of water which results from suspended particles and sediment or lack thereof in the water. After testing with a LaMotte dissolve oxygen kit as well as a black and white secchi disk turbidity test tube for 7 weeks, once a week at all three sites, it was found that O'Sullivan's Island had higher dissolved oxygen levels on average, while Sunnyside Boat Launch had the lowest dissolved oxygen levels on average. This means that a loamy and shrub riverbank is the best for keeping dissolved oxygen counts at a healthy level. O'Sullivan's Island also had the lowest turbidity with an average at 46.6 ml while Short Beach had the highest turbidity with an average at 34.78 ml proving that a sandy/marshy riverbank does contribute to a poorer quality of water. The goal of this experiment is to continue raising awareness for cleanup measures of local bodies of water and how to protect the watershed from further degradation.

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

EV EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

179

Fair Category

PS

Project
Number

6019

Title: Runaway With Me!

Student Name(s): X. Casimir

Abstract:

Have you ever wondered why sneakers are considered more qualified than other types of shoes? In this experiment the efficiency of sneakers compared to dress shoes with less heel and arch support(referred to as the flat soled shoes), and barefeet were tested. A 16 year old athlete ran 100 meters in each footwear option and his speed was tested by recording how long it took him to complete the quarter lap in the sneakers, the dress shoes, and then his barefeet. When wearing sneakers it took the athlete 15.4 seconds to complete the lap and the dress shoes tied with barefeet completing the quarter lap in 16.2 seconds. It was observed that dress shoes confine the foot, changing the way you land on the ground, and running barefoot proved to be quite difficult because the skin was exposed to the coarse texture of the track. I learned that callous form over wounded skin on feet which makes it more tolerable to friction and so people who have more callous on their feet have an easier time walking barefoot.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

PS

Project
Number

6021

Title: How Does a Curved Oar Handle Affect a Rowing Stroke?

Student Name(s): E. Koether

Abstract:

Rowing handles have always been straight. This project tested three different oar handles for mechanical advantage to see if an improvement could be made on current oars. Using three identical testing apparatuses the straight, curved, and bent handles were tested for ideal and actual mechanical advantage. Force probes attached at the effort and load sites recorded the effort and resistance forces. The ideal mechanical advantage of the handles was tested by using a ruler to calculate the ratio of the distance traveled by the load to the distance traveled by the effort. The results from this experiment showed that a curved handle had a greater IMA and AMA than curved and bent handles, proving that curving the oar handle would increase the efficiency of a rowing stroke. The curved oar gave an approximate 8% increase over the straight handle, a number that would provide a significant benefit especially at the high forces involved in a rowing stroke. This new handle design could be applied to both competitive and casual rowing, as there are currently no rules regulating the shape of the oar handle. If this handle was found to give an unfair advantage during races, then it is possible that rules could be put in place banning it's use until it is used widely enough to be fair. This handle would allow casual and competitive rowers to go farther for a given effort. The results of this experiment also apply to other class two levers, not just rowing oars.

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

PH 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

250

Fair Category

PS

Project Number

6022

Title: An Approach to Converting Pollutant CO₂ Emissions into Methanol Fuels to Reduce Environmental Harm from Greenhouse Gases

Student Name(s): P. Mohanraj

Abstract:

Due to industrial manufacturing and fossil fuel usage, CO₂ flue gas emissions have accelerated exponentially, culminating in significant climate change. An approach to counter this phenomenon involves chemically converting CO₂, in the presence of water, catalyst, and electrical activation energy, into methanol, an environmentally nontoxic byproduct.

Experiments involved investigating variables affecting the reaction's efficacy, including reactant concentration, catalyst type and amount, and form of electrical activation energy. It was hypothesized that high methanol output would occur with increased reactant ratios, increased amounts of catalyst, using pyridinium catalyst versus molybdenum disulfide, and activation energy from electrical circuitry versus the photoelectric effect on a submerged gallium arsenide semiconductor.

The methodologies concerned preparing samples of various molarities of 500mL CO₂ aqueous solution using dry ice, and pouring select amounts of catalyst into the solution. Electricity was provided with a 30V battery circuit or by the photoelectric effect on submerged gallium arsenide samples under a blue LED lamp. Following the reaction, the remaining samples of water, methanol, and catalyst were put into a distillation unit heated to 70 degrees Celsius to distill and measure produced methanol.

Results confirmed the hypotheses, and additionally showed that using molybdenum disulfide catalyst and the photoelectric effect with gallium arsenide, although producing less methanol, would yield higher output to cost ratios. Industrial implementation of this procedure would yield significant positive impacts on the environment, with the cycling of CO₂ into methanol if methanol is used as fuel, or a decrease in CO₂ production with other forms of methanol

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CH ET EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

222

Fair Category

PS

Project Number

6023

Title: Image Segmentation with a Convolutional Neural Network Algorithm for Robotic Applications

Student Name(s): J. Gartland

Abstract:

Image segmentation, or differentiating between individual objects within a cluttered image, is an important task for computer vision solutions. Image segmentation has many practical applications, from tracking subjects within images to determining the edges of objects for robot grasping. This research project attempted to create a novel algorithm that can perform image segmentation with more than 71% accuracy, which is the current record on the benchmark Berkeley Image Segmentation Dataset. To do so, a specially designed convolutional network algorithm with computer training was utilized. This algorithm passed pixel values of an image through multiple layers of mathematical calculations which simulated the processing of biological neurons. Using machine learning, the mathematical calculations within each neuron were adjusted based on the accuracy of previous attempts, and self-modified based on learned image features to produce more accurate results. Finally, the algorithm returned image segmentation boundaries. Results from running the algorithm have been inconclusive. Trials conducted on a Macintosh computer produced 97.5% accuracy, while trials performed on a cloud-based machine running Linux reported 100% accuracy. However, upon analysis of the outputted results, which did not match well with ground-truth image boundaries, it was determined that the algorithm inaccurately calculated error. This also affected the machine learning algorithm's ability to improve with training. The algorithm was revised to calculate error correctly and re-trained.

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

253

Fair Category

PS

Project Number

6024

Title: Quantification of Pollutants Produced by Combustion of Man-Made Versus Fossil Fuels

Student Name(s): K. Cloud

Abstract:

With Earth's rapidly growing population many assume there is a need for more fuel; however, it is more important to make the fuel used now more efficient than to find other sources that may hurt the environment either in the toxins they produce or the method with which we must obtain them. In this experiment, the waste products of burning common forms of house-hold fuels including Fireside Ultra wood pellets, Green Supreme wood pellets, Kingsford charcoal, Royal Oak charcoal, maple wood, and pine wood are quantified with the goal of identifying which fuel produces less waste following combustion. The various fuels were burned over a gas flame and their waste products measured and compared. This was accomplished by assembling a funnel-like system for the pollutants carried upwards by the smoke and trapped in a filter paper at the top of the funnel, then measuring the remains of each variable after it had been fully combusted. From following this procedure it was found that pine wood lost 96% of its mass but contributed one of the highest amounts of pollutants from its smoke in the filter paper. The Royal Oak charcoal lost the least amount of its mass (67%) but contributed very little smoke pollutants caught in the filter paper. From this it is important to see how man-made fuels are not as efficient as a natural alternative. A continuation of this experiment with many more trials, various comparisons of the quantified data, and different variables may yield more extensive results.

Technical Disciplines Selected by the Student
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CH EV EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

PS

Project Number

6025

Title: FIAA: Food Ingredient Allergy Analyzer

Student Name(s): Z. Service

Abstract:

The purpose of this science fair project was to deduce how an allergen could be detected from a sample of food. I am trying to, in the future, create a device that can test foods that don't have labels, such as those of a buffet or with possible cross contamination, and quickly and accurately tell if there was a certain allergen within the food. Some first thoughts were that of using the PCR method, or the Polymerase Chain Reaction, which takes DNA or RNA from a certain cell and super amplifies it to a size that can then be compared to other DNA or RNA. Unfortunately though, the PCR test would be ineffective, as it is most certainly not transportable and a lab would be needed, along with more time than wanted. Also, an ELISA test was considered, which is an enzyme linked immunoglobulin assay and tests not only the existence of certain antibodies, but also the concentration of these antibodies within the subject. However, the test would take too long for it to be reasonable, easily more than 30 minutes. Continuing, spectrometers were taken into account, however it was found that this would not be feasible due to the size of the proteins I am researching being so large, the spectrometers would not be able to measure them at all. Sadly, I currently do not have any solid answer to this question, but I have hopes of receiving help while at the science fair.

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

251

Fair Category

PS

Project Number

6026

Title: Novel Application of an Electromagnetic Induction Field to Inhibit Surface Bio-Fouling in the Marine Environment

Student Name(s): Z. Dillon

Abstract:

Biofouling is the growth of organisms such as barnacles and algae, on any surface near water. Utilizing induction fields to inhibit growth may serve as a viable preventative measure. For validity purposes double control was used, each trial consisted of four poly(vinyl chloride) devices. One control used a latex primer, and the other used an industry standard biocide paint. Iron fillings were incorporated into the latex primer and the biocide paint applied to separate columns and sealed with a 6 volt electromagnetic inside. Data gathered indicates a clear correlation that the experimental electromagnetic drastically reduced growth. Temperature was used as an indicator of the strength of the electromagnetic field. The field caused a 2.54°C difference in the surface temperature of the experimental columns when compared to the control columns. A sample from the surface of each column was fixed onto a slide, and placed under a microscope. In the highest concentrated area an image was taken and from that the percent coverage was calculated. The latex controls had 94.06% and 89.49% coverage for the first and second trial respectively. The experimental design cause a 93% and 88% reduction of growth. The experimental latex columns exceeded expectations, both trials had less than 1% of coverage. The biocide paint killed any growth that settled onto its surface both in the control and experimental. Further research will be conducted to determine the real world effectiveness of the system, efficiency on a larger scale, and validate the results of the first two trials.

Technical Disciplines Selected by the Student
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AT EE EN

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CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6027

Title: Examination of Different Wet Scrubber Sorbents in Reducing Acid Rain Production and Removing Solid Pollutants

Student Name(s): L. Mocchiola

Abstract:

Acid rain is a global issue that results from the burning of fossil fuels and threatens our ecosystems, environment, outdoor structures, and health. SO₂ gas released into the atmosphere from coal-burning power plants is the primary pollutant that causes acid rain. One way to reduce the emission of SO₂ from smoke stacks is a process called Flue Gas Desulfurization, or "scrubbing". Different alkaline sorbents are used in the wet scrubbing process. These sorbents capture SO₂ through a neutralization reaction, forming a precipitate, and this prevents the SO₂ from being released into Earth's atmosphere. My experiment examined the effectiveness of four wet scrubber sorbents: calcium carbonate, calcium hydroxide, sodium carbonate, and magnesium hydroxide. It was hypothesized that calcium hydroxide would be most effective in capturing sulfur oxides because it is the most alkaline sorbent and, therefore, would neutralize more SO₂. A model of the wet scrubber process was set up using test tubes and flasks. A vacuum aspirator was used to pull SO₂ gas, produced through burning bituminous coal, through the different flasks. pH readings of the "rainwater" and sorbents were taken before and after the wet scrubbing process. The precipitate for each trial of each sorbent was massed. Three trials were performed for the control and each of the four sorbents. The hypothesis was supported in two out of the three criteria. Calcium hydroxide had the largest percent decrease in pH after the experiment and was the most efficient in maintaining the rainwater's pH and not contributing to acid rain.

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

EM CH ET

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- Yes No

CSEF Official Abstract and Certification

Word Count

178

Fair Category

PS

Project Number

6028

Title: Critical Parameters for Investigating Orbital Stability for the Kozai Mechanism

Student Name(s): D. Raigosa

Abstract:

This project examines the effects of the Kozai mechanism in a Sun-Earth-Jupiter three body system. Kozai mechanisms are essential to understanding the inclination and eccentricity exchange and the trajectory of artificial and natural satellites in highly inclined orbits. These simulations test a variety of ratios of semi-major axes between the exterior orbiting satellite and the inner satellite system. The ratios vary by positive and negative factors of one eighth consequently altering the distance of the exterior satellite. To investigate long term gravitational effects on the inner satellite, Gravity Simulator is utilized to evolve the system over five hundred thousand years. NASA's Jet Propulsion Lab's HORIZONS System provides real and accurate initial parameters for the Sun-Earth-Jupiter system. The results determine a chaos threshold for the Sun-Earth-Jupiter system among parameters that produce periodic orbits when the ratio of the semi-major axes is decreased by a factor of five eighths. For all other parameters, the ratio of semi-major axes has a positive correlation with the period of the inclination and eccentricity exchange.

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):

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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

6029

Title: Development of Biochar-Based Sorption Material to Regulate Nitrogen Compounds in Aquatic and Terrestrial Environments.

Student Name(s): M. Gill

Abstract:

It is proven that biochar has a high cation capacity, and thus can adsorb elevated levels of nitrogen. In waste-water treatment plants, there's a high amount of various forms of nitrogen. Some are extremely toxic to plants, animals and humans. Therefore, a sorption material seems to be the ideal proposal to amend this issue. To ensure validity, all sorption material packets were weighed out independently and contain exactly the same amount of biochar inside. Each packet was individually rinsed in distilled water and then soaked in various, secured concentrations of 10 ppm of nitrate for 48 hours.

For all trials, everything has been kept constant. For both trials, the concentrations were 10 ppm. In the first trial, the first material adsorbed 0 ppm, as it is the control; second adsorbed all of the nitrate apart from approximately 3 ppm and the third adsorbed all except 2 ppm in 48 hours. In the second trial, the first packet was also the control. It collected 0 ppm, as there was no sodium nitrate. For the second material, everything except 1.35 ppm of the nitrate was adsorbed. These results were concluded after 5 dilutions for both trials.

In conclusion, there is positive evidence that the biochar sorption material is beneficial to adsorbing nitrate out of the water, and is effective in retaining the nitrate. The adsorption levels remained so, that the biochar adsorbed and held in the nitrate until introduced to a new environment, in this case, 400 ml of distilled water.

Technical Disciplines Selected by the Student
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EM 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

249

Fair Category

PS

Project Number

6030

Title: Improving Developer Efficiency by Determining the Fastest Scripting Language to Compile and Run

Student Name(s): M. Wyskiel

Abstract:

There are multiple types of programming languages available in order to automate processes done on a computer, each type used for different purposes. A scripting language is compiled as the code is run, instead of performing two steps as compiled languages do (building the executable and running it). Scripting languages compile the code on the fly and then run it immediately thereafter. Scripting languages are very useful for running quick scripts that automate tasks which are often tedious, and thus need to compile and run quickly to be effective. My objective with this project was to find the scripting language that best helps programmers to achieve this. I investigated and compared six of the most commonly-used scripting languages—Swift, Ruby, Python, AppleScript, Go, and JavaScript—in performing common tasks: arithmetic, writing to and reading from disk, and parsing JSON text, as well as a control for the classic “Hello, World” program. I ran each test 4 times for each language and compared the times taken to run each program. Contrary to my hypothesis, I found that the fastest scripting language to compile and run is AppleScript, with an average of 314 ms, with Python coming in second at 320 ms; however, Swift, Ruby, and Go took upwards of 1 second to complete their tasks. This was a limited experiment, and an expanded test of these and more programming languages could be plausibly executed to not only determine the fastest scripting language, but maybe even the “best” scripting language.

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

CS

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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

249

Fair Category

PS

Project Number

6031

Title: Improving Standard of Living for Refugees: Use of Recycled Materials to modify internal temperature and dryness, and to provide electricity and water in tented housing

Student Name(s): L. Rosato

Abstract:

Thousands of refugees flee their homes for various reasons each year. The first step in helping these refugees is to provide temporary housing. This housing is usually a tent with no electricity, heat, or inadequate protection from the elements. The purpose of this engineering project was to create a sturdy, tent-cover prototype made from recycled sails, mylar sheets, solar panels, and LED lights to provide a more comfortable standard of living for refugees and their families. Various versions of the tent were constructed using the above materials in addition to braided fishing line, contractor adhesive, pvc glue, pvc piping, solder, shrink tubing, an on and off switch, 3D printed connectors, needle and thread, and a water filtration system. The final prototype was constructed using PVC pipes with the sail cut and sewn so that it could be put over the skeleton and fit. Waterproof solar panels were placed atop the tent and wired to LED strips within the tent. The prototype was tested for temperature insulation, water leakage, purified water collection, and duration of LED illumination. Collected data was analyzed and applied to modifying and optimizing future prototypes. It was concluded that a life-size mock-up of this tent has tremendous potential to improve temporary housing for refugees as it is cost effective, uses recycled materials, resists weather, and the sail-portion of the shell can be easily swapped out if it becomes damaged. It can also be simply constructed by various humanitarian organizations around the globe.

**Technical Disciplines Selected by the Student
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AT EE EN

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- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

PS

Project Number

6032

Title: A Programmable LEGO Robot Used to Efficiently Analyze and Solve a Rubik's Cube Puzzle

Student Name(s): J. Niski

Abstract:

The purpose of this project was to discover the ability of a LEGO Mindstorms controller in relation to the analyzation and solving skills of a Rubik's Cube. This is a project that was meant to use a previously done task, and achieve it by different methods. The original project was successful, done by a professional programmer; therefore, this project has been based off of that original success. There have been different solving methods, some based off of the same basic principle, solving from the top down, layer at a time. Currently, this project has been successful in the manipulation of the cube and basic development of code. Based off of the original robot, the base motor and cube basket was built similarly to that project. The top arm was built, again similar to the original, but made to function oppositely, pushing the cube forward to rotate it on its faces instead of pulling it. In regards to software, RobotC uses basic C programming where users type out every command. Functions have been written for the cube solving robot which allow it to flip the cube and rotate the bottom face, two of the important functions needed to solve the cube. What the project has accomplished is the ability to easily manipulate the cube and its layers, giving it the ability to rotate individual layers as well as flip the cube 90 degrees. The project will be continued after this presentation and made to utilize the color sensor.

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EE CS AT

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- Yes No

CSEF Official Abstract and Certification

Word Count

113

Fair Category

PS

Project
Number

6033

Title: Exoskeleton Apparatus For Osteogenesis Imperfecta

Student Name(s): C. Kasak

Abstract:

Osteogenesis Imperfecta (OI) is a genetic disorder where bones break easily, sometimes with little or no apparent reason. It is caused by a mutation or mutations of type one collagen that affect COL1A1 found on chromosome 17 and COL1A2 found on chromosome 7. This project is predominantly focused on creating an exoskeleton to support the bones of a patient with OI. This will be accomplished by designing and 3D printing an exoskeleton for a patient with Osteogenesis Imperfecta. With this information, an exoskeleton will be constructed. This project is designed to help someone with OI do everyday activities while the exoskeleton keeps the bones in line so they do not fracture as easily.

Technical Disciplines Selected by the Student
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EE ME AT

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- Yes No

CSEF Official Abstract and Certification

Word Count

239

Fair Category

PS

Project Number

6034

Title: Development of a Zero Net Energy Hydrogen Fuel Cell for the Purpose of Generating Potable Water

Student Name(s): D. Peterson

Abstract:

By combining the process of electrolysis with hydrogen fuel cell (HFC) technology, a closed-loop water purification system can be developed that utilizes non-potable water and produces potable water. The experimental design incorporates the energy generated by the HFC and solar array supplementation, which cycles back into the electrolysis and fuel cell processes, therefore removing the need for a non-renewable energy source. The system's design incorporates two sections-- potable water generation and scalable energy requirements. The electrolyser draws 15W at 4V DC, and the 10-cell fuel cell stack draws 2W. On average, the fuel cell stack generates 3.9V, and the solar module generates 5.46V/3.3A, which is a sum of 9.36V. When scaled up, a solar array will sufficiently supplement the power from the fuel cell. The potable water output was validated using tilapia tank waste water as the model water source and culturing the water for bacteria before and after treatment. As theorized, the system works to effectively produce potable water that is free of the initial contaminants. The Dominion Fuel Cell Park in Bridgeport, CT electrolyzes 9 gallons of water per minute (gpm), and the fuel cell module puts out 4.5 gpm and 13,800 V of alternating current at about 47% efficiency. Future research requires a scaled-up analysis of the water's characteristics, and the energy consumption and generation data will be utilized to generate a real-world model for the closed-loop system.

Technical Disciplines Selected by the Student
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EE AT EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

PS

Project
Number

6036

Title: A Novel Approach to Sequestering Hydrogen at High Densities Through the Use of Titanium-Doped Nanocrystalline Magnesium.

Student Name(s): W. Rief

Abstract:

Metal Hydrides offer high hydrogen densities and since the hydrogen is chemically bonded to the metal, it is safe for transport and not volatile. There is one issue that prevents metal hydrides becoming the best storage solution, and that is energy density. The Department of Energy states that a metal hydride must contain 9% of its mass be hydrogen, whereas Magnesium Hydride (the one that will be studied in this project) can only achieve 7.66% (Bogdanovic B.) Unlike other metal hydrides, it can be recharged and discharged with hydrogen at a mild temperature and pressure, meaning that the energy needed to get hydrogen in this state is lower than the alternatives. If the efficiency of storing and releasing hydrogen from magnesium hydride could be increased, it's lower density of hydrogen would be offset by the fact that it's efficiency is so high. There has been speculation that grinding up magnesium into nanocrystalline balls using a ball mill could increase the efficiency. I will test both the pressure and temperature needed to charge and discharge the hydrogen from the metal Hydride. I will also attempt to dope Magnesium with titanium, since this could lower the pressure needed to charge the metal with hydrogen. This project will test this method as well as a combination of both of them to see which method is the best for increasing the efficiency of hydrogen storage and release in magnesium.

**Technical Disciplines Selected by the Student
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ET CH EN

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- Yes No

CSEF Official Abstract and Certification

Word Count

144

Fair Category

PS

Project Number

6037

Title: Optimizing Efficiency of Urban, Track-based Rapid Transit Systems

Student Name(s): W. Peisch

Abstract:

The objective of this project was to design, create, model, and manipulate a novel approach to urban rapid transit systems using independently-moving train cars in order to mathematically and practically increase efficiency. It was hypothesized that a system in which train cars each moved to only two unique stations would be more efficient than the status quo, a system in which the cars followed each other in a train. A computer program was designed with the java-based language called "Processing" to simulate cars moving independently between 21 stations, each with a different rate of passengers entering and traveling to them. This system was then compared with a system in which the train cars followed each other to each consecutive stop. Data from the average amount of time the passengers waited on both the platform and the train between the systems were compared.

Technical Disciplines Selected by the Student
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ET EE MA

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- Yes No

CSEF Official Abstract and Certification

Word Count

253

Fair Category

PS

Project
Number

6038

Title: Exploring Conditions For Struvite Precipitation and Crystal Growth

Student Name(s): M. Geradi

Abstract:

Municipal and farm effluent contain high phosphate and ammonia levels, which must be removed by the EPA mandated standards. Processing of effluent by anaerobic digesters produce ammonium ions and orthophosphate. Production of Struvite, a crystal consisting of magnesium, phosphate and ammonium in a 1:1:1 ratio, can be an effective method to bring levels of these contaminants to EPA mandates. This process has implication for environmental management and sustainability as Struvite is an excellent slow-release fertilizer and can allow for recycling of ammonium and phosphate.

This project aims to optimize conditions for recovery through struvite. Towards this goal, solutions of Ammonium acetate, Magnesium chloride and Potassium phosphate were mixed at varying concentrations over a range of pH (7-9.5). Observations were done to a maximum of 24 hours after solutions were compounded at room temperature. Crystal morphology was noted down. Recovery of ammonium and phosphate was measured using a reagent-based test and test strips. Recovered struvite was also dissolved and ammonium and phosphate levels were measured. The ratio of three ions was varied and compared with solutions compounded in a 1:1:1 ratio. Possibility of K-Struvite formation was tested by comparing usage of potassium phosphate V.S. sodium phosphate.

Crystal formation increases with increase in initial pH and precipitation was accompanied by drop in pH of the solution and reduction of phosphate and ammonium concentration. Recovery of ammonium and phosphate increases with higher ratio of phosphate and the addition of phosphate as a base. Recovery is slightly increased with the usage of sodium phosphate.

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

CH EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

216

Fair Category

PS

Project
Number

6040

Title: Residential Oil Spill Analysis: The Billion Dollar Question

Student Name(s): H. Ding

Abstract:

Fuel oil leaks are an environmental and economic issue. Each leak will have dangerous consequences if left untreated. It can be a fire hazard, with explosions triggered easily with a single spark, a huge environmental hazard, potentially polluting the area and ground water, and a costly economic problem, with each cleanup process potentially reaching into millions of dollars. From homes to gas stations, underground and aboveground, fuel tanks are found everywhere. The objective of this study was to analyze data from New York's Department of Environmental Conservation. A self-written program was used to analyze the consolidated information. The 400,000+ spill cases were then narrowed down to near 83,000 residential fuel oil spill cases. The trend, the causes, the affected resources, etc of those cases were analyzed. The rough estimate for the 83,000 residential spills was about 1.9 billion dollars after taking into consideration a high estimate and a low estimate. If the similar spill damage rate persists for all US houses which are using fuel oil, the cost for cleaning up the residential fuel oil spill in the past 38 years would total more than 7 billion. And in the coming years, the annual cost can reach 300 million dollars. This study's results can be used to push for the increase of prevention for spills.

Technical Disciplines Selected by the Student
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EV EM

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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

249

Fair Category

PS

Project Number

6041

Title: Sustainable Elementary School

Student Name(s): N. Vora

Abstract:

Today, the majority of our world is powered by fossil fuels. Carbon emissions are rapidly increasing. The goal of this project is to design a sustainable elementary school. This project strives to meet three main goals; lower energy consumption, reduce operating costs, and reduce the school's waste. This school will take advantage of existing technologies to maximize sustainability. These technologies include concentrated photovoltaics, a green roof water retention system and passive solar heating. Concentrated Photovoltaic Panels are made up of semi-conductors instead of traditional flat-plate silicon. Instead of being laid out in a flat rectangular pattern, the panels are laid out in a parabolic shape. A green roof system will use excess water to irrigate the plant life that is on ground level. I have used AutoCAD to design a model of the school. The Glastonbury Department of Education spends \$110,000 on electric utilities for Nayaug Elementary School only. This cost is after a standard solar panel system produces 163,307.1 kWh yearly. The sustainable technologies can significantly reduce the carbon footprint that is left by the school. The data can be used to improve the existing schools or be incorporated into plans for any future schools. After the 2015 United Nations Climate Change Conference, The United States will be making efforts to reduce carbon emissions. This project can aid in the reduction of carbon emissions. By implementing a sustainable elementary school, the Department of education will be able to cut down on costs and reduce carbon emissions.

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

250

Fair Category

PS

Project Number

6042

Title: Novel Glycerol-Free Biodiesel Production Using Enzyme Catalysis

Student Name(s): M. Haddad

Abstract:

Biodiesel production from vegetable oil and ethanol (EtOH) has become a demonstrated alternative energy source. Current processes convert triglycerides to biodiesel with 10% crude glycerol in 900 million pounds per annum in the US. [1] Last year, I developed a new method of production to avoid glycerol formation by using selective partial transesterification. Stopping the process at the monoacylglycerol (MG) stage resulted in 100% yield of good-quality biodiesel. [2] Preliminary data required additional research to verify the early findings and further support the mode of action.

The concept is based on addition of acetic acid (AcOH) to the enzymatic process to prevent the formation of glycerol by performing a faster transesterification of the terminal alcohols. Preliminary data suggested an absence of glycerol under EtOH+AcOH conditions, resulting in the formation of new products, based on GC analysis. This work tracked the formation of the new products using an internal standard (IS). Furthermore, GC/MS data became available and supports the proposed structures of the products MG acetate and biodiesel.

The reaction of MG acetate, formed under anhydrous conditions, was tracked after the addition of water. In the EtOH+AcOH experiment, 8% MG acetate (normalized to the IS) was formed. Its complete hydrolysis in the presence of water resulted in a 10% increase in biodiesel and 0.12% increase in MG. Throughout the analysis of each sample, no glycerol was detected.

These results indicate that the EtOH+AcOH method for biodiesel production is a sound, efficient process to prevent glycerol formation.

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

ET AT 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

253

Fair Category

PS

Project Number

6043

Title: Construction of an Agonistic Pneumatic Artificial Muscle Air Conservation System

Student Name(s): W. Heim

Abstract:

Pneumatic artificial muscles (PAMs) hold great promise as a lighter, safer, and flexible replacement for conventional pneumatic cylinders. When applied to humanoid robotics and prosthetics, however, the functionality of PAMs are limited by the need for external, pressurized air. This research aims to construct an Agonistic Pneumatic Artificial Muscle Air Conservation (PAMAC) system, where air pressure within the PAM itself will be conserved/reused during opposing movements, thus significantly reducing the need for an external air source. To begin, electronically controlled solenoid valves were connected to custom-made PAMs in a conventional configuration; one valve allows air to flow from the supply into each PAM, and another allows for exhaust. Then, an additional solenoid valve was placed between the open ends of each PAM to allow for pressure equalization; it is this action that allows for air conservation. To compare the air conservation system to a conventional system, each PAM was conventionally contracted and relaxed 50 times per minute while connected to a finite source of air, recording the number of successful contractions. This process was repeated for the air-conservation system using equalization valves. The PAMAC system successfully contracted the PAMs 3851 times, versus only 2011 contractions for the conventional system with the same amount of air. Using the PAMAC system, over 47% of the pressurized air was conserved with the addition of a single solenoid valve. This technology can be seamlessly applied to humanoid robotics and prosthetics to allow for portable, efficient systems that maintain the overwhelmingly positive characteristics of PAMs.

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

EE EN

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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

241

Fair Category

PS

Project Number

6044

Title: How does injecting hydrogen in an engine's air intake affect the time it runs?

Student Name(s): F. Cremel

Abstract:

How does injecting hydrogen in an engine's fuel inlet affect the time it runs? I believe that by adding hydrogen to an engine's air intake it will increase the time the engine runs because hydrogen is a highly combustible gas. By adding hydrogen to the mixture of air and fuel, it will increase the combustibility requiring the engine to use less fuel and still have the same amount of power with the hydrogen. This alteration will make the fuel last longer, therefore increasing the duration of engine being on. The Independent variable in this scenario is the hydrogen which is being injected into the engine. The dependent variable is how long the engine runs with and without hydrogen. The controlled variable is the 20 milliliters of fuel which is the basis for the experimentation. In this experiment, I injected hydrogen into the air intake of a small RC airplane engine, and so by doing this I had to adjust the air to fuel ratio due to the fact that the air was rich with hydrogen. I conducted several tests and recorded the outcome. After recording the outcome I turned off the HHO generator, adjusted the air to fuel ratio and conducted 3 more tests without hydrogen. In conclusion the hydrogen additives to the engine clearly determined that the engine with the hydrogen and air mixture increased the combustibility, therefore lowering the amount of fuel entering the engine, thus reducing fuel consumption.

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

ET EE AT

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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

169

Fair Category

PS

Project
Number

6045

Title: Metal Oxide Nanoparticles in Hexane Reactions

Student Name(s): B. Sohn

Abstract:

How the catalytic efficiency could be improved even more by forcing the catalyst to react with methane and hexane in different ways? In this paper, various metal oxides will be modeled and explained based on the compound's electron structure. Main objective of this research is to increase selectivity in catalytic reaction to produce desired product at high turnover rates.

Metal oxides are very useful in oxidation reaction, and the reaction can be facilitated by the catalysts. The catalytic efficiency of a compound depends on its electron structure. Electrons with the right amount of energy and at the right location would increase the efficiency. To react in different ways, we can change the position of the atoms of the molecules we are studying and see how that would affect results.

This project aims to determine the catalyzing ability of proposed metal oxides using different computational chemistry methods or programs such as Gamess and Chemcraft, in an effort to discover the optimal method and to compute the measures of catalytic ability.

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

EM 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

162

Fair Category

PS

Project Number

6047

Title: Self-regulated LED Dimming System for Reduction of Eyestrain and Energy Consuming

Student Name(s): X. Wu

Abstract:

This Self-regulated LED Dimming System is designed for relieving eye strain in the performance of visual tasks of high contrast (ex. reading on fine prints) and for energy saving with sufficient environmental light.

The design of this system consists of two major parts: one is the brightness detector installed on a pair of glasses which is designed to measure the brightness received by users and send commands to LED driver wirelessly, the other one is a wireless automatic dimming LED driver which is designed to receive commands and adjust the brightness of LED lamp through PWM output.

After multiple tests and measurements, this system is proved to be able to control the brightness of the LED lamp received by the eyes of users in the range of 200 to 500 LUXs which is the ideal brightness for high contrast visual tasks. Secondly, the energy saving efficiency can be up to 30% by examining it in 5 different times of a day.

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

EE

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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

262

Fair Category

PS

Project Number

6048

Title: Fabrication of a Magnetically Vertical-Aligned Boron Nitride Nanotube Membrane in a Lyotropic Precursor for Salinity Gradient Power

Student Name(s): C. Li

Abstract:

Boron nitride nanotubes (BNNTs) have significant potential in nanofluidic technology as they possess a slightly higher water flux than that of carbon nanotubes, and 10x higher than that of any reverse osmosis membrane. Also, larger-diameter BNNTs are capable of harvesting osmotic power with efficiencies exceeding 1000x that of the pressure-driven counterpart. The primary limitation towards the application of these properties are the difficulties associated with performing widespread characterization of BNNTs within a nanocomposite. This research develops a facile, scalable method for fabricating polymer nanocomposites containing vertically-aligned BNNTs by exploiting the diamagnetic 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, which guide the alignment of BNNTs sequestered within the micellar cores. To begin, 1g/L BNNTs were dispersed in di-water containing 1% sodium taurodeoxycholate. Following centrifugation, the supernatant was collected and used to prepare a thin film (<1mm) LLC matrix; polarized optical microscopy confirmed its stability. The thin-film was heated to 65°C under 1.4T magnetic field, and cooled 0.5°C/min to 35°C, where it underwent sample annealing for 2 hours to improve orientation. The thin-film was then polymerized with 365nm UV light. Characterization of the resultant polymer nanocomposite was determined via SEM, demonstrating the formation of aligned micelles. Polarized Raman Spectroscopy at sample orientations of 0°/90°/180° demonstrates a Raman shift peak when the sample is at 90°, confirming the alignment of the BNNTs due to increased absorbance along the long-axis of the tube.

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

ET EN AT

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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

241

Fair Category

PS

Project Number

6049

Title: Making Wonderful Pictures

Student Name(s): H. Zhang

Abstract:

Holograms are awesome. They can record much more information about the object, but they are really hard to make. How can we make holograms just as easy as taking a picture? Make a camera that can take holograms. Since sunlight doesn't contain lasers and the light coming in must be coherent, I choose to also use laser to illuminate the object and actually only record the laser information. The major difference between taking a holographic picture and making a regular hologram is that there is sunlight interfering with the light field recording process. The holographic plate is only sensitive to light with wavelengths between 600-680 nm and my laser holds a wavelength of 650 nm. I chose to use a bandpass filter passing wavelengths at center of 650 nm with a FWHM of 10 nm. By chance, I found matboards from my art class might be a good material to build the camera. However, it turned out to be very fragile and unstable even with hot glue and tape. I designed the layout and asked one of my classmates to 3D print out the camera with black plastic. I used black electrical tape to seal it so no light will leak inside by accident. The result wasn't pleasant because there is still some sunlight going through and recorded. I wanted to use a combination of a longpass and a shortpass filter to try to get a better result, but was restricted by budget.

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

EE 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

195

Fair Category

PS

Project Number

6052

Title: The Application of Eye Center Localization and Tracking in Spherical Robots

Student Name(s): H. Mo

Abstract:

The estimation of the eye centers is used in several computer vision applications such as face recognition or eye tracking, especially for the identification of letters and systems. Nevertheless, this technology hasn't been used in common people's lives and most of methods often fail to accurately estimate the eye centers in difficult scenarios, such as low resolution, low contrast, or occlusions. Therefore, I propose an objective function which can accurately find eye center location by using image gradients. This method is invariant to changes in scale, pose, contrast and variations in illumination. It is a significant improvement regarding both accuracy and robustness. At the same time, it is a revolutionary method of robotic control. It makes people experience robotics in a different way. This spherical robot will response to robot driver's eye center movement and transfer the vision of the robot in real-time back to the operator. Because of this function, I would like to call it "The Third Eye". For future development, this eye centers tracking system is very easy to transplant to other mobile devices which can help the group of people with paralysis to use their smart phones or tablet computers.

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

CS AT MA

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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

254

Fair Category

PS

Project Number

6053

Title: An approach for mitigating the effect of ocean acidification on shellfish while sustainably extracting dissolved CO₂ from seawater.

Student Name(s): A. Roychoudhury

Abstract:

30% of CO₂ produced during the combustion of fossil fuels is absorbed by seawater. This has resulted in an alarming increase in seawater acidity* leading to a reduction of: pH, carbonate-ion concentrations, and saturation states of CaCO₃ - the building blocks of marine organisms. This has a destructive effect on calcifying species, e.g. oysters, clams, sea urchins, and corals. My research objective was threefold – (i) examining the effect of ocean acidification on calcifying species, (ii) exploring a mitigation approach and (iii) developing sustainable means to extract and sequester dissolved-CO₂. I first investigated the effect of CO₂ dissolved in seawater on pH and rate of natural sea-shell disintegration. Subsequently, the effect of recycled, pulverized clam and egg shells for reducing the degradation rate was studied and remarkably, a significant decrease in sea-shell degradation was observed. Acidic conditions were simulated by bubbling CO₂ into aquarium grade saltwater to produce a range of pH, to expedite reaction rates and highlight dangers of continued acidification. The test samples with recycled pulverized shells exhibited a stable, near neutral pH at the end of my experiment. Additionally, nascent CO₂, observed bubbling from crushed shells, was successfully trapped by reacting with CaO in the presence of Ni (catalyst), to make lime (raw material for cement). Algae growth in pH-varied solutions, to capture bubbling-CO₂, was also examined and significant growth was observed. Consequently, I was able to demonstrate a means for reduced disintegration of natural seashells due to ocean acidification and identify means to sustainably sequester CO₂.

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

AT EV 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

200

Fair Category

PS

Project
Number

6054

Title: Effectiveness of Amino Acid-Functionalized Gold Nanoparticles for Colorimetric Detection of Mercury in Water

Student Name(s): D. Cai

Abstract:

Mercury (Hg²⁺) is a very toxic element. It contaminates water and accumulates in the body, causing damage to our health. It is therefore desirable to develop efficient sensing methods for Hg²⁺. Gold nanoparticle (AuNP) –based sensors have been proven effective in environmental monitoring due to their ultrasensitive colorimetric response to pollutants in water. This research studies effectiveness of mercury detections using AuNPs functionalized with various amino acids in weak acidic and basic groups, and with different sequence of mixing the materials. Briefly, AuNPs were synthesized following previous literature. Then Hg²⁺ and amino acids were added to the AuNP solution. Results show that amino acids in weak basic groups effectively attract mercury thus promoting aggregation of AuNPs to induce color change. This confirms previous studies on the effectiveness of Lysine in an AuNP mercury sensor. The current research then explored Hg²⁺ detection when switching the order of mixing the materials, i.e., amino acids were added to AuNP solution prior to adding Hg²⁺. It was observed that the detection accuracy was further improved with the new procedure from the published methods. The sensor was used to detect Hg²⁺ in real environmental samples and found the mercury level in Connecticut water was undetectable.

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

CH

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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

261

Fair Category

PS

Project Number

6055

Title: Increased Charge Rate and Capacity for Olivine Lithium-Ion Batteries via Efficient, Upcycled Nanoscale Electrodes

Student Name(s): C. Popham

Abstract:

Lithium-ion batteries are used as the power source for a myriad of devices, from smartphones to electric vehicles. The main issues preventing further growth and development of these batteries are safety and capacity - both of these must be addressed in order to secure the future of the Li-ion energy market. A possible solution to these limitations may lie in adaptation of silicon anodes; Si's specific capacity can reach 4.2 Ah g⁻¹, 12x that of the most commonly used anode, graphite. To date, however, Si anode technology remains untapped due to its massive volume change and instability during Li cycling. Concurrently, Li-ion electrode technology can be improved using lithium iron phosphate (LiFePO₄) in place of LiCoO₂. LiFePO₄ possesses increased thermal and chemical stability, charge stability for over 2000 cycles, and decreased environmental impact when discarded. In this research, Si-anode and LiFePO₄ technologies were simultaneously adapted to design an improved Li-ion battery. To prepare silicon for use as an anode material, Si wafers were first (metal-assisted) chemically etched, to create nanoscale channels on the surface. These channels provide space for the crystal to safely expand and contract without damage to its structure. Lithium-ion batteries, including etched, nanostructured Si-anodes, were assembled, and compared to a standard CR2032 cell at low-load conditions (10ohm resistance). The new Si-LiFePO₄ design demonstrated 48% higher specific capacity, and exhibited 250X improvement in consistent output, suggesting that they are better-suited than the CR2032 for long-term applications such as pacemakers, emergency lighting, and devices which require consistent power.

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

EE AT CH

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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

181

Fair Category

PS

Project Number

6056

Title: Object Detection for Autonomous Drone Navigation

Student Name(s): H. Shipman

Abstract:

Unmanned aerial vehicles often use pattern recognition to navigate surroundings. This project used a sign marked with two symbols a fixed distance apart for the drone to recognize. The drone estimated its position in relation to the sign by recognizing the size of either symbol compared to the other. Haar Cascade Classification was used to train the program to recognize the pattern. During the calibration process, images of the sign were processed at a variety of distances away, and the data was recorded and used to observe how the sign dimensions appear in relation to the drone's orientation. The drone used a two-stage algorithm — first, a simple search routine to acquire the target, and second, using the symbols known distance apart and size, it estimated an approach vector. To test the drone and the program, the duration of the drone's flight, the drone's orientation in relation to the horizontal, and the landing coordinates in relation to the target were recorded. Two sets of trials were performed at a distance of 10 feet away. The average error versus target was 12.21.

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

CS

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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

265

Fair Category

PS

Project
Number

6057

Title: Water Droplet Repulsion and Reducing Icing Tendencies on Superhydrophobic Surfaces

Student Name(s): H. Stober

Abstract:

The need to repel water droplets, and reduce icing tendencies on contact surfaces, is important to many industries where water is a hindrance, particularly in aviation, where freezing of water on aircraft jeopardizes flight safety. Efforts to de-ice aircraft in sub-freezing temperatures remain costly and time consuming. The development of a superhydrophobic (SH) coating that would repel water, lower the freezing-point of aircraft-contacted water, and subsequently lengthen the time taken for freezing, would be highly desirable to minimize the need for deicing. In this research, two such coatings were investigated for their water-repelling and freezing-point depressive properties. First, a polymer nanocomposite dispersion was prepared by mixing 0.4% fluoroacrylic copolymer (FCP, Capstone ST-100) with a 2% suspension of carbon-nanofibers (CNFs, 100nm diameter, 20-200 μ m length), and spray-deposited onto a glass substrate. Concurrently, aluminum was cleaned, etched, and treated with 1.43mM trichloro(1H,1H,2H,2H)perfluorooctylsilane (TCPFOS). SEM analysis of both treated substrates demonstrate uniform SH coatings, of 10 and 20 μ m, respectively. To measure time to freeze, and the freezing point for water, a 50 μ l droplet of water was separately placed on each SH coated surface, and each was super-cooled within a -25oC freezer. Using thermal imaging to characterize temperature changes, water's freezing point was lowered to -15oC by the FCP-CNF coating on glass (versus -10oC for normal glass), and the time to freezing was extended from 2min30sec to 14min20sec. For the TCPFOS-coated aluminum, the freezing point of water was the same as that for clean aluminum (15oC), however freezing time was increased from 3min to 4min.

Technical Disciplines Selected by the Student
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CH EN AT

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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

248

Fair Category

PS

Project Number

6058

Title: On Quantum Search Implementation into Artificial Multi-Layered Perceptron Quantum Neural Networks

Student Name(s): J. Mo

Abstract:

Compared to classical computers, quantum computers can perform exponential speed-ups when processing data in a massively parallel fashion, such as searching through a very large database. Using these exponential speed-ups in a neural network made efficient for quantum computing has largely been unexplored. A multi-layered perceptron quantum neural network closely resembles an artificial neural network in the sense that there is an input layer, hidden layers, and an output layer. The main difference in these neural networks is the utilization of quantum algorithms and quantum gates. The advantage of using a quantum computer to process a multi-layered quantum perceptron network is in its ability to utilize quantum search to search through possible weight vectors, providing a polynomial speed-up to the exponential task of finding a solution to the quantum neural network. This is done by assigning the quantum state of the system into a superposition of all possible weight vectors then categorizing each input from a training set with respect to all possible weight vectors simultaneously. The only issue was accuracy in the quantum search but it was improved by utilizing a gradient descent search to find an accurate weight vector. After analyzing the entire system, it was concluded that quantum search improved the overall efficiency of the quantum neural network with a polynomial speed-up. Examinations of these systems are essential for the advancement of sectors like natural language processing as they may enhance current simulations for brain activity and data processing.

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

CS MA PH

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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

198

Fair Category

PS

Project
Number

6059

Title: The Efficiency of Various Airfoil Designs in a Wind Tunnel

Student Name(s): S. Jain

Abstract:

A lot of energy is used in flight. There are many different designs of wings for flight. In this investigation, the most efficient designs of wings were tested to increase the speed of the wing and reduce the amount of energy used. It was hypothesized that the low camber wing would be the most efficient.

4 different airfoils were made out of polystyrene insulation foam and then put into a wind tunnel one at a time. Lift and drag were both recorded and lift to drag ratios were compared to test the efficiency of the different wings. 5 trials were done per wing.

The low camber wing had the highest lift to drag ratio. The next highest ratio was for the deep camber wing. The next highest was the symmetrical, and then came the control, the triangle wing.

From this investigation, it was concluded that the higher the ratio of the top curve to bottom curve of a wing, the higher the lift to drag ratio is. This was proven throughout all the wing models.

This investigation can be continued to find the best height of the low camber wing to find the most efficient wing for airplanes.

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

EN AT 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

246

Fair Category

PS

Project Number

6061

Title: Determining whether or not the Quicksort is really the quickest

Student Name(s): S. vanZyl

Abstract:

The Quicksort algorithm lives up to its name. First written by Tony Hoare in 1959, It is considered to be the fastest sorting algorithm there is, and is used extensively throughout computer science. Through a logical process called recursion the Quicksort is able to sort numbers, letters, and any other type of data with extreme speed. But recursion is very resource intensive, as it effectively causes multiple copies of the same code to be run simultaneously. Through the course of my experiment I tested the Quicksort algorithm against two other popular sorting algorithms, the Selection sort and the Insertion sort. By running the code, written in the Java programming language to ensure cross-platform consistency, on various hardware that I have in my home I aim to see if the Quicksort could be outmatched by its slower, but less intensive, rivals across all hardware.

And indeed it was not. After thoroughly testing all three algorithms I wrote 15 times on a data set of 250,000 numbers on all the computers in my home I have concluded that the Quicksort is consistently the fastest, even on extremely low end hardware. This means that the algorithm that most modern applications, programming languages, and operating systems rely on to sort data is in fact the fastest, and also validates the work of many other computer scientists who sought to make something that was as fast as possible, and verifies the integrity of much of the worlds critical computer systems.

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

255

Fair Category

PS

Project Number

6064

Title: Aggregation of Phospholipid Based Vesicle Using Triblock Polymer

Student Name(s): R. Oleynik

Abstract:

The motivation of this study is to learn more about the effect of lipid to polymer ratios on the biosensing platform in lipid-based vesicles. Nanoparticles are useful because of their ability to detect cancer in the body with the aid of antibodies. This early detection is crucial in avoiding the rapid spread of tumors. In this study, nanoparticles were synthesized for bio-sensing applications. This was accomplished by combining a long chain lipid (dipalmitoyl-sn-glycero-3-phosphocholine, DPPC) and a short chain lipid (diheptanoyl-sn-glycero-3-phosphocholine, DHPC). After this, the nanoparticles underwent a temperature cycling procedure. Next, the nanoparticles went through a 100nm extrusion filter. This transformed the multilamellar vesicles (MLVs) into unilamellar vesicles (ULVs). The polymer (polypropylene oxide - polyethylene oxide - polypropylene oxide) was added to the samples, which served as a linker to create a cluster of ULVs. The clustering process was monitored using apparent UV absorption and dynamic light scattering. Dynamic light scattering reflects the hydrodynamic radius of the particle and UV absorption records the change in turbidity. If large clusters are formed, then both the UV absorption and the hydrodynamic radius will increase. Three different polymer to lipid ratios were used: 2.5:1, 1:1, and 0.5:1. The results show that with an increase of polymer to lipid ratios, the aggregation process was facilitated. The nanoparticles were fabricated at a laboratory under the mentorship of a Chemical and Biomolecular Engineering professor. The results of this study could provide a more effective way to detect malignant cancer cells in susceptible patients.

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

247

Fair Category

PS

Project
Number

6065

Title: Penny Cleaners

Student Name(s): K. Le

Abstract:

The aim of this project is to demonstrate which solution on the pH scale can clean the penny the best. Which solution (Sulfuric acid, Hydrochloric acid, Lime, Vinegar, Milk and Baking soda) will clean tarnished pennies the best? If we drop tarnished pennies in different solutions to clean, then Sulfuric acid will clean the best because the tarnish on pennies is caused by oxidation. Tarnish can be cleaned well by acids. The smaller pH level of something is, the more acidic it is. Sulfuric acid has a pH of -0.3 which is the smallest pH level of six solutions, so it will clean the best. I create a scale of pennies 1-10 (10 is the cleanest) so we can see the difference before and after cleaning. Then I fill cup 1 with 20 ml H₂SO₄, fill in cup 2 with 20 ml HCl, fill in cup 3 with 20 ml lime juice, fill in cup 4 with 20 ml vinegar, fill in cup 5 with 20 ml milk and fill in cup 6 with baking soda aqueous solution. After that, drop one penny in each cup. Check the coins after 1 hour and 30 minutes and finally place them on the penny ranking chart and record how much clean the coins are. The result showed that the penny which was dropped in H₂SO₄ solution was the cleanest out of six pennies. My hypothesis was correct due to sulfuric acid being the most acidic of the six solutions.

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

196

Fair Category

PS

Project Number

6066

Title: Cell Phone Radiation

Student Name(s): G. Barada

Abstract:

This experiments studies the radiation that an iphone 6, Samsung Galaxy S6 and a Pantech Breeze III emits when on stand by and calling someone. Radiation is the energy of electromagnetic waves of high energy particles. Although there are many technologies that emit radiation, I chose cell phones since most people use them daily. There are many scientists who worry about if cell phones are harmful, so this experiment can help show the amounts of radiation we are exposed to unawaringly. In order to test this, I used a radiation meter to measure the amount emitted when on a phone call. I measured the radiation with the EMF meter 2 cm away from the phone. Results showed that the older phone, Pantech Breeze III, used the least amount of radiation. While the iPhone used the most radiation. After comparing the stand by radiation and the radiation emitted on a phone, each cell phone did see an increase of radiation when on a phone call rather than stand by, however this was not a huge change. This shows that cell phone radiation does not pose an immediate danger, however after daily usage there may be some risks.

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

211

Fair Category

PS

Project Number

6067

Title: Is Oobleck the Key to Solving Beach Erosion?

Student Name(s): A. Amarante

Abstract:

Is Oobleck the Key to Solving Beach Erosion?

Beach erosion is a major issue for beaches throughout the world, and efforts are being made to slow or even stop the sand from eroding more at beaches. The answer could be in a simple household ingredient—cornstarch. A mixture of cornstarch and water, commonly known as oobleck, is a non-Newtonian fluid with the properties of a liquid and solid. If the correct oobleck to sand ratio was determined then there would be less sand erosion because the properties of the oobleck would increase the sand's resistance to movement by the force of wave currents. In the trials, oobleck was mixed with sand in 5, 10 and 15 percent amounts and placed in a wave table which was used to simulate the ocean waves that cause sand to erode at beaches. Based on the results it was concluded that the 5% oobleck trials were the most effective at retarding erosion. Higher concentration trials such as 15% were less successful due to the excess of the oobleck being washed away with the waves. The information obtained from the project could be applied to beach erosion improvement efforts. Perhaps an organization could take the initiative to add oobleck to sand that will be imported.

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

EN EM 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

229

Fair Category

PS

Project Number

6068

Title: The Effect of Osmotic Balance, pH and Detergent Levels on Osmosis through Biological Membranes

Student Name(s): E. Hurley

Abstract:

The environment today is being affected by anthropogenic pollution, such as detergent runoff, excess salt, and excess pH. These factors, although minor, can have a large effect on osmoregulation in organisms. In this study, the effect of changes in salinity, pH, and detergent levels on osmoregulation in beets was determined. The solutions were prepared and put individually in their own wells along with an evenly cut beet in each. After the allotted time, solution was run through the colorimeter one at a time for two minutes. After these two experiments, the pH solutions were tested with test strips. These three tests will help determine how these environmental factors affect osmosis into and out of biological membranes. By doing all of these experiments, little change was noticed in the pH strips. The salt had less transport from 0%-9%. The transport increased from 12%-15%. For detergents, transfer fluctuated throughout. The salt had little transport from 0-9%. This data can be used to preserve foods. If certain foods were put in very low level salt solutions, they could potentially last longer. If one was health conscious, pH could be used. For every pH solution, after the 15 minutes the liquid surrounding the beets were not as dark as the other two tests. Less transport was made out of the cell. If one was to change the pH to preserve foods.

**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

208

Fair Category

PS

Project Number

6069

Title: Using NFC Chips to Further Modern Day Advertising Via Mobile Devices

Student Name(s): C. Thanasoulis

Abstract:

Through use of mobile devices and IOS/Android applications, modern day advertising can improve thoroughly. This project utilizes NFC chips, Androids, and Mobile applications to show future advertising capabilities. NFC chips were encoded so that they can be recognized and act upon a mobile device. This small connection would be made while both objects are in motion. It is a small scale prototype, and the motion of the NFC chip and mobile device represents how the project applies to a larger scale. Ideally this project would be brought to a larger scale where a tablet replaces the NFC chip. In this larger scale scenario, the Tablet would serve as a means of visually advertising. A plethora of applications exist within this project. An example would be if the tablet was attached to the back of a consumer's car while they drive. Per say it advertises for a foundation or charity. A driver behind them would then have a specific application downloaded which enables them to store data from the tablet they see. Then they can donate to the foundation they saw being advertised, if they so desire. That is just one of many applications, and it would be rather inexpensive to begin implementing into our tech-savvy society.

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

EE CS

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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

PS

Project Number

6070

Title: Assisting Impoverished Nations with an Affordable Ocean Wave Powered Reverse Osmosis Water Desalination and Generator System

Student Name(s): M. Rogers

Abstract:

One of the foundations of supporting life is a supply of clean drinking water. Unfortunately, many third world nations do not have access to this. My invention seeks to address this issue by providing an affordable and effective way to harness the kinetic energy of ocean waves to desalinate it as well as generate electricity. My system implements a horizontal array of 5 hollow PVC cylinders of which ocean water can enter through orifices at the top. At the end of each of these cylinders, is a PVC piston and rod that is of equal length of the cylinders. All 5 of the piston and rod assemblies are linked to a large aluminum plate that is of a large surface area. As water enters the orifices in the tops of all 5 cylinders, it will fill each one entirely. As the wave further progresses forward, it will exert a force on the aluminum pressure plate, causing the pistons to compress the water in the cylinders. The water is then forced through a reverse osmosis membrane at the opposing end of the cylinders. The membrane desalinates the water, depositing the brine waste back into the ocean whilst the salt-free water exits through a return hose into a holding tank on land. As the water flows through the hose, it will spin several turbines creating electric current which acts as a generator. My affordable and compact design can aid suffering nations by supplying clean drinking water and a steady supply of electricity.

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

EE ET EN

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

211

Fair Category

PS

Project Number

6071

Title: Probing Cognitive Abnormalities in Causal Reasoning in OCD

Student Name(s): J. Bi

Abstract:

In Obsessive Compulsive Disorder, the individual suffers from anxiety-causing obsessions that lead to relieving compulsions. Causal learning is the ability to identify causality or the relationship between cause and effect. A Java program was created with Eclipse to parse data from a separate DMDX assessment into an Excel format. Within the larger study, certainty levels and prediction error were examined in OCD patients. It was hypothesized that OCD patients would show lower certainty values. In the programming phase, a form was designed for the application. It was followed by a repetitive process of coding and debugging until completion. For the second phase of the project, OCD and control participants were gathered. They took the electronic DMDX assessment, which consisted of hypothetical allergy related situations testing for cognitive abnormalities in causal learning. OCD participants did not show statistically significant abnormalities in causal learning compared to control subjects, but possessed lower confidence values [$t(20) = -1.9, p = 0.065$]. Lower confidence values in OCD patients suggested an inflated sense of responsibility as their scores correlated with scores taken from the Responsibility and Attitude Scale [$r(5) = 0.901, p = 0.006$]. If done in accordance with fMRI, it will be possible to obtain a greater understanding of the relationships between mental disorders like OCD.

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

BE 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

229

Fair Category

PS

Project Number

6072

Title: Preventing Car Accidents With Ultraviolet Light and Sensors

Student Name(s): J. Wu

Abstract:

For this project, a prototype system was developed that would allow cars to stop automatically when they reach red traffic lights at intersections. This system is incredibly useful, because it would be able to prevent accidents and deaths that can occur when red lights are ignored by drivers. To design the prototype, a chassis was first constructed with motors and corresponding wheels to represent a car. Then, an Arduino board and motor shield was attached in order to control the speed of the prototype. An ultraviolet (UV) sensor and an ultrasonic distance sensor were connected to the Arduino board through a breadboard, and a battery pack was installed to power the prototype. The idea behind the design was: A UV light built in the ground would emit small amounts of UV radiation once a traffic light turns red. Once the prototype passes over the UV light, the UV sensor attached to the bottom of the prototype would sense the increase in UV light and send a signal to the Arduino board. The board would automatically slow the prototype down until it would reach a complete stop in front of the red light. However, other cars might have already stopped in front of the stoplight. To avoid collisions, the distance sensor would send a signal if it senses a car ahead. Then, the Arduino board would stop the prototype immediately.

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

EE AT CS

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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

140

Fair Category

PS

Project Number

6073

Title: The Effect of a Corked Baseball Bat on Swing Velocity and Elasticity

Student Name(s): N. Smith

Abstract:

It is commonly thought throughout the baseball community that corking a wood bat will make a player hit the baseball farther. By replacing the wood with cork, it creates a lighter swing, and more velocity to the ball. In this experiment the swing velocity and performance between a corked bat and a regular wood bat were compared. Using a constructed swing machine and a radar gun, data, including the velocity of the bat and the distance the ball traveled, was collected by swinging both bats 60 times each. From this data, it was determined that the corked bat provided a faster swing, but did not hit the ball farther. The wood bat swung slower but the ball went a greater distance. These results indicate that there is no performance enhancement by using a corked bat further than a faster swing.

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

246

Fair Category

PS

Project Number

6074

Title: Novel Use of Carbonic Anhydrase for Sequestration of Atmospheric Carbon Dioxide from Soil Respiration

Student Name(s): G. Worthington

Abstract:

In response to rising surface temperatures across the globe due to excess carbon dioxide in the atmosphere, this project's purpose is to limit the amount of carbon dioxide in the atmosphere through sequestration in neighborhood soils. The enzyme, Carbonic Anhydrase, located in hemoglobin and responsible for increasing the reaction rate between water and carbon dioxide to form carbonic acid, has been used to sequester carbon dioxide in streams by Bond. Therefore, novel research is being done with the expectation that the application of Carbonic Anhydrase will reduce the concentration of carbon dioxide in soil. These results have been attained through massing out soil for each soil depth, and adding 30% water by mass to each sample. Then, approximately 1.5 mg of carbonic anhydrase dissolved in water measured out to be added to soil is added to three samples of each depth, with there being a control at each depth as well. Vernier CO2 Gas Sensors monitor the CO2 concentration in nalgene bottles with the soil samples to see a drop in CO2 in ppm for soils treated with Carbonic Anhydrase. At a soil depth of six inches, there has been a very high rate of sequestration of carbon dioxide. There are 2.16 billion acres of Undeveloped land in America alone and therefore 6,440,000 kg of carbon dioxide is in Undeveloped soil. And therefore the enzyme can be applied to help sequester a majority of this carbon dioxide, and stop it from wreaking havoc in our environment.

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

EV 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

238

Fair Category

PS

Project Number

6075

Title: The Plant and the Microwave

Student Name(s): J. Cordonero

Abstract:

The purpose of this experiment is to investigate the effect of the microwave in the water that I'm going to use in watering these plants. I found that these plants need mild weather to grow. However, when the temperature is high, the plants tend to work harder to obtain more of the nutrient it needs. Also, if I'm watering the plants with the heated water from the microwave the plant can suffer burn as it happen to us. On the other hand, if I'm watering the plant with the heated water from the microwave, then the plant is going to die. I planted 8 beans in a 4 plant container. I put 2 seeds in each one. Later, I was watering the first container with normal water, and the rest of the container, I was watering with the heated water from the microwave. Container labeled B, I was watering with heated water for 5 second, the second container with the heated water for 10 second in the microwave and the third container I was watering the plant with the heated water for 15 second in the microwave. I observed for 15 days and I got the following results: Container A grows at 18.5 cm, B grows at 7cm, C grows at 10 cm and D grows at 21 cm. According to those results, my hypothesis was in certain way incorrect, because I was expecting to see the plants dying.

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

EV PS 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

240

Fair Category

PS

Project
Number

6076

Title: A Practical Use of the MFC Partial Air Cathode: Improving Performance by Implementing a New Design for Applications in a Conventional Septic System

Student Name(s): E. LoPreiato

Abstract:

This experiment builds on the validation of partial air cathodes shown last year to produce current and subsequent power for practical applications. It is hypothesized that if individual partial air cathodes (PACs) are connected in parallel to their corresponding anodic counterparts, then the corresponding current output and subsequent power generation will be greater than the production of an individual unit. Furthermore, scale-up of power output can be substantially increased by improving the conductivity as well as lowering the resistivity of the cathode. This was accomplished by employing aluminum mesh along with carbon cloth fiber in the cathode design. A parallel array of PACs improved current production by a factor of 1×10^4 over last year's design. A shortcoming of this experiment however, was noted after six days because high current production could not be sustained. If this shortcoming can be addressed adequately, then a hypothetical septic tank using cheap, readily available materials can be utilized to produce off the grid power for practical use. In order for the PAC to be practical in a septic system, a regulatory mechanism can be applied according to effluent levels to maintain optimal PAC configuration. Adjustable cathodes in the septic tank as well as adjustable accessory electrodes in the distribution box and/or leeching field piping may also be employed to this end. Efforts at investigating these possibilities lend itself toward great potential in further refining this technology in numerous ways.

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

EE 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

130

Fair Category

PS

Project Number

6077

Title: Providing a Design Suggesting the Viability of IHTP Thrusters for Commercial Use

Student Name(s): T. Cortellesi

Abstract:

Commercial ventures are increasingly looking towards the aerospace industry, and there is an increasing demand for high-power, high-efficiency low-toxicity spacecraft thrusters. IHTP, or Isopropanol-High-Test-Peroxide thrusters provide a much larger thrust capacity and efficiency for roughly equivalent size and simplicity as today's monopropellant thrusters widely used in spacecraft and satellite attitude control. HTP itself is a rather dangerous substance so the fuel and oxidizer themselves were never tested. The IHTP Thruster's design is limited to theory, and is a suggestion that will hopefully be taken into consideration by space ventures and manufacturers for testing and implementation. Given the relative low cost of the fuels and the potential for simple, lightweight, effective design, IHTP thrusters may well be integral to the future of commercial space industry.

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

PH CH 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

255

Fair Category

PS

Project Number

6078

Title: The Fabrication and Characterization of Carbon Nanotubes Using Different Transition Metal Nanoparticles

Student Name(s): J. Silliman

Abstract:

Carbon Nanotubes (CNTs) are allotropes of Carbon with interesting conductive and physical properties, making them potentially useful in many Nano-technological applications, specifically transistors. The hypothesis is that transition metal salts and block copolymer can be used in a chemical vapor deposition (CVD) furnace to grow forests of single walled CNTs. The independent variable is the choice of transition metal salts (Iron Nitrate, Nickel Nitrate, and Cobalt Nitrate) used as the nanoparticle site for growing the CNTs. The dependent variables are the diameter, wall thickness, and are the CNT's single walled or multi-walled. The transition metal salt is mixed with block copolymer and stirred for 16hr. The mixture is spin coated on the surface of the substrate. The copolymer/transition metal mix self-assembles into a micelle like structure, in which the transition metal lies. The copolymer is burnt off by an oxygen plasma leaving an array of transition metal nanoparticles. The surface is placed in a CVD furnace where carbon nanotubes are grown from the transition metal nanoparticles. Atomic Force Microscopy (AFM), Scanning Electron Microscope (SEM), and Transmission Electron Microscopy (TEM) are then used to characterize the grown CNTs. Two separate analysis of variance (ANOVA) tests were conducted to determine whether the mean diameter and wall thickness are significantly different among the grown CNTs due to the transition metal nanoparticles. This experiment determines what transition metal salt is best for producing forests of CNTs with the desired attributes. We found that CNTs grown with iron nanoparticles are on average going to be single-walled.

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

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

245

Fair Category

PS

Project Number

6079

Title: Differentiation Between Fresh And Used Cooking Oils

Student Name(s): A. Dalmia

Abstract:

Cooking oils come from a variety of sources such as soybean, peanut, corn, sunflower and others. After frying cooking oils, they must be monitored for quality control. As there is significant price difference between fresh and used cooking oils, it has been reported in China and Taiwan that used cooking oils also known as gutter oils have been filtered, decolorized, or boiled and sold as high quality cooking oil. This is done to improve profits yet it's not suitable for human consumption as it can cause diarrhea, abdominal pain, and stomach and liver cancer. The main objective of my research is to distinguish fresh oils from used oils and study the effect of heating on six different oils for different times using a mass spectrometer. My hypothesis was that if oils are heated for extended period of time, then its main component known as triglycerides will decompose and this change can be the basis for differentiation between fresh and used (gutter) oils. Six different cooking oils (soybean, sunflower, peanut, safflower, corn, and canola) were heated at 375 degrees Fahrenheit to simulate frying for different times (0, 4, 12, 24, 72, 96, 144 hours). The data showed that the triglycerides in each oil decomposed to form diglycerides and fatty acids on heating. Also I discovered that the signal for two different sterols decreased also on heating. I developed a method based on the decomposition of triglycerides and sterols to differentiate between fresh and used cooking oils.

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

CH 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

231

Fair Category

PS

Project Number

6080

Title: The Effect of Air Pressure on the Distance of a Soccer Kick

Student Name(s): H. Molot

Abstract:

Due to conflicts in the field of sports involving deflation, the air pressure level of sports balls has been a hot topic among scientists and athletes. Much research has been done, but many questions remain unanswered about deflation vs inflation. This study examines how different levels of psi (Pounds per Square Inch, or, "air pressure) impacts how far a soccer ball travels when kicked. A machine has been built to kick the ball with constant force throughout all trials. To collect data multiple tests were set up. Two different size 5 soccer balls were kicked at 13.1 psi, 3 times each. Then, the psi level was reduced by 0.5, and each ball was tested three times at the level of 12.6 psi. This process was repeated from every range at a 0.5 increment from 7.1-13.1 psi. Additional trials outside of this range were conducted to collect more data. The preliminary data shows that between the recommended range of psi (7.1-13.1), there is a slightly significant trend of 11% in the direction that the hypothesis predicted; it is better to kick a ball at higher levels of PSI when trying to achieve greater distance. However, there is a noticeable and statistically significant trend that supports the hypothesis once a range of 3.6 psi is breached; below this level it is clear that a decrease in psi leads to a decrease in distance.

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

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

230

Fair Category

PS

Project Number

6081

Title: How Does Pitch Effect Turbine Efficiency

Student Name(s): J. Zuklie

Abstract:

Wind power is a clean way of producing energy and is becoming more popular. So how can I determine the best pitch for different wind speeds to make a wind turbine more effective. To test the project I used 5 pitches (15, 30, 45, 60, and 75 degrees) each were tested 20 times each on high, medium and low fan speeds to simulate different wind speeds. The mock wind turbine setup was designed by me to be able to change its pitch and 3d printed at my school in order to get a higher quality print. To count the RPM I made a simple break laser system that was able to count up by 1 every time the beam was broken by the blade. To get the true RPM I divided that number by the number of blades. From the data I have collected I can determine that 30 degrees was the most efficient angle in all wind speeds, this was followed very closely by 45 degrees. For high speed 30 degrees got an average of 158 RPM, medium speed averaged 121 RPM, and low speed averaged 74 RPM. Since 30 degrees had the highest RPM I can determine that it should be the most effective pitch in all wind conditions and theoretically produce the most energy over time compared to if you used different angles with a wind turbine.

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

EE ET 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

249

Fair Category

PS

Project Number

6082

Title: The Use of Solar Sails and Electromagnetic Propulsion in Space Travel

Student Name(s): L. Baker

Abstract:

The purpose of this experiment was to determine the effectiveness and plausibility of various forms of passive electromagnetic-based propulsion systems for use in space travel. This was partially done through the construction of a cloud-chamber based particle detector. The hypothesis was that if energetic particles of cosmic origin have enough energy to ionize atmospheric molecules, that energy can be utilized to propel a vessel through space using their intrinsic momentum. Through many trial and error operations, the detector was eventually able to delineate the paths of various particles, exemplifying the energy available to specifically designed space travel systems. One possible implementation of this ideology is in the "solar sail" design, in which passive radiation (in the form of light and other particles from the sun) accelerate a large, lightweight sail directly away from the center of the solar system. The most exciting application of this technology is the potential for space travel at speeds on the same magnitude as the speed of light. Based on a study on the technology at UC Santa Barbara, a drive utilizing ground based lasers working to propel a spacecraft could accelerate an object to speeds up to 30% the speed of light. At this pace, a 100 kg vessel could be sent to Mars in approximately three days. In conclusion, the use of electromagnetic propulsion could vastly accelerate space exploration for future generations. The technology deserves the focus of aeronautics organizations that are truly interested in the future of space travel.

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

AT PH ET

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

PS

Project Number

6083

Title: Is There Tin in My Fish?

Student Name(s): A. Seyfried

Abstract:

Tin is an element that most people do not realize can be a danger to their health. If tin is consumed, in concentrations greater than 120 parts per million, it can cause various health effects. Consumption of tin can cause stomachaches, liver and kidney complications, and gastrointestinal damage. Studying the concentration of tin in food sources may allow us to better understand how much the metal is really present and how much of a concern it may cause. Six canned seafood samples and three fresh seafood samples were obtained from local supermarkets. Each one was finely chopped and the organic material was dissolved on a hot plate with nitric acid and hydrochloric acid. Once each sample had become a fairly transparent liquid they were each diluted to a volume of 10 mL and run through an Inductively Coupled Plasma instrument. This instrument displayed all tin concentrations on a computer monitor in parts per million. After calculating in the concentration of the blank, the mass of the original fish sample, and the volume of dilution, a final concentration was reached. Based on these final tin concentrations the fresh sockeye salmon had by far the most tin present. However, even this sample is not even close to reaching the dangerous levels of tin concentration. The results that were obtained suggest that tin concentrations in seafood are not great enough to cause health problems, contrary to what was predicted. It appears that tin concentrations in seafood are not cause for concern.

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

ME CH 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

225

Fair Category

PS

Project
Number

6084

Title: Saxophone Overtones

Student Name(s): Z. Oliver

Abstract:

Felipe Salles, a jazz music professor who plays the tenor saxophone at the University of Massachusetts Amherst, who leads jazz workshops on overtones, inspired the idea behind this project. Taking his ideas, the overtone series produced by the four major saxophones, the soprano, alto, tenor, and baritone, were analyzed to determine which saxophone has the most ideal tone, which would include the greatest influence of upper overtones on the fundamental frequency. The concert pitches of C and Db were played on the four saxophones and the sound pressure was measured by a LabQuest microphone; the Fast Fourier transform graphs were then produced in order to analyze the overtone series produced. It was determined that the overtone series produced by the saxophone included more upper overtones with increasing size of the instrument and to a lesser extent, the lower the fundamental frequency. There were some overall exceptions to these two findings, but the baritone, being the biggest, produced the greatest amount of upper overtones and typically had a fuller tone than the rest of the saxophones. This experiment, musically, can cause changes in instrumentation in bands based on the tones of the saxophones and more scientifically, can expand the possibilities of the upper range of the saxophone and expand possibilities of musical instruments with a greater understanding of the conical air column that the saxophone employs.

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

252

Fair Category

PS

Project Number

6085

Title: Designing an Airfoil Spinner to Improve the Efficiency of Horizontal Axis Wind Turbines

Student Name(s): A. Peck

Abstract:

Given the current rate of climate change, renewable energy is vital to our future. Wind energy is one of the most promising sources of renewables, but currently falls short in efficiency of electrical output when compared to the Betz limit. In my project, I focused on designing different shapes of hubs, or airfoil spinners, to maximize electrical output for small scale wind turbines, through directing the wind more smoothly across the nacelle of the turbine, so the blades have more wind to be pushed through, and thus more possible kinetic energy. To obtain the most optimal designs, I used online modelling software to analyze the effect of different shaped spinners on output and wind flow. These were then analyzed based on minimizing the drag coefficient, and analyzing the Tollmien-Schlichting waves (boundary waves). The Reynolds number was used to calculate the type of wind flow. The best performing spinner shapes were picked for testing, and mounted on a 1-meter, 5 bladed turbine. Based on this, the voltage, amperage and wattage were calculated. The first spinner design improved the average output by 6%; the second improved on average by 11%, when compared to the average outputs of the control group. Based on these numbers, the tip speed ratio (TSR), rotations per minute (RPMs), power in the wind, and coefficient of performance (Cp) were calculated to analyze all aspects of the performance when compared to the control group. These findings illustrate the significant effect spinners will have on efficiency for small scale turbines.

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

EE ET 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

252

Fair Category

PST

Project Number

6501

Title: Creating an Indoor Mobile School Navigation Application

Student Name(s): V. Li, D. Wang

Abstract:

In the past decade, the invention of GPS (Global Positioning System) has radically simplified the way we find directions outdoors. However, there is a strong lack of this kind of technology for indoor spaces. For unfamiliar building such as museums, schools, or college campuses, people must refer back to maps to find their way around. Often times this can severely restrict someone's ability to easily and efficiently navigate their way around a foreign indoor space. That is why the purpose of this project is to create a mobile indoor navigation application that would work indoors specifically with our current high school. This program was designed as an Android application that is easily downloadable off the Android market place. The features of the app are simple. Using the user's login information from our high school, the app is able to download a schedule of classes and room numbers from the school's database. Once a student needs to navigate to another classroom, the app is able to highlight an efficient path to whichever room is on their schedule. The pathfinding is done with the A* algorithm which is an efficient pathfinding and graph traversal algorithm. Currently, the app's functionality includes being able to use the A* algorithm to generate a path which is then displayed on the Android device. This demonstrates the feasibility of an indoor navigation application based on a pre-inputted map. For future work, integration with our school's student database must still be implemented, as well as turn-by-turn directions.

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

215

Fair Category

PST

Project Number

6502

Title: Synthesis, Characterization, and Application of Noble Metal and Noble Metal Alloy Nanoparticles to Proton Exchange Membrane Fuel Cells for Enhanced Catalytic Activity

Student Name(s): X. Zhang, A. Soni

Abstract:

Nanoparticles can be engineered with unique compositions, shapes, and sizes. Because of this flexibility, they are used in a growing list of applications in science and industry. Using a modified two-phase Brust-Schiffrin method, we synthesized noble metal nanoparticles and alloy nanoparticles including Au, AuAg, AuPt, Ag, PtAg, Pt, AuPt 1:6, AuPt 6:1, AuPt 1:3, and AuPt 3:1. We then characterized them using Transmission Electron Microscopy, UV-Visible Spectroscopy, and Zeta Potential analysis techniques. Most particles were between 2 and 6 nm in diameter, with the exception of Ag which had a mean diameter of 27 nm. 200 microliters of nanoparticle suspension were coated onto 5 by 5 cm Nafion 117 membranes used in Proton Exchange Membrane Fuel Cells (PEMFC) to test for catalytic activity. Contrary to previous literature that reported AuPt as the best coating for improving catalytic efficiency, we found that the AuAg coating was more effective. At maximum output, the AuAg-coated PEMFC resulted in 73% more power output compared to the control PEMFC and 10% more compared to the AuPt-coated PEMFC. AuAg particles showed significantly greater stability in suspension than did AuPt with a high Zeta Potential of -84.66 mV, which suggests long shelf life. We demonstrate an environmentally and economically feasible process to improve PEMFC using AuAg nanoparticles.

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

EN ET 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

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

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

4. Is this project a continuation? Yes No

5. 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

PST

Project Number

6504

Title: Improving Methodologies for Preclinical Data Collection: Tracking Motion of Biological Test Subjects in Laboratory Environments

Student Name(s): M. Jacobson, A. Mukherjee

Abstract:

The objective of this project was to create a non-invasive, non-stressful, external device that could accurately track, and monitor via computer software, the movement of laboratory test subjects in preclinical drug development trials. It was the intent that the constructed device would aid scientists during preclinical trials when monitoring the movement and frequency of laboratory subjects as both are indicators of overall health in a rodent. Using a circuit combined with a laser and mirrors, a laser grid was created that detected if a mouse crossed it (very similar to a security system motion detector). The apparatus was mounted to the outside of a pre-existing rodent habitat. As this device was external, no direct interaction between the mouse and the apparatus occurred. An arduino code was constructed to collect data and when combined with the laser grid, counted the number of times that a mouse crosses the grid within a specific time frame. All data collected tracked the rearing of only healthy mice. Construction of the device was successful; however, researchers hope to increase the density of the laser grid in order to improve accuracy of data collection.

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

EE 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

251

Fair Category

PST

Project Number

6505

Title: A Novel Procedure for the Preparation of Perovskite Solar Cells Using a Dip-Coating Method

Student Name(s): M. Matejka, B. Fernandes

Abstract:

With the many new types of solar cells that have come onto or onto the verge of the commercial market in the last few years, we have been particularly interested in those of the perovskite variety. Perovskite solar cells, made of a relatively simple combination of methylammonium iodide (chemical formula $\text{CH}_3\text{NH}_3\text{I}$, abbreviated MMI) and lead iodide (PbI_2), these solar cells have shown extreme promise in their relatively low cost and high energy conversion efficiency.

One step in the preparation of most perovskite solar cells is to apply a solution of methylammonium lead iodide ($\text{CH}_3\text{NH}_3\text{PbI}_3$, abbreviated MPI) to a glass substrate using a spin coating machine. Unfortunately, spin casting machines can be extremely expensive and are not available in many high school or less advanced laboratories.

In this experiment, we report on a new method of preparation of the perovskite solar cells. The cells were prepared using a procedure identical to what is used for traditional perovskites by mixing solutions of lead iodide with MMI in solvent DMF (dimethylformamide). When it came to the point in the preparation where spin coating would traditionally be used, we substituted a dip-coating process.

After annealing the glass substrates that were dipped in solution, we exposed them to a xenon lamp in order to test their efficiency in comparison to that of traditional perovskites. The following report may provide an additional factor to take into consideration, in addition to cost and durability, when thinking about the practicality and sustainability of solar energy in the future.

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

ET EN 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

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

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

4. Is this project a continuation? Yes No

5. 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

PST

Project
Number

6506

Title: Using Heat Sinks in Integrated Photovoltaic Systems to Enhance Hydrogen Production Through Electrolysis

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 enhancement of hydrogen production through the electrolysis process was tested. A heat lamp was concentrated on a photovoltaic cell that was connected to an electrolysis machine through a heat sink to transfer thermal energy. The amount of hydrogen produced was measured, and the efficiency of the system with and without the heat sink was determined. As a result, the use of a heat sink doubled the amount of hydrogen being produced. The results also showed the efficiency of a photovoltaic cell without the heat sink was 3.13%, whereas the efficiency rose to 6.38% with the heat sink, making the process with the addition of the heat sink much more efficient. With the potential of increasing the efficiency of solar panels, affordable solar hydrogen hybrid systems could be implemented on the residential level.

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

ET EE 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

250

Fair Category

PST

Project Number

6507

Title: Renewable Hydrogen Internal Combustion Engine (HICE): Using a Novel Apparatus With Applied Technologies to Improve Efficiency and Safety

Student Name(s): H. Zaidi, C. Swetzes

Abstract:

Hydrogen Internal Combustion Engines (HICE) have been widely regarded as inefficient and expensive in the automobile industry, as large amounts of energy are lost as heat and the conversion into rotational motion. Furthermore, the direct combustion hydrogen is dangerous, as profoundly shown in the Hindenburg disaster of 1937. This project addressed the inefficiency and danger of HICE, by utilizing a novel apparatus with applied technologies and data gained from experimentation. We researched the efficiency of different materials, liquid solutions, and chamber-shapes in electrolysis. The experimentation compared the hydrogen and oxygen produced in a controlled, 24-hour, setting for copper mesh, copper wire, copper plates, aluminum mesh, aluminum wire, aluminum plates, and stainless steel mesh, wire, and plates. Additionally, square, cylindrical, and flat (square with small height) chamber shapes were tested, as well as salt water, water, and soap water. Through this research, we developed a low-cost and efficient HICE. The final model uses piezoelectric generators for combustion, steam, and wind power to decrease the amount of energy lost, as well as a combustion chamber leading to a pulse jet. Additional energy recycles (into a feedback loop), sustaining the combustion for longer. Due to the results from our experimentation, stainless steel mesh, salt water, and a cylindrical chamber were used in electrolysis. To improve safety, it was all enclosed within an emergency brake system, with valves shutting off important parts of the engine. This apparatus decreased the cost, improved the efficiency, and improved the safety of current HICE models.

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

ET EE AT

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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

56

Fair Category

PST

Project
Number

6509

Title: Corsair F4U-4 Harness Rescue

Student Name(s): R. Kiefer, J. Stark

Abstract:

This project in its present form is the result of researching, planning, and designing the construction of a harness to be fit on a damaged corsair for rescue purposes. The idea is to attach a harness on the aircraft to recover it, and be carried to an airport in Beaumont, TX to be repaired and restored.

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

ET

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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

263

Fair Category

PST

Project Number

6510

Title: Designing and Constructing an Underwater Turbine with a Self-Functioning Water Desalination System Simulating the Conditions of the Long Island Sound

Student Name(s): M. Moghul, A. Mohammed

Abstract:

71% of earth is covered with water, 97.5% being salt-water. In this experimental design, we sought to explore a water-turbine that could produce enough energy to power desalination as well as other, further, uses. The objective of the experiment was: "Fashioning and constructing a water-turbine where 50% of the electricity produced from it is used to desalinate saline-water". A waterproof-turbine was constructed and tested to determine if it would be able to produce voltage for general usage and water desalination, all the while simulating the conditions of the Long-Island-Sound. The procedure for constructing the water-turbine included assembling a fan, constructing a desalination-system, and transferring the energy from the turbine to the desalination-portion. It was noted that the energy produced was not able to split as intended, so all the voltage was transferred to the desalination-portion. The results indicate that this was not accomplished throughout the course of our experiment. Our project produced results in terms of volts, but was not sufficient to desalinate salt-water. On average, 0.01263 volts were produced in trial 1, 0.0159 volts in trial 2, and trial 3 volts averaged to 0.014. The average temperature of the salt water in trial 1 is 49.85. In trial 2, the average water temperature in the desalination-part was 49.16, and 50.3 was the average of saltwater in trial 3. Overall the experimental design failed to desalinate water, however, if done on a larger scale this idea may have produced more promising results in terms of pure water and voltage as outcomes.

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

EN EE 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

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

- Yes No

CSEF Official Abstract and Certification

Word Count

182

Fair Category

PST

Project Number

6511

Title: Soil Remediation: Removing Contaminants by Means of Thermal Desorption Followed by Remineralization Through Addition of Organic Material

Student Name(s): A. Mellert, W. Gorman

Abstract:

The purpose of this investigation was to create a small scale, cost efficient apparatus that uses low-heat thermal desorption to remove contaminants from polluted soil. Using a sheet metal junction box, a gas grill, and heavy duty aluminum foil, several samples of contaminated soil were desorbed at temperatures under 500oF. After the desorption process was complete, the dry, unusable soil was mixed with different concentrations of leaf compost in an effort to return organic matter and essential minerals to the soil sample. Seed growth in contaminated soil samples were compared to seed growth in the desorbed and remineralized soil samples. Data on the amount of water, contaminants, and organic matter removed from each sample as well as data collected on seed growth were compared and analyzed for statistical relevance. It was concluded that the low-temperature desorption process, although seemly more efficient in both cost and energy, was inconclusive due to the availability of similar high-temperature processes. That said, low-temperature desorption, followed by the addition of leaf compost warrants further investigation in terms of energy saved and sustainability gained.

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

AT EM 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

204

Fair Category

PST

Project Number

6513

Title: The Efficiency of Electromagnetic Motors and their Correlation to Conventional Electric Motors

Student Name(s): N. Bland, E. Barnes

Abstract:

The motor industry has not seen many improvements in recent years on electric motors. As a result, there has been no development in increasing the efficiency of electric motors. To test whether increased magnetism in an electric motor would increase its overall efficiency, a direct current (DC) motor was constructed. The DC motor was then covered with magnetic plating to increase magnetism, and was tested against a direct current motor without the plating. Both motors were tested for three variables: the rotations per minute of the axle (RPM), Torque, and Volts. It was determined that the DC motor had a better torque/load but required more volts (12 Volts) to run at full RPM, whereas the electromagnetic motor, which had a lower torque, required a lower power consumption (6 Volts) to get at full RPM. Although the electromagnetic motor had lower efficiency (18%) than the DC motor (26%), this does not decrease the importance of electromagnetic motors. The electromagnetic motor's lower torque and lower consumption in energy means that it can be much more versatile in household appliances, rather than in cars. The results from this study conclude that the electromagnetic motor is beneficial to homeowners who want to lower cost on energy consumption.

**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

252

Fair Category

PST

Project Number

6514

Title: Incorporating Biomimicry into Airfoil Design

Student Name(s): C. Greifenberger, K. McCormack

Abstract:

Mankind has been striving for efficiency in flight for more than a century, yet some of the best displays of this efficiency can be seen in nature. Studies suggest that whale-like protrusions or bumps from the leading edge of a wind turbine significantly improved its efficiency. But, can this concept of biologically integrated designs or biomimicry, be incorporated into airfoils (a blade, sail, or wing-like structure used to study fluid motion)? This project tested the effect of biologically inspired airfoil designs on normal and axial forces, which were converted into lift and drag. It was hypothesized that if biomimicry was incorporated into airfoil design, then flight efficiency would be improved or maintained. The independent variable was the type of design and the dependent variable was the efficiency of the airfoil (lift to drag ratio). The airfoils were designed using 3D CAD modeling, printed using a 3D printer, and tested in a wind tunnel. The designs included bumps or fish-like indents stretching from the leading edge to the trailing edge of the airfoil, and stabilizing fins. All results were compared to the Clark y-14 model, which is a standard airfoil model. A design was considered efficient if it provided results with a higher lift to drag ratio than the Clark y-14. It was found that as the attack angle increased above 6° , the designs with the whale-like protrusions tended to maintain the highest efficiency. Additionally, the dorsal fin design maintained similar efficiency to the Clark y-14.

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

225

Fair Category

PST

Project Number

6515

Title: Does water temperature effect to sublimation time of dry ice?

Student Name(s): Y. Quinones, K. Lopez

Abstract:

The main purpose of this experiment is to find out if water temperature affects the sublimation time of dry ice. Sublimation is the transition of a substance directly from the solid to the gas phase without passing through the intermediate liquid phase. Sublimation is an endothermic phase transition that occurs at temperatures and pressures below a substance's triple point in its phase diagram. It usually takes about 4 hours for 1 pound of dry ice to sublimate. However, in hot water dry ice can lose 50 to 100 pounds in an hour. There are six stages in order for the dry ice to sublimate; freezing, melting, condensation, vaporization sublimation, and deposition stages. In our hypothesis we believe that if we increase the temperature of the water in which the dry ice is going to sublimate we can increase the rate in which the dry ice will go through the different stages. To do this we are going to put 10 grams of dry ice into two cups of hot water and three cups of cold water. Once we put the dry ice in the water we will time how long it takes for the dry ice to completely sublimate in the hot and cold waters. Overall we will observe that the rate of sublimation in dry ice will increase as the temperature of the water increases.

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

212

Fair Category

PST

Project
Number

6516

Title: The ATLAS Project: The All Terrain Land Accessing System

Student Name(s): A. Raciti, K. Ness, M. Chastain

Abstract:

While walking on trails, it is often necessary to cross difficult sections of terrain. Bridges can be made in these areas, however it can be very difficult and very costly to deliver materials to the location of the bridge. This is due to the difficulty of carrying the large/heavy materials deep into a trail. Over 29 million people hiked in 2014, and there is a need for well-maintained, and easily/quickly deployable bridges.

The purpose of investigating this problem was to design and build a working solution. This investigation was started with the searching for and summarizing of articles on the subject, next moving into research on the existing products used to solve this issue and the patents that relate to it as well. Once this was done, the design requirements were determined and the final design was modeled with a 3-D modeling software. Then, the viability of the design was determined based on the design requirements established earlier.

The final design consists of an easily deployable bridge that can be stored in a hiking pack and is easily portable to a remote location. Some applications of this design would be use in a hiking pack, as well as potentially seeing use in law enforcement and with fire fighters.

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

250

Fair Category

PST

Project Number

6517

Title: Printing Skin: Using Different Polymer Filaments to Print Prosthetic Coverings

Student Name(s): E. Lee, P. Patel

Abstract:

This experiment aimed to print a covering using a 3D printer and different polymer filaments in order to create a prosthetic covering that emulated the properties of human skin. The different materials tested included ABS pellets mixed with different ratios of thermoplastic elastomers, both in pellet form and from TPE wires, and NinjaFlex and MakerBot filament. An extruder was used to melt pellets into a thin filament, and ten different coverings were printed using the 3DP1000 printer. The effectiveness of the coverings in being used on prosthetics was tested through four procedures, each testing a property of effective skin substitutes: flexibility, durability, water resistance, and elasticity. The NinjaFlex covering, which was the most expensive, demonstrated the most of these properties, while the MakerBot covering's different thicknesses showed that multiple layers mean increased durability at the cost of flexibility. However, the 1 ABS : 1 TPE wire covering, which was significantly cheaper to make, demonstrated similarly effective properties as the pre-manufactured filament coverings at only a fraction of the cost, especially in the categories of flexibility and elasticity. Almost all of the pellet combination coverings performed significantly better than the positive and negative controls, the ABS and elastomer pellet coverings. In the future, these materials can be incorporated into coverings to provide a skin-like material that increases comfort where prosthetics connect to the body. Further research and improvements can be conducted by printing the coverings in different shapes, or using actual prosthetics as a mold to print on top of.

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

AT CH 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

234

Fair Category

PST

Project Number

6518

Title: Cardice

Student Name(s): M. Bangi, Q. Tran

Abstract:

This experiment is to determine which type of liquid dry ice sublimates in the fastest. The independent variable is the type of liquid. The dependent variable is the time it takes for the dry ice to completely sublimate. If acetone is used to sublimate in dry ice then the time it takes for the dry ice to completely sublimate will be faster because acetone has a higher heat capacity. The materials used were 40 ml of oil, acetone, and water, 3 blocks of dry ice, 3 glass cups of the same size, 3 stopwatches, 1 tong, and a graduated cylinder. First, take 3 cups of the same size. Label each cup water, acetone, and oil. Measure 40 ml. of each type of liquid and put it in the corresponding cup. Drop 1 cube of dry ice into each cup and start a stopwatch for each cup. After the dry ice completely sublimates in the liquid, stop the stopwatch and record the results into the datatable. For the results dry ice sublimated in acetone the fastest - 42 second. In tap water for 25.52 minutes and in oil for 47.52 minutes. The hypothesis was supported. If acetone is used when sublimating dry ice then the time for dry ice to completely sublimate in acetone will be faster because acetone has a higher heat capacity. The results are not valid. There should have been more liquid used.

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

71

Fair Category

PST

Project Number

6519

Title: Going Potatoes! A Biodegradable Replacement to Polyethylene

Student Name(s): C. Tallo, J. Vohra, E. Vittori

Abstract:

The experiment is being conducted to test if starch plastic, a biodegradable material, is a valid replacement to polyethylene. This degradable plastic will cut down on littering and pollution. This will prove in an everyday situation if it is a valid replacement, which the data supports it can. Starch plastic proved to be better in the puncture test, but not the stretch test. This means it is more durable, but brittle.

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

CH 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

246

Fair Category

PST

Project
Number

6520

Title: Tactical Military GPS

Student Name(s): T. Archambault, J. Archambault

Abstract:

The purpose of our project was to solve the problem of troops not having an efficient and reliable way of communication. The problem that we solved was finding a better alternative to military radios. Our approach to finding a solution to this, was to design a device that would be both cheaper than a military radio, but also easier to use. We investigated what factors we need to account for, such as ease of use and portability. We were able to determine that while attempted in the early 2000s with the land warrior system, a reliable and light form of gps tracking has not been successfully done. This Project can contribute a safer battle field for all U.S and NATO personnel. With accurate tracking comes the reduction of Friendly fire scenarios, the term Missing in Action would be wiped out because even with the death of someone wearing the device they will still be able to be tracked. This device will allow battlefield commanders to give better orders and better understand the area of operation, address areas of concern and express those concerns to his or her subordinates. with the resources available to us we have come as close to our original goal of creating this device, with money being a factor we were not able to make a working prototype but we were able to map out what this product can do and how useful it can be, as well as how realistic it is.

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

CS AT 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

244

Fair Category

PST

Project Number

6521

Title: Designing a Benchtop Pump Using Ferrofluids and Electromagnets as an Actuating Mechanism

Student Name(s): S. Saxe, J. Nadelmann

Abstract:

Heart disease is the leading cause of death worldwide. Patients who progress to end-stage heart disease are limited to heart transplantations; donor shortages limit transplants to 2000 annually. An alternative treatment is a Ventricular Assist Device (VAD) which support failing hearts. Often continuous flow VADs have many complications such as GI bleeding, and blood clotting. A solution would combine the advantages of positive displacement pumps with continuous flow pumps by using ferrofluids and electromagnets; a prototype features an iron stator surrounded by four electromagnets, a polytetrafluoroethylene tube designed for blood flow, and an inner tube filled with a ferrofluid. The wires of the electromagnet were connected to a circuit board with an on/off algorithm that enabled current to be isolated to individual wires in a cyclical fashion. When current surrounded one electromagnet, a magnetic field was created that attracted the ferrofluid. Due to the flexibility of the tubing, the ferrofluid subsequently compressed the tube of blood and propelled it forward as the magnetic fields, and thus the ferrofluids, cycled. A proof of concept has demonstrated the feasibility of this actuating mechanism, where electromagnets are placed on the outside of the mechanism and subsequently use ferrofluids to move material cyclically. The pump is expected to be successful in clinical testing as the machinery does not come into direct contact with the blood, thus reducing the likelihood of postoperative GI bleeding, and stroke, while increasing the time a patient can be placed on a VAD.

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

EN ME 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

243

Fair Category

PST

Project Number

6522

Title: The Optimization of Hydrofoil Performance Through Hybridization of Base Design

Student Name(s): B. Doughty, A. Cornish

Abstract:

In the 1970's there was a large fascination with hydrofoils as they were becoming more promising in their development stages as well as possible advantages for military use. Hydrofoils are additions to boats near the bow and stern underneath the boat that increase lift by decreasing the direct pressure from the hull (Aviation History 2007). In the 2000's, these designs were brought back for further testing the three common designs of flat foils, round foils, and V-shaped foils. To continue this research, we combined these designs to create what we believed would be the most stable and produce the greatest lift. By constructing these foil combinations attached to the same replications of model boats, flow patterns were able to be observed. By video recording food dye dropped into a fish tank and propelled by submersible pumps, the round foil and flat foil combination created the optimal flow as the coloring went underneath both sets of foils. This is unlike the V-shaped and flat foil combination that created enough turbulence to disrupt current flow and reverse the current underneath the front foil. This combination could be used for government or recreational use to allow for greater lift as it increases speed. In the past government have been interesting in this technology but due to funding have not been able to pursue further research past developmental stages, however, with our observations we believe hydrofoils could be a viable option with further research.

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

245

Fair Category

PST

Project Number

6523

Title: Se.F.T (Tent improvement Project)

Student Name(s): A. Bailey, B. Raymond, J. Fox

Abstract:

Every year an estimated 45 million people embark on camping trips in America. Among these campers, tents are by far the most preferred form of shelter. It comes as a surprise that the standardization that can be seen in so many other markets is lacking in that of camping tents. In today's camping-tent market the prices of tents can range from ten to hundreds of dollars, and the same large variation can be seen in quality, durability, and weight as well. Through researching existing tent designs, surveying active campers, testing functional prototypes, and using our own knowledge of the camping experience, my team and I intend to incorporate the essential functions of all analyzed tents, integrate new functions desired by our survey participants, and ultimately create a simplistic, easy to use tent for the camping consumer base. Our process for analyzing past tent designs includes researching patents for products related to our tent, researching current tent designs, and systematically reviewing these designs to select the essential elements required in a camping tent. After we select the functions and features to include in a standard tent design we will construct a scale prototype out of nylon sheeting, and A.B.S. plastic. This prototype will then be exposed to a variety of environments to test for functions such as rain, and wind resistance, durability, and tent setup complication. The finalized design will offer a complete, and simple solution to the problem of having a functional tent design.

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

EE AT EN

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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

205

Fair Category

PST

Project Number

6524

Title: Extracting DNA from hair follicles of *Canis latrans* to Understand Interrelatedness Among a Transient Population

Student Name(s): S. Shaikh, T. Calcano

Abstract:

The purpose of this project was to gather genetic information through hair sampling to determine interrelatedness between coyotes traversing a given area. It was hypothesized that the transient coyotes traversing our study area were related within two generations. This project should answer questions related to coyote migration and overall movement of given populations. There are currently few scientific studies regarding specific coyote populations within Fairfield and Lower Westchester counties as attempts to tag and track them have been unsuccessful. Stealth cameras were set up along wooded trails on the school's athletic campus to build a photographic database of animals, coyotes and others, that visited the immediate area around the camera. Hair collecting "traps" were then constructed and placed near the cameras in an effort to extract viable hair follicles for genetic analysis. Various methodologies were employed in the construction of several traps in an effort to optimize follicle collection. Traps were baited and hair collected over a 4 week period. Genetic analysis is still being conducted, however photographs reveal that individuals did not visit the trap more than once suggesting that the hair collected was from transient, rogue males. Although compelling, this data is inconclusive in determining if any of the rogue males were related.

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

AS EM 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

183

Fair Category

PST

Project
Number

6526

Title: Eco-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 gelatin. 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 gelatin. Our plans for improving are working on sustainability on our batteries, as in the past the gelatin 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

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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

PST

Project Number

6527

Title: Board Barrier

Student Name(s): C. Usaty, A. Altermatt, M. Lanoce

Abstract:

Whether you are a beginner learning 180's on a snowboard or an expert learning rodeos it's always dangerous to try these tricks for the first time on the real snow. That's where our product steps in, introducing the "Board Barrier". Our product allows you to use your snowboard on a trampoline without risking the chance of damaging your trampoline or yourself. When we began research we first found a foam snowboard, but this product wasn't realistic due to the weight and the material. After the research process we moved on to designing and testing our own prototype. We started this process by printing a miniature snowboard from our 3D printer. We then used textbook cover material to cover the edges. This material was perfect for our prototype because it was very elastic and slid over the edge very easily. After our prototype was completed we began testing to ensure that this material would withstand the real metal edge of a snowboard. First, we performed a stress analysis test on Auto Cad. This test proved to us that we needed to enforce the middle area of the snowboard the most. Most of the pressure from the rider is distributed directly under the bindings. Secondly, we performed various tensile strength tests on our materials. These tensile strength tests pointed us in the direction of elastic type materials, such as a textbook cover.

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

EN EE AT

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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

141

Fair Category

PST

Project Number

6528

Title: The Efficiency of Biodiesel Blends Compared to Petroleum Diesel

Student Name(s): W. Pierre-Louis

Abstract:

With the issue of greenhouse gas emissions, biodiesel continues to show improvement in the matter of replacing gasoline as the source for fuel. To further research the efficiency of biodiesel in engines, corn oil-made biodiesel was tested in a replica engine along with different blends of it to test for fuel efficiency. The results concluded that the B100 blend had the highest fuel efficiency (6.5 mL/minute), while just straight petroleum had the lowest fuel efficiency (13 mL/min). Biodiesel has the ability to replace the use of gasoline, because it has been proven that they have a higher fuel efficiency, and produce less wear and tear on the vehicle. Future studies should continue to research uses of biodiesel, including using it to produce hydrogen for fuel cell vehicles, clean up oil spills, provide lubricity for diesel, and heat homes.

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

ET EN

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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

230

Fair Category

PST

Project Number

6529

Title: The Future of the Prosthetic Limb: Sacrificing Visual Aesthetics and Individualized Movement to Yield Greater Strength and Utility

Student Name(s): M. Restieri, C. Burdick, G. Wolfram

Abstract:

The importance of this project lies in the increasing number of lost limbs that occur due to the use of I.E.D bombs of today's battlefields. The objective of this project was to design an ideal prosthetic arm (below the elbow) using a combination of previous prosthetic models, concepts, and codes in order to increase basic utility for the user. In an effort to meet this objective a combination of InMoov 3D prosthetics and prosthetic programming that receives signals from the opposing biological arm were employed. The project was completed by using multiple arduino products, servo motors, flex sensors, and 3D printed pieces and the prototype was completed in 3 stages. In the first stage a prosthetic was created that sacrificed visual appeal for function. This was accomplished by using Tinkercad.com and the 3D printer to create pieces that resulted in a tentacle-like prosthetic. The second stage was completed by connecting the arduinos, sensors, and wireless X-bee modules and then sewing them onto a soft glove. The hardware attached to the glove communicated with receivers and servos attached to the prosthetic tentacle so that the glove-hand controlled movement in the prosthetic. The bulk of this project included the trial and error construction of the prosthetic and the circuitry required to control it. Stage 3 utility trials were inconclusive as modifications must first be made to the original prototype.

**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):

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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

234

Fair Category

PST

Project
Number

6530

Title: The Effect of the Chemiluminescence on the Glow Time of Luminol

Student Name(s): J. Jeong, M. Brenchak

Abstract:

Luminol is commonly used in forensic chemistry to pinpoint the location of any criminal case; the reaction of chemiluminescence causes the substance to glow in the presence of blood. However, the glow time only lasts for an average of 30 seconds, and this may not be enough time for the investigators to gather accurate information. If they knew the time range with the glow of luminol in different temperature environments, it is more likely to gather accurate information about the case. In conducting the experiment, 15 milliliters of luminol solution was sprayed over three different carpets in an environment of cold, room, and warm temperature, spread with 3.5 milliliters of synthetic blood. The hypothesis was that the environment with the lowest temperature will provide the longest glow of luminol. The data collected supported the hypothesis giving 10 minutes more glow time for the carpet samples kept at 10°C than the samples kept at 30°C. It did not only affect the time range but overall, the colder environment had a distinguishable longer bright glow compared to the warmer environment; the reason was because of the chemical reaction of chemiluminescence occurring in a slower state due to the infrequent movement of the molecules releasing less kinetic energy. The purpose for the results of the experiment is for investigators in everyday life to gather a more accurate evidence to solve any type of a case.

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

CH 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

242

Fair Category

PST

Project Number

6531

Title: The Everything Hanger

Student Name(s): D. Kelly, A. Lungo, B. Leonard

Abstract:

It seemed impossible for our group to get through the morning, without breaking at least one hanger, before we began our project. Our group believed that this was a very recurring issue. After creating a survey with around 70 responses we were able to conclude that it was not just us that had this problem, but many of our friends, families, and even strangers believed it to be as well. After validating the importance of our project we jumped right into research. Our group took all of the responses from our survey in hope to work those, voiced opinions, into our design. Our hypothesis was that a hanger that was collapsible, durable, presentable, but still affordable would be a great solution to this problem. We soon began sketching and creating prototypes on Autodesk inventor. On Autodesk we are able to create a 2D sketch of our parts and test the parts of our hangers for the stress and strain, to create the most dependable hanger we could. Throughout the design process, we asked our classmates for criticism and made changes, where necessary, to minimize the flaws and maximize the outcomes. Our project was to create a hanger that fit the needs of others. We wanted to make lives easier by helping people save money on a product that would last longer and look better than previous solutions. We hope you all find our solution useful and as successful as we feel it is.

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

EE 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

248

Fair Category

PST

Project
Number

6532

Title: How Acidic Are Our Oceans?
pH of Water VS Varying Amounts of Carbon Dioxide Stoichiometrically Calculated from
Three Fuels

Student Name(s): E. Rigsby, C. Yerxa

Abstract:

Ocean acidification is a growing area of concern today. It has many dangers to take into account such as destroying biodiversity in aquatic populations, dissolving coral reefs, and increasing bicarbonate formation while lowering carbonate formation. This lab was designed to gain a higher social awareness on the implications of fossil fuel reliance and a shift towards new sustainable replacement fuels. More specifically, this experiment took a deeper look into the question, "What effect does the presence of carbon dioxide emissions from gasoline, diesel, and propane have on the acidity of the ocean?" To begin, the mass of CO₂ theoretically released from gasoline, diesel, and propane per kilojoule of energy released was stoichiometrically calculated. Then, a 3L Poland Spring Bottle was filled, capped, and inverted in a small plastic tub also filled with tap water. Using a Labquest, the initial temperature and pH was recorded. After that, a small flask (with two small pieces of dry ice in it), scale, rubber tube, and stopper was set up so that the dry ice was sublimated for a corresponding change in mass according to the three theoretical fuels mentioned earlier. Lastly, after waiting two minutes for the water to reach equilibrium, the final pH was recorded. This process was repeated so that the three theoretical fuels had three trials each equaling nine total trials. After testing, it seemed that gasoline acidified the water the most, having an average pH drop of 0.597, while diesel and propane were 0.343 and 0.190 respectively.

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