

70th Annual Fair



**Connecticut
Science &
Engineering
Fair**

March 12 - 17, 2018

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)

Special Categories

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

Special Category Composites

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

CSEF Official Abstract and Certification

Word Count

161

Fair Category

LT

Project
Number

1001

Title: Growing, Growing, Gone! A Fertilizer Experiment

Student Name(s): C. Jeffers, G. Chirayil

Abstract:

Fertilizers help plants grow well by providing the primary plant food elements, nitrogen, phosphorus, and potassium (NPK). In this experiment, different fertilizers were used to see which one can grow wheatgrass the best using organic fertilizer, compost, chemical fertilizer, and used coffee grounds in a four week period. For the control experiment, only topsoil was used. The reason coffee grounds were used was to see if this type of common household waste can grow plants efficiently. The best fertilizer was determined by measuring height, weight, amount of leaves per blade, and germination. For the germination, coffee grounds did the best because ninety-five percent of the seeds germinated. Chemical fertilizer had the most leaves per blade with an average of 2.57 leaves per blade. Organic fertilizer had the tallest wheatgrass plants with an average of 7.4 inches per blade and the heaviest blades with a weight of 2.32 grams. Based on the results, organic fertilizer helped grow the wheatgrass the best.

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

84

Fair Category

LT

Project
Number

1002

Title: Caffeine's Affect On Plant Growth

Student Name(s): A. Staggs, A. Bill

Abstract:

In this experiment, we asked the question what will caffeine do to a plant? We chose this experiment because we were wondering if we add caffeine to plants, they will grow. We predicted that if we add caffeine to the plants it will stunt the growth of the plant. We observed that the tea made to plants grow taller than the water and the coffee. In the future it would be interesting to redo the experiment during summer and find out how it affects flowers.

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

155

Fair Category

LT

Project Number

1003

Title: 5 Second Rule?

Student Name(s): D. Ismail, I. Saboor

Abstract:

5 second rule, everyone has thought about it, but is it actually accurate? Does my food stay clean when I pick it up from the floor before 5 seconds? Does location and type of food matter? These are the questions we will be answering. Our hypothesis states that picking up food before five seconds will not stop the transfer of bacteria. We dropped turkey and almonds in the hallway and cafeteria for five and three seconds. We then spread them across nutrient agar dishes. We put them in the incubator for 5 days. Our hypothesis was proven, we also found out three major things. First off, the cafeteria has more bacteria than the hallway. Secondly, dropping the food before five seconds does not stop the bacteria from transferring, but it does have less. Lastly, the turkey picked up more bacteria because it was a wet food. In conclusion, the five second rule is a myth.

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

MI ME EM

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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

210

Fair Category

LT

Project
Number

1004

Title: Adaptation Experiment on Yeast

Student Name(s): L. Sun, B. McGee

Abstract:

This science fair project is an experiment investigating the question: How can a sudden climate change in an animal's environment affect the animal's adaptation rate? The hypothesis is that if there is a sudden rapid environmental change, then the time it takes for an animal species to adapt would be faster.

This experiment is modified from an evolution and adaptation study on baker's yeast led by two McGill University biology professors; Andrew Gonzalez and Graham Bell. For this analysis, baker's yeast was placed into varying environmental conditions by using salt. The differences in their color and their reproduction rate was observed to measure the adaptation rate of the yeasts. When comparing the adapted yeasts to the constant yeast, it was clear that the yeast with the most amount of salt had the most dramatic change in its color and reproduction than the other yeast with less salt.

In conclusion, observations and data show there is a dramatic difference in the appearance of the yeasts with salt and the constant yeast. It was concluded that if there's a rapid change in an animal species' environment, then the time it takes for the species to adapt would be much faster than an animal species that live in an environment that's gradually changing.

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

EV 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

240

Fair Category

LT

Project
Number

1005

Title: Studying the impact of acid rain and gutter water on the growth of three plants

Student Name(s): Z. Isaacs, D. Klein

Abstract:

The industrialization of society has improved the quality of life for man and resulted in pollutants that disrupt the natural ecosystem. This project aims to study the impact of specific pollutants on the growth of plants. We tested the growth of radish, grass, and mustard plants exposed to acid water and gutter pollutants to mimic contaminants from rainwater. We subjected all plants to water at different pHs for three weeks and recorded data on the growth of every plant. We collected gutter water and created four solutions by adding different amounts of vinegar (acetic acid) to reverse osmosis water (RO) to mimic battery acid (pH 2.7), acid rain (pH 3.77), regular rain (pH 5.78), and neutral water (pH 7). In the first experiment, we found that all three plants grow well in gutter water and die in acidic water at pH 2.7. In a follow-up experiment, we found that all three plants grow best at pH 5.78 followed by water at pH 7 and lastly water at pH 3.77. Our results demonstrate that plants have been optimized to grow at the pH (5.78) of rainwater rather than acidic water (pHs 2.7, 3.77) or neutral pH. We anticipate that our project can be expanded to study how other pollutants affect the growth and viability of plants. If more contaminants enter the environment it could decrease the acidity of rainwater and result in mass loss of plants and disrupt our ecosystem.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

224

Fair Category

LT

Project Number

1006

Title: What Whitens Your Teeth the Best?

Student Name(s): K. Fitzgerald, E. Gallagi

Abstract:

In this project we researched a few topics that helped us come up with our Dependent Variables and Conclusion. One topic was: "What is a tooth made of?" We found that a tooth is not just made of bones but of four different types of tissues as well (pulp, dentin, enamel, and cementum). We also researched: "Why do your teeth stain more when you get older?" With age, the outer hard tissue (enamel) wears away with age and reveals the darker next layer, dentin. This may cause yellow or grey discoloration.

We used eggs and marble tiles to represent a tooth and the enamel in order to determine which substance was most effective when it comes to preventing too much stain. The eggs and mini marble tiles are similar to teeth because they are white and hard. We stained 8 marble tiles and eggs with tea or tomato sauce, then brush each tile and egg with either water, Colgate toothpaste, Colgate whitening toothpaste, or Zoom whitening treatment. We found that Zoom was most effective in whitening the stained eggs and tiles. The Zoom treatment contains hydrogen peroxide (gel) which activates by sitting on the tooth for 15 minutes (3x). The Zoom treatment would be very effective to break through the tooth enamel and remove difficult stains that may come with age and certain foods.

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

ME BE

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

231

Fair Category

LT

Project Number

1007

Title: Strawberries and DNA

Student Name(s): D. Tarazona, N. Manzano

Abstract:

Abstract Strawberries and DNA

The purpose of this project was to see if climate and possibly growing techniques have any effect on the strawberries and its DNA. In this project, my partner and I experimented with several different strawberries grown in different areas to see if location affects DNA yield. We already knew that sun exposure could lead to damage to DNA in humans, but were curious if it had the opposite effect on plants. We wanted to test if this was true and saw several, noticeable differences. We predicted that if each group of strawberries were grown in areas with warmer weather and more sun, then the DNA yield will increase because the strawberries are larger and the sun aided in growth of DNA. To do this lab, we purchased three brands of strawberries grown in different areas; Delaware, California, and Florida. After that we minced up the fruits and combined rubbing alcohol, dish soap, and normal water in a bowl. Then we mixed the mixture and mashed fruit together into a jar covered with a cheesecloth. We let it sit and tiny "threads" began to pop up to the surface. We then used a syringe to measure the amount of threads and recorded needed information. Our data showed that the strawberries grown in Delaware yielded the most DNA, followed by Florida and California. Therefore our hypothesis was not supported.

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

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

249

Fair Category

LT

Project
Number

1008

Title: Insecticide or Suicide: Creating and Comparing Natural and Unnatural Insecticides

Student Name(s): N. Satanovsky, K. Gotouhidis

Abstract:

Toxins in pesticides are incredibly harmful to living beings, including the plants they are applied to. Pesticides have an extensive range of hazards, including short-term effects, such as headaches, and chronic effects such as cancer, endocrine disruption, and reproductive harm. We wish to alleviate these problems by creating a natural insecticide which can function with the same effectiveness as a toxic insecticide. If we are able to accomplish our goal successfully, we could prevent many issues. We made sure to use ingredients that were organic and mainly vegetables. The primary component in our homemade insecticides was sulfur, which is a natural repellent to most insects. We placed crickets in a confined environment for each plant. We had four plants: one sprayed with toxic insecticide, two with homemade pesticides, and one controlled plant, which we sprayed with only water. Every three days, we collected data and resprayed our plants with water and insecticide. We later discovered that our experiment was not executed with precision. We did not take notice of many variables and did not properly care for the plants in order to keep them in good health. The first group of crickets to die were the ones in the toxic environment, but it seemed that the natural insecticides repelled, rather than killed the insects. To conclude, it appeared that our homemade insecticides do repel insects, however, in order to bring this project to a higher level, we must refashion our project into a modified and more sophisticated manner.

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

5. 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

LT

Project Number

1009

Title: Investigating short-term effects of video games on the body and brain

Student Name(s): A. Zoghol, A. Kabatilo, Z. Kabatilo

Abstract:

Many people in the modern world play video games almost every day as a form of entertainment. Players don't realize, however, that video games can have a physiological impact, and there have been numerous studies and experiments to analyze its effects-positive or negative-on the brain and the body. The impact of games, however, can vary depending on the type of game played. The most popular and commonly played video game genres include shooter, horror, and adventure. We chose three games that fit these genres and the goal of our study is to see what happens to our bodies when we play games. We measured the blood pressure, temperature, and heart rate of participants before playing the game, and after. We recorded the data in a journal and conducted multiple trials with different participants. As participants were playing the game we asked if they were sweating, or if they were nervous, excited, etc. Half of the participants stated that they started to sweat when playing Fortnite, an adventure game. We also noted changes in their blood pressure when playing the 3 games. Depending on the game their blood pressure increased or decreased. For example: In Fortnite, one participant's blood pressure went from 98/64 to 112/90. In Call of Duty Advanced Warfare, another participant's blood pressure went from 106/71 to 97/58. This showed that games do have a physiological impact on the body.

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

96

Fair Category

LT

Project
Number

1010

Title: What substance will keep the apples fresh the longest?

Student Name(s): M. Karameta, S. Pasholi

Abstract:

For our project we wanted to see what substance worked the best for preserving apples. For our process, we cut up apples into six pieces and put them in labeled cups. We chose the six substances that we thought would work well. We measured the perfect amount of each substance and soaked the apples in the substances. We let the apples soak for exactly twenty four hours. We repeated this process two more time and recorded the color and texture of the apples every twelve hours. We found that lemon juice preserved the apples the best.

**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

196

Fair Category

LT

Project Number

1011

Title: Mind Vs.Music
Music Affects the Brain

Student Name(s): S. Thomas, V. Mealha

Abstract:

The purpose of this experiment is to figure out if music can help students or adults comprehend and focus on their work better. The results from this experiment will either prove or debunk the theory of the Mozart effect. If music is played to different age groups while testing, then some of the music genres will either increase or decrease the test scores. The procedure used was fairly simple. Create five tests for five days, for eight total people from different age groups. Once this is done gather the test subjects, and play different genres to them. Then after the whole experiment, compare the results. It was observed that it didn't matter if the music played was preferable, that didn't necessarily affect the test scores. Country and Pop music gave the best results, while Classical and Rock music gave the worst results. It is concluded that music does affect the way we learn, and can be both good and bad to our learning ability. If this experiment were to continue things would be done differently. Even more Experiments would be conducted. The test subjects might have a month worth of tests with different extended music genres.

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

BE 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

152

Fair Category

LT

Project
Number

1012

Title: The Effects of Ocean Pollutants on Marine Organisms

Student Name(s): J. Bonilla, E. Couvertier

Abstract:

As you may already know, oil spills are damaging our marine ecosystems, but we tend not to acknowledge the damage it is doing to smaller creatures in the sea, such as Brine Shrimp. We are approaching the issues of how these spills are affecting us as humans and the food chain surrounding all types of environments. We are studying how do the types of marine pollutants and concentrations affect aquatic life. To do this, we started off with stabilizing the temperature to room temperature, also known 20oc and divided the brine shrimp into 20 per container. The disodium phosphate killed the organisms at a faster rate, followed by the raid insecticide and finally with the motor oil. However, they were all effective in toxicity by the 24th hour mark. To conclude, our hypothesis was disproven due to all of the pollutants that killed the organisms in 24 hours, even with less concentration.

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

MI BI 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

214

Fair Category

LT

Project
Number

1013

Title: Now you "C" it, now you don't

Student Name(s): M. Fontana, S. Steinerd

Abstract:

This experiment was conducted to find out which fruit has the most Vitamin C. Flu and cold season is coming around so we wanted to see which fruit was the best for you. In this experiment 6 fruits will be tested to see which one has the most Vitamin C. To test this, a tincture iodine solution will be created by taking 1/2 tsp of cornstarch to 8oz water, then placing 2 tsp of the cornstarch solution into 8oz of water and add 4 drops of iodine into the cornstarch solution. One ounce of solution will be placed equally into clear plastic cups. After doing this you have to dissolve a crushed vitamin c tablet in water. This is the control. Then juice the fruits and filter them with coffee filters. Place the juices into clear cups. Finally using a medicine dropper add the fruit juice solution drop by drop until each tincture is clear. Filter to remove any remaining pulp. Count the number of drops it takes to make your tincture of iodine solution clear. If it takes less of the fruit juice drops to make it clear the more Vitamin C it has. At the end of this experiment orange and kiwi both took eight drops, so those are the best fruits

Technical Disciplines Selected by the Student
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ME BI

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

232

Fair Category

LT

Project Number

1014

Title: Water you Drinking?

Student Name(s): T. Pereira, S. Jarboe

Abstract:

The purpose of this experiment is to find out which water purifier does the best job at purifying water. The hypothesis stated that the Brita would be the purifier that was the best but after conducting the experiment it was proven that the Pur was the best purifier to use. In this experiment we used a do it yourself (DIY) filtration system, a Brita water purifying system and a PUR water purifying system. Having clean water to drink is very important.

We made the DIY filter out of a soda bottle, coffee filters, sand and gravel. We then took 500 ml of murky water and wrote down the color and smell of the water and test it for Chlorine, iron, lead and pH levels. We then poured the murky water through all three purification devices 3 times each. After each run, we looked at the water and wrote down the color and smell and retest for Chlorine and pH levels. This was repeated 3 times for multiple data.

After the experiment was conducted the results were that the original hypothesis was in fact wrong, the Brita filter was not the filter that made the water the cleanest, the Pur was the filter that did the best job in purifying the water. In conclusion the hypothesis was wrong and the Pur was the filter that made the water the cleanest not the Brita.

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

EV EA 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

194

Fair Category

LT

Project Number

1015

Title: Eins

Student Name(s): E. Baez, E. Almanzar

Abstract:

The app we created was made for the purpose of making sure that languages don't die out and that more of the world is multilingual. We chose this experiment because we felt that everyone was just learning English, all though there are so many other languages out there we wanted to make sure other languages didn't die out. Our goal was to make a simple app to teach languages in multiple ways so everyone has access to the information in a way they understand. We made the app using 'Justinmind' a free prototyping software, we each worked on it on and off while the other typed up descriptions and procedures. We ended up having to restart our project once because of a mysterious issue and we were forced to completely restart but we pushed through it and made the sign in screens, buttons, placeholder screens, and lesson 1 for multiple options. People who tried out and watched while we filmed the traditional classroom video say that they liked the way the lesson was taught like a conversation and how we went into detail about the pronunciation of letters and different ways to say letters.

Technical Disciplines Selected by the Student
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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

251

Fair Category

L7

Project Number

2001

Title: Does a female's sport and medical history affect their gait (stride) and possibly cause a gait abnormality?

(

Student Name(s): M. Kulick

Abstract:

Abstract

Have you ever wondered if a woman's sports activity and medical history affected her gait and possibly cause a gait abnormality? I developed an experiment that would do just that. My hypothesis is that it does because when you are enduring physical activity while going through the gait cycle even a twist of your ankle could cause a problem with the whole cycle. The medical history of a female can affect a female's walking pattern because "problems with your gait and balance are caused by a specific condition." Said by Physical Therapist Kellie Kulick. Gait is a person's manner of walking, and there are two phases of gait (stride) swing and stance phase. To test my hypothesis I just used the following materials. Baby powder, a yoga mat, and a tape measure. I had four females step into a container of baby powder and walk on a yoga mat, and afterwards I looked and analyzed their walking pattern. I tested two girls and two women of various ages, I recorded data including step width and their step length. The goal of this experiment was to test girls and women for gait abnormalities caused by their sport and medical history. I concluded that two out of four of the girls and women I tested had a gait abnormality caused by their sport and medical history. My hypothesis was proven based on the data that indicated things like knee replacements, dancing, surgeries, and all different activities and medical histories were relevant.

**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

5. 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

2002

Title: Does Practice Make Perfect

Student Name(s): E. Colon

Abstract:

My project is does practice make perfect. The purpose for this project is to show who practicing may or may not help you improve on a skill mentally or physically. People should care about this Project because it can help you on a skill that can be used in daily life. The problem is if you practice either mentally, physically, or just don't practice will you increase on the skill. You must have three volunteers, tell another do 10 free throws. Then tell one to physically practice free throws For 30 minutes a day for two weeks,tell another one of your volunteers to mentally practice free throws for 30 minutes a day for two weeks, and tell your last volunteer to not practice at all for the next two weeks. Compare you first day to your last day and write your conclusion.The hypothesis that physical practice will be most successful in improving free throws was supported by the data. By the end of the two weeks. The physical practice improved by 5 shots, the mental practice improved by 1 shot, and finally the no practice (test subject 3) did not improved at all but decreased by 1 shot. With these results it has been indicated that the more practice you do, you will improve but if you don't practice you may decrease or even just stay the same. In conclusion, my hypothesis was proven, that physical practice is more effective than just mental practice and just no practicing at all.

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

250

Fair Category

L7

Project
Number

2003

Title: Connecticut Charities App

Student Name(s): M. Tessema

Abstract:

The Connecticut Charities (CC) app was designed to assist people in Connecticut in finding local charities prioritized by personal preference versus commercialized organizations getting search priority. The procedure was to: design it using paper, start creating it using App Inventor, and to keep adding charities by adding a new screen and button for each one. App Inventor is made by MIT to let novices do computer programming by creating apps for Android phones. The procedure for the coding on the home page is to make each button with the charity go to a new page when pressed. That page has a Web Viewer that takes it to the website of the charity. The back button is programmed to go back to home screen. The observations found while creating it was that it was hard at first to go back and to add many charities. One victory in the end was that it was easy for the user to operate. It was also able to direct them to major Connecticut charities. In conclusion, it was challenging to create the app as the design intended because there isn't always enough information known yet about coding to make it. Since the design was more complex than expected, it had to settle for a simpler design. If this topic were to be explored further, then it might be able to automatically add charities in Connecticut instead someone doing them manually. It also could have a search feature so people can search their favorite charities.

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

93

Fair Category

L7

Project Number

2004

Title: How acids and bases affect enzymes?

Student Name(s): M. Estrada

Abstract:

The purpose for this project is to uncover How Acids and Bases Affect enzymes. It also is to find out which of the five samples has the highest amount of bubble growth , also where all of them place on the pH scale. We will complete this experiment using these following materials , 5 equal size glasses , masking tape, distilled water, yeast, baking soda, measuring spoons, hydrogen peroxide, lemon juice, pH test strips , and measuring cups. In the end we will come up with a conclusion to all of these things , and uncover the answer.

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

168

Fair Category

L7

Project Number

2005

Title: It's Brine Time: A Study of How Salinity Affects the Hatching Rate of Brine Shrimp

Student Name(s): B. Sanchez

Abstract:

Our school uses brine shrimp (*Artemia* sp.) to feed a lot of it's aquarium residents. It is a popular food source commonly used in aquaculture. To save money, we try to hatch and raise our own. We are always looking to determine the ideal conditions to hatch and raise the brine shrimp in. In this experiment I was finding which of three salinities would have the greatest hatching rate in an artificial environment. The salinities tested were 0ppt, 34ppt and 68ppt.

To test this, I prepared the three different salinities, added artemia cysts, then counted hatched larvae for 5 days using a plankton wheel. Of the three salinities tested, the salinity that had the best hatching rate for brine shrimp. I know this because 34ppt had the highest average amount of larva counted, with total count of 268. 68ppt was not that much less, with a total of 231. In the future, I would like to take a closer look at these salinities and some in between them.

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

AS EV EM

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

158

Fair Category

L7

Project Number

2007

Title: Biomechanics of Dance

Student Name(s): F. Saunders

Abstract:

The purpose of this project is to prove that dance does help with other mental and physical skills. My question was to see if dance influence one's thinking and how they transfer the fundamentals of dance in other activities.If a person trained in dance and its fundamentals then it will help them with their memory.During the experiment the camera was setup to record the experiment that was planned.Questions were asked of the subject including how they would transfer the skills from one sport to another. Then they were given 30 seconds to memorize a set of images. Next they did the physical part of the experiment which was a group of movements like:jump, turn 2X,etc. In the experiment shown the dancers tested better with their memory than the non dancers.In some way it is true that dance does have some kind of influence on how people think and transfer smoothly from one sport to another sport.

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

241

Fair Category

L7

Project Number

2008

Title: Plants Jammin

Student Name(s): C. Thomas

Abstract:

Does music affect how fast a plant will grow? Music is known to have a positive or negative effect on people and animals; therefore, plants should respond to music in the same way. In many scientific experiments, it has been proven that plants react positive to classical music compared to other types of music. The open question is will classical music promote plant growth faster. So within this experiment classical, hip pop music and no music was used to test how fast plants will grow.

Is it true that classical music promote plant growth faster? It has been studied that certain tunes have been found to stimulate plants through sound waves. Classical music transmit a less tune which helps plants grow as other music such hip pop hinder the growth because of the greater tune that is transmitted to the plants. It is also believed that those who play classical music for plants tend to take better care and give more attention; therefore, the plant grows more quickly.

As a result of my experiment, it seems like no music had more of an effect on the plant growth than classical and hip pop music. The plant that was not exposed to music grew faster than the plants that was exposed to music. It's incredible that my hypothesis was correct base on the research. I think more research has to be done on this topic of how music help plants grow faster.

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

249

Fair Category

L7

Project Number

2009

Title: Filtrating Salt Water With Household Items.

Student Name(s): A. Ajdinoski

Abstract:

Many people all around the world die due to dehydration. Seventy-one percent of our planet is made up of water but only four percent is fresh water. Most methods of distillation are very expensive or could not be conducted with regular, easy to find items. My goal is to be able to distal salt water from objects that could potentially be washed up on a beach or could be easily found around anyone's house. I used a rocket stove -a large 2 liters can with a regular can put through a hole near the bottom of the 2 liters can perpendicular to each other- which served as a heat source. The rocket stove was fueled with twigs. Two trays filled with sand which held to glass bottles neck to neck were seated on an oven rack. One of the bottles were filled with salt water and the other one was empty. The rack was held by two bricks on each end. The tray with the salt water was put above the flame of the rocket stove. Approximately after an hour, the salt water was transferred to the empty bottle. When I consumed the water that had transferred to the empty bottle I did not taste any salt. The water had purified due to the fact that the salt water boiled and turned into steam. The steam traveled to the second bottle. The second bottle was cold which transfer the steam to fresh water. The water is now drinkable.

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

EN

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

L7

Project Number

2010

Title: Underwater battle: The effect of pollutions on Brine Shrimp

Student Name(s): A. Brown

Abstract:

Pollution has a major impact on our life. Brine shrimp are microscopic creatures that mainly live in the great salt lakes. They are easy to grow and react easily to change in their environment. Two major pollutants of the great salt lakes are, chemical fertilizers, and laundry detergents. This experiment was designed to test if two pollutants (fertilizers and laundry detergent) had an effect on the hatching of brine shrimp eggs. The experiment showed that the Brine Shrimp thrive on nitrogen rich waters like the fertilizer enhanced water. When the Laundry detergent was added to the water the Brine Shrimp were unable to hatch. In the beginning the Fertilizer had predictable levels of juvenile shrimp, but after 4 days the shrimp's population jumped in big numbers, compared to the control, to the amount where I was unable to accurately count the number of hatched shrimp. Two days after treatment, there was no difference between control and fertilizer 1%. However, there is a difference between Control and Fertilizer 5%. The average of the all the groups comes from 3 biological replicates. The control had 99.88 hatched shrimp per 500 uL of water. Similarly the fertilizer 1% had an average of 80.33. The fertilizer 5% had an average of 50.11. While the Laundry detergent 1% had a mean of 7.11 and the Laundry detergent 5% had a mean of 0.33. Unlike the difference between control and laundry detergent, which has a big difference, the two laundry detergents don't have a big difference.

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

AS 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

147

Fair Category

L7

Project Number

2011

Title: Can plants grow in different liquids.

Student Name(s): D. Boudreau Jr

Abstract:

Are plants able to grow in different liquids? This was the question I wanted to research. I hypothesized that the plant growing in regular water would do best. I used grey water from the laundry, Pepsi soda, and regular water. I planted 2 bean seeds in 3 different containers. I watered each container every other day with the different liquids and took measurements of each plant once they germinated. At the end of my experiment I found that the seeds being water with soda, began to germinate a little but then died, The seeds watered with grey water germinated, grew a bit and then died as well. The seeds watered with Palin water grew the most. My hypothesis was proven correct. I do think that once plants are bigger you may be able to use grey water, since the grey water didn't kill the seeds right away.

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

PS EV CH

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

242

Fair Category

L7

Project Number

2013

Title: What's On Your Mind

Student Name(s): C. Fay

Abstract:

I noticed that on Picture Day, the photographers always tell you to turn your head a certain way. I wondered why my sisters angle of the face made her look innocent and nice, while mine looked more intimidating because of my head angle. In this project I tested how intimidated or soothed people perceive somebody whose head is tilted at different angles along a vertical axis. To do this I took pictures of the same person with a chin tilt of -30° , -15° , 0° , 15° , and 30° . The model's eyes always looked at 0° . Then I tested 15 students and asked them to place a tick mark on a line that ranged from soothed to intimidated. The farther right the tick mark was, the more soothed the participant felt. The farther left the tick mark stood, the more intimidated they felt. Overall, in my testing I found that positive head tilt (looking down at someone) was more intimidating than negative head tilt (looking up). In addition, perception seemed to be different for subgroups of gender and age. Kids 12 and over found pictures with 0° or negative tilts much less intimidating than those with positive tilts. However, kids under 12 found pictures with 0° and 15° tilt to be the most intimidating. Boys overall found the model more intimidating than girls. In conclusion, head tilt appears to affect how intimidating one is perceived to be. Future research should examine changes over age.

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

BE

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

198

Fair Category

L7

Project
Number

2014

Title: Clean Up Your Act

Student Name(s): J. Williamson

Abstract:

The reason that I picked this experiment is to find out which type of filtering material works best to clean water, and which material filters water the fastest. The materials that I have selected to use have different properties, which means some will have different filtering times, and different results. My independent variables are the filtering materials, and the color of water used in each trial. My dependent variables are the time it took to filter the water, and whether or not there was any color change to the water.

If I use angel hair, then it will clean the water the fastest and the best. I think because of the way the angel hair is made it will do a better job of cleaning the water and take the least amount of time to do it. What I learned was the charcoal and the alum worked the best to filter the water, but the angel hair did filter the water the fastest. The information can help people from this research, because people can see which materials work best to filter water, so we can keep clean water in the world, because we all need water to survive.

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

230

Fair Category

L7

Project Number

2015

Title: A Plant's Favorite Color

Student Name(s): A. Zwolinski

Abstract:

All living things on earth depend on plants for survival. Scientists are always trying to find ways to make plants grow bigger, faster, and healthier. Plants need light to grow. Although sunlight appears white, it is a spectrum of colors. By modifying this spectrum so that a plant gets more of one color, the plant's size and strength will be affected. This experiment examined different colors of light and their effects on plant growth. In this project, six plants were put in separate pots and each one was covered with a different color of cellophane. These colors were red, blue, white, yellow, green, and black. The plants were all placed in the same window and received the same amount of water. Every four weeks the plants were measured and examined for new leaf growth and dropped leaves. The plant that grew the most was covered with blue cellophane followed by white then red. The plant with the most new leaves was red followed by blue. In conclusion, the plants that were covered in red and blue grew the most and had the most new leaves. The plant covered in black lost all its leaves and died. Plants not only need light, but the specific color of light will affect how they grow. It is possible to grow plants bigger, faster and healthier by exposing them to red or blue light.

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

251

Fair Category

L7

Project Number

2017

Title: comparing the growth of organic and non organic seeds when watered with filtered and tap water.

Student Name(s): N. Hanna

Abstract:

The purpose of this experiment was to see how organic, and non-organic seeds reacted to filtered and tap water. There are actually two different experiments that I combined. One of the control groups was the non organic seeds with tap water. The other was non organic seeds with filtered water. My independent variables were the organic seeds with tap water, and the organic seeds with filtered water. During the course of my experiment I went on vacation. No one could water my plants for me. To solve this problem I created a self watering system. The system was composed of a plastic shoe box with a section cut out of the top. A piece of felt was laid in the hole so water would wick up. The plants were grown in a cardboard egg carton, and the water was absorbed. Toward the end of the experiment the plants couldn't support their height, so I had to replant them in bigger pots. The reason why I chose this experiment is because people say that organic foods are better for you. I wanted to know if the chemicals in water and in seeds affect the growth. In my research I learned that certain things aren't harmful to humans, but are harmful to plants. As a result of the research I understood why the organic seeds with filtered water grew taller. In the end of my experiment I determined that when sugar snap peas are watered with filtered water, they grow taller.

**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

160

Fair Category

L7

Project
Number

2018

Title: Which Gender Has Better Memory?

Student Name(s): R. Pigeon

Abstract:

Which gender has a better memory? The purpose of this experiment is to test which gender has a better memory. My hypothesis is that the female gender will have a better memory. In my experiment I tested fifteen females and fifteen males. I had all of my subjects look at twenty pictures for one minute. Next the subjects wrote down as many pictures as they could remember. After I tested all of my subjects I compared the results of their memory. I averaged the number of pictures the female gender remembered and then compared it to the average number of pictures the male gender remembered. My hypothesis was correct although the results of my experiment indicated that the results were inconclusive. The female gender remembered an average of 9.8 of the twenty pictures. The male gender remembered an average of 9.2 of the twenty pictures. Even though the results of this experiment were inconclusive the female gender remembered slightly more.

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

141

Fair Category

L7

Project Number

2019

Title: Does pH affect the growth of grass?

Student Name(s): J. Cirone

Abstract:

The experiment conducted was “Does pH affect the growth of grass?” The purpose of this experiment was to test the effect of pH on a growing grass plant. It was predicted that the water would grow the plants the highest out of the two substances water and vinegar. The grass was watered with thirty ml of water and vinegar every two to three days. After a total of ten days of growing, the final measurement of the height for the grass watered with water’s average was one hundred and forty mm. Then the grass watered with vinegar had an average of zero mm. In conclusion the hypothesis was correct because water grew the grass plants much higher than the vinegar did. This experiment proved that pH does in fact affect the growth of grass. The objective of this experiment was met.

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

EV 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

224

Fair Category

L7

Project Number

2020

Title: Hydrogen Power

Student Name(s): S. Henao

Abstract:

The purpose of my project is to show what our future could be like and how our vehicles or way of transportation could work in the future. I built a hydrogen dry cell mainly composed of stainless steel plates and gaskets for no possible leakage. The dry cell was small, about the size of a hand. The hydrogen dry cell separates the water bonds into hydrogen and oxygen. I am using the dry cell to perform the process of electrolysis to separate the bonds. The reason I am separating the water bonds is that I will try to use the hydrogen as a fuel to a motor. I have tested powering the dry cell with three different kinds of solutions which are mixtures all of the water, water and baking powder water, and baking soda. When I tried only water nothing happened. then I tried water and baking powder end to nothing happened, then I tried water and baking soda and it worked because I could see the hydrogen bubbles running back up to the bubbler and through the vaporizer and through the spark arrestor. I wanted to experiment whether water and salt would work but I thought it is kind of off topic and the salt water would most likely eat up the stainless steel plates. In the end my experiment was successful.

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

256

Fair Category

L7

Project Number

2021

Title: Color or Black and White? Which Evokes More Emotion?

Student Name(s): E. Cruz

Abstract:

The purpose of this experiment was to observe whether color or black-and-white photographs evoke a stronger emotional response from subjects. My hypothesis was that if people saw the same picture in color and in black-and-white, then color would evoke a stronger emotion. In this experiment, five pictures were used to show the emotions of sadness, fear, anger, happiness, and surprise, each one in color and in black-and-white. A total of 20 subjects were then asked which emotion the pictures evoked as well as the intensity of the emotion utilizing a scale ranging from 1 (no emotion at all) to 5 (very intense emotion). Data was collected and analyzed calculating the average and standard deviations for each emotion for the color and black-and-white photographs. I also calculated the p values for each of the emotions. The results showed that for each emotion, subjects had a stronger emotional response to pictures in color rather than in black-and-white. However, from the statistical point of view, only the colored picture of happiness showed a significant statistical difference (p value of 0.0012) when compared to its black-and-white counterpart. In conclusion, the data collected from this experiment partially proved the hypothesis. Only one emotion, happiness, evoked a stronger emotion in its colored picture. Anger and surprise had slight differences in emotional intensity (p values of 0.0657 and 0.0530 respectively), while sadness and fear showed little to no difference in emotional intensity at all (p values of 0.1795 and 0.2885 respectively).

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

245

Fair Category

L7

Project Number

2022

Title: Memorizing with Music

Student Name(s): M. Amisano

Abstract:

I tested to see if music improves concentration and memory by comparing completion times while playing an online matching game with and without music. I chose to investigate this because, in many households, including mine, there are often disagreements discussing whether music should be played while doing a tedious task such as homework. The purpose of the project is to answer the question: Does music really help concentration and memory?

To answer this question, I found an online memory game called "Concentration". I let each subject play the game one time, without being timed to learn the rules followed by three times without music while being timed. I waited two to three hours and had each subject complete the same game three more times with music of their choice playing. I recorded the times for those tests as well. I calculated the average time it took for subjects to complete the game with and without music of their choice and compared them to each other.

According to my test results, music does, in fact, improve your memory. Five out of six subjects had improved test results with music as opposed to without. They improved by 24.91% This proves that for the majority of people music does improve concentration and memory.

The data collected in this experiment can be used when studying, doing homework or performing any other tedious task. Anytime you want to relax or focus and clear your head just put on some music.

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

BE ME

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

236

Fair Category

L7

Project
Number

2023

Title: Can A Potato Be used to power a lightbulb

Student Name(s): A. Maldonado

Abstract:

The purpose of my experiment is to see if I can use a potato and power a lightbulb. I will use two zinc plated nails, two pennies, 3 pieces of copper wire, and a potato, and try to power a 60-watt light bulb. First, I cut the potato in half and cut little slits in the potato, then I cut little slits, one in each side. Then, I wrapped the first piece of copper wire around the first penny, and I stuck it into the first slit. I repeated the same step with another penny and another piece of copper wire. I then wrapped one zinc-plated nail around the final piece of copper wire needed, and I wrapped the other side of the copper wire around the other zinc-plated nail. Although it was a spud, it still made a chemical reaction in between the zinc, the copper, and the juices from the raw potato. The zinc reacted to the phosphoric acid found in the potato, and the copper was a negative anode, oxidizing the acid in the potato, this created the cloud of hydrogen gas. When I measured the electricity volts with the voltmeter, I found out that there was only .2 volts running through all the items used. In conclusion, one potato is not enough to power the 60-watt lightbulb. Next time I will test it with a smaller watt lightbulb.

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

AT ET

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

L7

Project Number

2024

Title: Do different species of trees vary in growth from invasive species in the same forest area, when looking at their growth rings?

Student Name(s): N. Tracy

Abstract:

This project tested if different tree species growth patterns vary when looking at their growth rings and if so, do weather conditions affect the growth of these species in the same forest area? The hypothesis was that either Red Oak or Cottonwood would be less affected than the other species since no deformations were observed in any of their samples. Core samples, height, and diameters of 15 trees representing 5 species were taken. These measurements were collected with tools such as an increment borer, inclinometer, and calipers. The location of each tree was plotted using Google Earth. Additional testing took place indoors and included calculating average growth per year, age determination using growth rings, and comparison to historic data and weather sets. To find average growth per year, the growth rings were transferred onto a piece of paper, and then measured with electronic calipers. A tack was used to keep track of which growth ring was being counted. Historic high and low levels of rain and temperature from NOAA data sets were compared to the growth ring samples. Additional analysis compared the growth ring data to years of high Gypsy Moth infestation. Age did not necessarily correlate with height or diameter of these trees when comparing different species. Average annual growth varied by species of trees. Some individual trees showed differential growth during certain years that correlated with dramatic increases or decreases in annual temperature or precipitation, especially Red Oak and Pignut Hickory. Gypsy Moth impact on growth was inconclusive.

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

PS EV EM

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

94

Fair Category

L7

Project Number

2025

Title: Ready, Set, Grow

Student Name(s): M. Stratton

Abstract:

For my experiment, I wanted to discover if plants grow better in organic fertilizer, chemical fertilizer, or no fertilizer. I thought that the plants would grow better in chemical fertilizer because of the chemically enhanced nutrients. I carried out my project by growing plants in three different pots: one with organic fertilizer, one with chemical fertilizer, and one with no fertilizer. After a period of about a month, the plants in the organic fertilizer grew fastest, while the plants in the chemical fertilizer grew slowest. In conclusion, organic fertilizer enhances plant growth the most.

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

249

Fair Category

L7

Project Number

2026

Title: The Effects of Salt Water on Radish Growth

Student Name(s): D. Goldberg

Abstract:

Most people know that water is essential for plant growth, but it is not as obvious how things in the water affect plant growth. I was interested in learning how salt affects plants. My hypothesis was that plants watered with salt would decrease in size as the salinity increased. To test my hypothesis, I decided to plant radish seeds because my research showed that radishes have low salt tolerance. Radishes were planted in small seed starters, and watered with tap water. An additional one teaspoon of salt was added in each group. Each group was watered with either one cup, half-gallon, or gallon of tap water with an added one teaspoon of salt. There was also a control group watered with tap water. Plants were watered with their solutions most days.

Over ten days I observed how the radishes grew. Plants watered with salt grew less sturdy, and showed small differences. Surprisingly, the one teaspoon per gallon group had more seeds sprout than the control group. This goes against what I learned in my research about salt and plants. At the end of the experiment I began to notice the actual effect of salt.

From the results I theorized that if watered with a minimal amount of salt, plants may flourish more than if watered with no salt. After the process I reflected that salt may not be as bad as it seems to plants. Salt may have a positive effect on certain plants if used in moderation.

Technical Disciplines Selected by the Student
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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

215

Fair Category

L7

Project
Number

2027

Title: How Does Water Salinity Affect a Scallion's Growth

Student Name(s): R. Zou

Abstract:

Richard Zou

February 26, 2018

I have performed my experiment because I was curious about the effects of salt concentration on scallions. My hypothesis was that the scallions that received no salt would grow the most. I conducted my experiment by adding different amounts of salt in the one cup of water the scallions were placed in. I also changed the water every three days and measured the scallions to the nearest tenth of a centimeter every two days. I continued this experiment for two weeks. My data showed the scallions that received salt only grew an average of zero centimeters to one centimeter every two days while the scallions that received no salt grew an average of two tenths of a centimeter to six centimeters every two days.

My conclusion was that if the scallions received salt, they wouldn't grow as much as when you added no salt. I noticed the scallions that were placed in salt water had their growth slowed around day six but it was really obvious around day 8. If I had to do this experiment again I would have more scallions per group to make sure my results were consistent. I could also change the type of plant to see if other plants react the same way to salt

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

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

- Yes No

CSEF Official Abstract and Certification

Word Count

203

Fair Category

L7

Project Number

2028

Title: The force to separate

Student Name(s): J. Hernandez

Abstract:

My project is about a hand-powered centrifuge and how it works because of centripetal and centrifugal force. It is cheaper than any other centrifuge you can find. My hypothesis is that a hand powered centrifuge can work almost the same as mechanical ones found in labs. In my procedure the first thing you have to do is make a data table with five trials adding it by 30 seconds each trial. Next you have to take your wood circle and drill two holes close to each other then tie a string through the holes. Then make mixture of water, cornstarch, and iodine (your preference) and spin centrifuge to get results. My results were at 30 seconds was 0 percent separation, 60 seconds was 0.25 percent separation, 90 seconds was 0.75 percent separation, 120 seconds was 0.80 percent separation, and 150 seconds was 0.95 percent separation. My conclusion is that my project was for underdeveloped countries to have something that did not cost a lot of money to make, and to separate bloods and find diseases like malaria. My hypothesis was proven because the hand-powered centrifuge does work almost the same as a mechanical one but just slower and with smaller batches.

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

ME EN

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

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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

L7

Project
Number

2029

Title: Informal Soldiers

Student Name(s): W. Visalga

Abstract:

In this project, I tested if the consumption of the food by the soldier fly(*hermetia illucens*) larvae was affected by the food type. I ran two different tests. In the first one, I tested how much of cantaloupe, honeydew melon, banana and raspberry would get consumed by the soldier flies's. I tested cantaloupe and honeydew melon together and banana and raspberries together, and tested each pair every 2 days, for six days. I also ran 4 trials without the soldier flies to see how much of the weight loss in grams was caused by water loss or decomposition unrelated to soldier flies. The consumption of the fruits with flies did not have much of a difference between the containers without flies. A side observation gave me the idea for my second test. I noticed in the soilless container just a few untested flies, that they were devouring the food. My second test was to see if the amount of soil affected how much of two fruits, bananas and oranges were consumed by the soldier flies. My first trials were banana in one container and orange in another, I did not add soil, but I did add the flies. I did the same without flies. The consumption of the fruits now was noticeable. I ran these for trials again, except I used soil. The difference was significant. This led me to believe that I did something wrong in my first test.

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

AS 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

161

Fair Category

L7

Project
Number

2030

Title: Hot and Hard Headband

Student Name(s): A. Kopec

Abstract:

As a figure skater, I am used to the cold air and hard falls that came with ice skating. However, I could never find a warm and protective alternative to bulky helmets and over-sized headbands that weren't as warm as they looked. When I realized that there were also many other sports that didn't require helmet but could use both protection and heat without full gear, I decided to create a headband just like the over-sized one I used to wear, but with real warmth, and added protection in oppose to a full helmet, all built-in. Once I finished it, my project turned out just like my idea. The padding was strong and did help reduce impact, and the headband was as warm as I wanted it to be. Overall, I think that my idea hit two birds with one stone. It helps with cold and frigid temperatures, and lack of head protection, both problems with bad consequences.

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

EN 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

154

Fair Category

L7

Project Number

2031

Title: Too Grow Or Not To Grow

Student Name(s): S. Guzman

Abstract:

Based on this experiment I learned that acid rain can and will affect not only seed germination but also the environment around us. My project would help the world today because people are still polluting the earth. Farmers need rain for these plants to grow healthy. If the plants aren't receiving good quality rain and they are getting too much acid rain, the plants can start to wilt and die because of the acidity. They might not even grow at all as I learned from the pH3 level of my different solutions. I think that the quality of air pollution should be important to all of us because constant exposure to it can have a dangerous effect on all of us. We should all each do our part in keeping the world free from pollution because it will not only be beneficial to all living things now, but for all future generations to come.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

L7

Project Number

2032

Title: Don't Rain on my Radish (How does acid rain effect the growth of radishes?)

Student Name(s): S. Johansen

Abstract:

My experiment is what is the effect of acid rain on the growth of radishes. My hypothesis is that acid 2 will cause the most damage, acid 8 will cause the least damage, and regular water will cause no damage. I believe this because the higher the number is the less acidic it is. I hope this experiment will help prevent future problems with acid rain. The steps I took for this project is first, I planted the radish seeds. Second, I watered the radishes until soaked, then drained them. Third, I watered them every other day with water until it reached 1cm. I then, started to add the right amount of acid to the radishes. I continued to do that every other day. After 20 days, I pulled out the radishes and measured the height of all radishes. The result of my project was that acid rain does have an effect on the growth of radishes. I measured the heights of all the radishes in the end. The heights of acid 2 were .5, 4, 4.2, .2, and 1.5 cm tall. Acid 8's heights were 9, 9.5, and 3.5cm that were alive. The heights of the ones that were dead were 6, 4, 5, .5, 4.2, 5, 4.5, 8.5, 4.7, and 10 cm tall and all were alive. In conclusion, acid rain does have an effect on the growth of radishes. I enjoyed doing this experiment and would do it again.

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

162

Fair Category

L8

Project Number

2501

Title: Will H₂O Win?!

Student Name(s): Y. Perez

Abstract:

My science fair project tests whether the theory that plants only need water and sunlight is true. After doing multiple trials with each plant, the 25% sugar with water grew the most. When I observed my results, I noticed that the just plain H₂O grew a lot more then the 50% sugar but not as much as the 25%. I was very confused as of why the 25% grew more then the 50%. Then I saw that the soil had clumped up and prevented the plant from growing. This was because the sugar made the soil clump together. 50% of sugar was just too much sugar. My experiment can help farmers in the future grow their crops faster as well as through the winter when there isn't much sun out. Plants live off of photosynthesis. Plants get their sugar naturally from the sunlight but how are they going to get it when there isn't much sun out. I proved this theory wrong.

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

5. 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

2502

Title: The Effect of Musicianship on the Speed of Learning a Language

Student Name(s): I. Jiang

Abstract:

Project Title:

The Effect of Musicianship on the Speed of Learning Languages

Objective/Goal:

The project was designed to test if musicians were able to learn languages faster because of their experience in engaging all parts of their brain. It's expected musicians would be able to learn quicker with more accuracy.

Methods/Materials:

This experiment lasted over a span of five days for each individual. Six girls from the eighth grade took part in this experiment. Two of which had been musicians for three years and four who were not. Each spent five minutes for five consecutive days, taking an online course for Italian, a language they had no experience with.

Results:

According to the data, musicians are able to answer an average of 23.5 questions in five minutes. The non-musicians, on the other hand, were only able to answer an average of 23.5 questions in five minutes. The accuracy of musicians was also greater by an average of 15.61%. The brain exercise musicians receive from playing an instrument greatly enhances their ability to problem solve and learn at a greater speed.

Conclusion/Discussion:

The hypothesis that language will be affected by musical experience is supported by the data gathered during this experiment. Individuals with a musical background were able to learn

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

252

Fair Category

L8

Project Number

2503

Title: Toxic Metals

Student Name(s): M. Liu

Abstract:

Cosmetics, household items, cleaning agents, clothing, and other merchandise often disperse nanometals into the environment when washed down drains.

The purpose of this experiment is to determine if nanometals, such as silver, copper, and zinc will affect plant life and microorganisms. Heavy metals such as lead causes damage to the cell wall and tissue of humans. If heavy metals are bad for plants and animals like lead then exposing Duckweed and Daphnia Magna to silver, copper, and zinc will cause harm in the same way.

In this experiment, three groups (copper, zinc, and silver) were placed in three cups, each containing 500ml of pond water and 10 Daphnia. Each of the three cups were labeled with the trial numbers (1#-3#). Each of the cups contained 5 $\mu\text{g/L}$, 10 $\mu\text{g/L}$, or 25 $\mu\text{g/L}$ of the solution (copper, zinc, and silver). The control group only had one cup that contained 500 ml of pond water but without any solution. This process was repeated, but instead of using ten Daphnias in each cup, 10 duckweed plants were instead placed in each cup.

This experiment was conducted over a four-day period, during which each cup was observed. After each day the average of dead and living Daphnias and Duckweeds were recorded. The data showed that nanosilver and copper both shortened the lifespan of the Daphnia and the Duckweed, but zinc had no effect.

The data indicates that nanosilver and copper do affect plants and microorganisms negatively and could potentially affect ecosystems.

Technical Disciplines Selected by the Student
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EV MI 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

5. 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

2504

Title: A Study on Different Angiosperm Xylem Based Sucrose Filtration Systems

Student Name(s): V. Trombetto

Abstract:

Xylems are the vascular tissue in plants that allow plants to absorb and use water and other nutrients. This allows nutrients to flow throughout the plant. This energy is then used during photosynthesis. Angiosperm plants use sucrose as their main source of energy. To determine which xylem was capable of absorbing the most sucrose, five angiosperm branches were placed in beakers with 300mL of water, and 50g of water. Multiple branches were used in this experiment, being a pussy willow, a white oak, a Japanese maple, a red maple, and a black ash. The pussy willow was hypothesized to likely absorb the most sucrose, as it needs the most energy for photosynthesis. This experiment tested what type of angiosperm xylem made the best sucrose filter. To test this, each branch sat in its own sucrose and distilled water mixture for 30 minutes. This allowed each branch to absorb sucrose from the mixture. After the 30 minutes, each branch sat above its mixture for another 30 minutes, releasing all access water absorbed. This left only sucrose in each mixture. The mass of the final mixtures was then compared to the mass of each initial mixture. After two trials, the pussy willow branch absorbed an average of 3g of sucrose, while the black ash branch absorbed an average of 1g of sucrose. This proves the hypothesized results correct, as the xylems in a pussy willow are greatest at filtering sucrose, while the xylems in a black ash are poorest at filtering sucrose.

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

PS EM EA

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

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

L8

Project Number

2505

Title: Development of a Rapid Test for Lyme Bacteria in Ticks

Student Name(s): J. Kage

Abstract:

The purpose of this experiment was to develop a rapid, cost-effective, and easy to use test to detect whether Lyme disease bacteria (*Borrelia burgdorferi*) are present in ticks. Antibiotic treatment for Lyme disease transmitted by the blacklegged tick (or deer tick, *Ixodes scapularis*) is effective but can have significant side effects. As the population and percentage of infected deer ticks is rising in Connecticut, the risk of infection is also increasing. This test can help give the patient a better idea on whether they should consult a doctor and begin treatment. The principle of the test is that of a competitive lateral flow immunoassay, where positive and control lines are used to give results. A positive test is represented by the absence of a colored line at the test line, and a negative test is represented with two colored lines. The test was conducted 17 times, including several failures from dilution errors, along with errors in the length of time between adding reactants, where reactants dried out too fast, stopping the continuation of the test. All but four tests proved successful, leading to the conclusion that the test can be accurate and reliable. Future applications would require concentrations and diluents to be changed and tested for the optimal ratio, as well as tests to find what is the minimum amount of *Borrelia* that the test can detect. This test also has several possible research applications, including the surveying of the number of infected ticks in a certain area.

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

MI CB 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

194

Fair Category

L8

Project Number

2506

Title: the new creature of the sea

Student Name(s): M. Swierczek

Abstract:

By creating my own prototype I am able to draw near to the conclusion of creating an accurate depiction of an octopus robot. For me the idea of having the potential to see creatures in the perspective of an creature is something worth helping. The only thing that is standing in the way is, octopuses do not have a pattern in their movement, each tentacle has a mind of their own, however it does allow the octopus the ability to move in such a flowing matter. In order to accomplish this task I created tentacles which flow with the current movement and a material that was strong enough to withstand the currents and continue to move. However it did occure to me while testing that I would need a bigger and more powerful engine in order for the robot to take on deep pressure. This project aided my knowledge to spark an idea that this prototype can be replicated with better materials that can survive in the ocean environment. My project met my design criteria as well as contributing to the ocean research in Connecticut for finding a solution to the weakening of coral skeletons.

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

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

248

Fair Category

L8

Project Number

2507

Title: Sugars in Foods: Implications for Diabetics

Student Name(s): W. Lichtenberg

Abstract:

Many Americans live with diabetes, a life altering disease that is affected by a what types of sugars a person eats and the resulting amount of glucose in their system. It is hard to know the different types of sugars in foods. There is currently a debate about healthy breakfasts, specifically about how much sugar is in the yogurt people eat for breakfast.

This project measures the concentration of glucose and sucrose in different types of yogurt by seeing how sucrose is converted into glucose with an enzyme, invertase. Glucose strips were tested in a variety of solutions with different concentrations of glucose to ensure that the strips work properly. Once the glucose strips were deemed effective, drops of invertase were placed in a sucrose solution as a control sample to see how much time it takes for the invertase to digest the sucrose completely. This solution was tested every 5 to 10 minutes until the glucose concentration plateaus, establishing the time it takes for the invertase to convert the sucrose to glucose, which for this experiment was after 80 minutes. Solutions of various yogurts, including 2% fat milk, lactose free, Greek health and fit, and generic vanillas, were tested by adding invertase to the solutions and testing them with the glucose strips before the invertase was added and 80 minutes later to assess the concentration of glucose after the invertase digested the sucrose. Greek yogurt had the lowest concentrations of glucose. Appropriate yogurts for diabetics are discussed.

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):

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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

2508

Title: Cleaning Coins

Student Name(s): C. Collins

Abstract:

My experiment is about the growth of bacteria on coins. The goal is to compare how much bacteria grew on the coin before and after the coin was cleaned. I did this project because I wanted to explore how much microscopic bacteria grows on the human hand and how easily it can be transferred to ordinary objects such as the coin. In my project I am trying to figure out which cleaning solution will clean the coins the best and to see if any bacteria will grow. To perform this experiment I first swabbed the dirty coins and inoculated petri dishes. Then, I put the dirty coins in their cleaning solutions and let them soak overnight. The following day, I swabbed the clean coins and inoculated new petri dishes. I let the petri dishes sit for eight days. The first thing I noticed in terms of results was that the coins that were soaked in water had more bacteria growth than the coins soaked in baking soda paste. I also noticed that as the days increased, the number of bacterial colonies increased or stayed the same. What I concluded about my project was that depending on how long I left the petri dishes to sit and what kind of cleaning solution I used, determined the outcome of the project. I think that the significance of this project was to observe the bacteria growth on coins and to show all the different bacteria that could be carried on the human hand.

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

MI CH

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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

L8

Project Number

2509

Title: Brushing Bacteria

Student Name(s): K. Evans

Abstract:

My science fair project is called Brushing Bacteria. I tested which method of cleaning a used toothbrush kills the most bacteria. I used 12 toothbrushes, Petri dishes prepared with nutrient agar, and lab safety materials. These along with hydrogen peroxide, salt water, antibacterial soap, and a UV light cleaner. These 4 ingredients are my 4 methods of killing bacteria. This project can be used in the real world because this will teach people how to clean their toothbrushes and prevent certain bacteria like E. coli, food debris, etc. so they have a lower risk of getting sick. I hypothesized if I took 4 used toothbrushes and cleaned them 4 different ways then the toothbrush I cleaned with hydrogen peroxide would kill the most bacteria, In my experiment, I brought all of my materials to school to get ready for the experiment. I then prepared 8 nutrient agar plates for my first trial. I brushed my teeth 4 different days. after the 4 days, I let them each sit for 5 days. After the 5 days, I swabbed each of the toothbrushes and labeled them to the corresponding Petri dishes. I then used my methods for 2 minutes each and then rinsed them off. I wait until they were dry then swabbed them with the new corresponding plates. I waited for them to grow bacteria and recorded them in a data table. I did this with 3 trial and averaged them to see which killed the most bacteria. This killed lurking bacteria.

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

CB MI

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

237

Fair Category

L8

Project Number

2510

Title: Forest Fire simulator: Affecting plant growth

Student Name(s): A. Morquecho

Abstract:

Some forest fires are helpful and other forest fires can be harmful to the environment. People ask firefighters to start a fire to clear the area, but weather can cause forest fires in different ways, dry underbrush can make a forest fire from the temperature and other sorts of ways. My question is, how can the amount of time of a forest fire affect the soil for a plant to grow? To solve the question, 5 plant pots will be used for planting, one with just soil that won't be affected by burning of wood, other plant pots will have soil that has been affected by burning, each pot will increase by 5 mins of burning for each potted plant, the fifth plant will have wood burnt for 25 mins. Once burned, 1 bean seed will be planted in each pot and will wait for 1 week of how much the bean grows. Through the days the plants haven't sprouted, but on the 7th day they've sprouted out, only five have sprouted, the day after the rest have sprouted, but one was still emerging. On the eighth day, they've all grown more than 1 centimeter in two days. From plant #1 to plant #5, they've grown at least 3 cm's tall. It shows that when the soil gets burned the least amount of time they'll be able to gain back its nutrition and grow taller than before.

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

PS EA EM

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

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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

L8

Project Number

2511

Title: Organisms in an Ecosystem

Student Name(s): A. Almeida

Abstract:

I'm April Almeida & my project is called Organisms in an Ecosystem. My experiment is based on ecosystems & especially water & its chemicals. I'm testing ecosystems in tap & spring water to see how big of a change there would be in my plants, elodea, because of both waters. I used ecosystemic plant Elodea during this procedure. But what is Elodea? It is a genus 6 plant in the "waterweeds" category. This is the plant I'll be working with. The question in my project is - which water will work the best? Tap -- which has many chemicals & salts, or spring -- only filtered through? My results came out to the Spring water winning. Before placing the Elodea in the Spring water, the weight was 33 grams. After three weeks, it was 37 grams. With the Tap, before placing Elodea in the water, was 34 grams. After, it was 36 grams. The Spring water grew 4 grams in the Spring water, while the Tap grew only 2. My project was based on ecosystems & how they would change in different waters. Many people believe that tap water is bad, which is true, but still drink & use it for living purposes (drinking, planting, pets). My project is for them to see how bad it is to use tap water with anything by demonstrating an ecosystemic plant. Thank you!

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

EM EV PS

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

164

Fair Category

L8

Project Number

2512

Title: Stunted Growth: How Do Cell phones Affect Plant Growth and Can Certain Materials Prevent It?

Student Name(s): B. Hyland

Abstract:

The purpose of this experiment was to see if there is a relationship between direct contact with cell phone radiation and the growth of plants and if certain types of barriers placed between the plants and radiation might have an impact on the effect of the radiation. The research question was: Does styrofoam, wood and metal barriers placed between a Petri Dish filled with seeds and soil have the ability to interfere with cellular radiation and how it affects the growth of the seeds and plants. My hypothesis was that the introduction of these barriers would limit the effect of radiation on the plants. After conducting the experiment, it was determined that all three barriers did limit the effect of the radiation to some degree, with wood and metal being the most preventative. The results support my hypothesis that barriers would limit effects of cell phone radiation. If you want to grow many strong and tall plants, keep them in a cell free zone!

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

PS 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

227

Fair Category

L8

Project Number

2513

Title: The Effects of Digestion on Sugary Drinks

Student Name(s): C. Tucker

Abstract:

For my science fair project, I investigated which drink would have the highest glucose concentration level after enzyme invertase was added. The invertase represented the digestive process that happens in our body by breaking down sucrose into glucose and fructose. This project is important because it would help people with Type 2 diabetes know what drinks are safe to consume. I tested Diet Coke, Coke, Arizona Iced Tea, Gatorade, and Monster Energy. Out of these drinks I thought that the Monster Energy would have the highest glucose level. I put 15 mL of each drink into a cup labeled with its name. Then, I used glucose testing strips to measure the amount of glucose in the drinks before the invertase was added. I added .5 mL of the invertase to each drink and waited 25 minutes. I then used the glucose testing strips again to get the new glucose concentration level. I compared my results to see which drink had the highest glucose level. I found that my hypothesis was not supported and it was the Arizona Iced Tea that had the highest glucose level. The Iced Tea had 2%, Gatorade had .25%, Monster had 1%, Coke had 1% and Diet Coke had 0%. This shows that Diet Coke would be the safest option for people with diabetes and Arizona Iced Tea would be the most harmful.

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

219

Fair Category

L8

Project Number

2514

Title: Bloom of Doom

Student Name(s): M. Seaman

Abstract:

The goal of the experiment "Bloom of Doom" is to determine an environmentally safe solution for uncontrollable algal blooms in Candlewood Lake. The algae forms clumps called algal blooms that can sometimes be toxic to humans and aquatic life. Unfortunately, beaches are often closed due to outbreaks of algae caused by excessive amounts of nutrients in the water. I conducted a survey and found that recreational activities on Candlewood Lake is important to those surveyed. Therefore, an experiment was conducted to show that nutrients can be reduced without using harmful chemicals. In this experiment a piece of equipment, called an algae scrubber, was built. An algae scrubber is used to reduce and/or remove nutrients from a body of water. I collected nutrient rich water from Candlewood Lake. Heaters were used to mimic the temperature of the lake in summer. Lights, connected to electronic timers, were used to mimic the sunrise and sunset. Over a period of nineteen days using a submersible water pump, nutrient rich water was filtered through the algae scrubber. Initial measurements showed that nitrates weren't present however 0.04 ppm of phosphates were present. Each week measurements were taken until the phosphates were no longer present. The objectives of this experiment were achieved because the nutrients were successfully reduced and eventually eliminated using the algae scrubber.

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

EV 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

172

Fair Category

L8

Project Number

2515

Title: Germs Germs Everywhere

Student Name(s): s. hatton

Abstract:

My project was done by comparing the amount of germs found on the stuff we touch on a daily basis. The testing was done by obtaining samples from a lift button, computer keyboard, nurses doorknob, and a toilet handle. The purpose is to compare the amount of germs found in the places we touch.

Why should care about my project is now it shows why hand washing is necessary to prevent the spread of bacteria. My hypothesis that the elevator button and the keyboard would have the most bacteria. My teacher prepared 4 petri dishes, one was serving as the control. I tested the following surfaces, toilet handle, nurse's office door handle, computer keyboard, and the elevator call button. Each area was swabbed and then spread onto each labelled petri dish. The petri dishes were then placed in the science room incubator for 48 hours. My results showed that the computer keyboard had the most bacteria growth, followed by the nurse's door. My hypothesis was partially proven as a result of my experiment.

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

ME MI

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

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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

2516

Title: Got Your Back

Student Name(s): E. Ruccio

Abstract:

Scoliosis is a condition wherein the spine curves, rotates, or collapses, affecting three out of every one hundred people worldwide. In many scoliosis cases X-rays are taken of the patient's spine with as little as three months between each, exposing the patient to enormous amounts of potentially harmful radiation. The other options for treatment, surgery and bracing, are just as, if not more costly. To help solve this issue, I started looking at other technologies to detect and monitor scoliosis curvature. Infrared radiation is a technology that is able to reveal soft tissue. I theorized that it might allow me to view an outline of the soft tissue surrounding the spine, which would have curved with it as the scoliosis developed. In order to conduct the experiment, I borrowed a Near Infrared ("NIR") camera from my school, and tested different variables with it. Reflectors of some sort can be used to reduce scattering and focus the Infrared, so I tried using mirrors and different types of tape, along with a NIR heating lamp. The results were better than I had expected, as the camera I used was not built specifically to reduce scattering. With different combinations and individual isolation of variables I was able to achieve effective results. In several cases a vague outline of the spine was present in my images. In the future, this could be applied to an invention I am working on that will use non-invasive and harmless technology in order to detect scoliosis curvature.

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

EN EE ME

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

237

Fair Category

L8

Project Number

2517

Title: Music Therapy APPLIED

Student Name(s): E. Woei

Abstract:

For the 2018 STREAMS Fair, I created an app to help music therapists and their patients, including those who cannot afford non-medicinal approaches for pain management due to conflicts with insurance or other issues. To design and code my app, I am using AppInventor 2, a program created by MIT to benefit young coders interested in computer science, as well as amateurs of all ages. Overall, my project's result was very strong, as I met my criteria by creating an original, helpful, and functional app with multiple features. The app has three useful features, which includes one to listen to relaxing music, one to focus on meditation techniques, and one to record what was done during an appointment. In the future, my main aspiration is to keep improving my app and create one that is even more useful. Some of my ideas include adding a feature for playing virtual instruments, and also to make the app more accessible for the vision and hearing impaired. I also hope to be able to test my app with music therapists from leading hospitals, as well as other patients who are not using formal music therapy to manage pain or stress. With my project, I created an app that benefits music therapists, their patients, and patients who cannot afford proper care. My app is original, helpful, and functional, and has multiple features to provide a well-rounded source of care.

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

CS ME BE

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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

151

Fair Category

L8

Project Number

2518

Title: Study of Chicken Hierarchy

Student Name(s): A. Cho

Abstract:

The purpose of this experiment was to understand chicken's actions and if these actions apply to a hierarchy. Because chickens have a distinct communication among them, I wondered if their actions could be a way to also communicate their thoughts and who is better than the other. My hypothesis stated, if chickens demonstrate commanding or harsh actions to other chickens, there is an established hierarchy among the chickens. For my project, I choose four chickens that were the same age to do my observations on. During my observations, I spent five days designing a pecking order from their habits and actions towards each other. In conclusion, after recording my observations and creating a hierarchy for the four tested chickens, there was a distinct pecking order. This shows that chickens communicate with each other with more than just squaks. Their actions demonstrate leaders and who is the strongest out of the group.

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

BE 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

249

Fair Category

L8

Project Number

2519

Title: The Effect of Cleaning Solutions on Bacteria that Grows on Cell Phones

Student Name(s): M. Gordon

Abstract:

Cellphones are one of the most used technological objects across the world. This, provides that, many cellphones, are dirty as they are not often cleaned. The purpose was to find bacteria on different phones and the alternatives to eliminate the bacteria. It was first hypothesized that phones not regularly cleaned, will have more bacteria living and on it than phones that are. It was then hypothesized that different solutions will have different outcomes to the amount of bacteria killed. Three cell phones and nutrient agar plates were swabbed. Each phone was then cleaned with different solutions such as an ultraviolet sterilizer, homemade cleaning solution, and purell disinfectant wipes. Each phone as well as agar plates was then swabbed again. All plates were placed into an incubator.

The second hypothesis was correct as all phones had a different amount of bacterial growth after they were cleaned. The first hypothesis provided that the phone almost never cleaned would be extremely dirty which was correct. The phone that was regularly cleaned had some bacteria on it, and the phone sometimes cleaned had the least amount of bacteria.

It was concluded that, each cleaning solution had a different effect on the phone it cleaned. The best cleaning method was the disinfectant wipe as it cleaned the most bacteria off of the dirtiest phone. It was also concluded that despite being constantly cleaned, an often cleaned phone may not be the cleanest as, the method of cleaning may add bacteria to the cell phone.

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):

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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

2520

Title: What Effect does Common Water Pollutants Have on Daphnia Pulex heart rate

Student Name(s): P. Seiler

Abstract:

When you wash your car, the soap that is used gets into the sewer and eventually into underground water, streams, and brooks. When you throw something in the trash, it ends up in landfills. Eventually, the garbage and soap runoff get into the drinking water and oceans. If you use city water, you might be drinking polluted water. In this project, Daphnia was used. Daphnia is a common water creature that lives in freshwater. The common water pollutants that were used were car soaps, plant fertilizers, and sediment. First the Daphnias were separated into four containers of water. A different pollutant was added to three of the containers. The fourth container was the control group, and had no pollutants added to the water. The data that was received was not surprising. Most of the Daphnia that was put in the soap water died. The heart rate for the sediment-water was 59 beats per 15 seconds. The heart rate for the Daphnia in the fertilizer was 71 beats per 15 seconds. The control Daphnia had a heartbeat of 43 beats per 15 seconds. In conclusion, all the Daphnia in the container to which car soap was added died. It was determined from the data that common water pollutants kill and greatly stress the Daphnia. And through deduction are probably worse for the drinking water. Maybe you should think twice about where you throw your trash and wash your car. Do you really need to wash your car there?

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

MI EA 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

127

Fair Category

L8

Project Number

2521

Title: Design and Testing of a Chitin-Based Filter for the Bio-remediation of Nitrates

Student Name(s): M. LaBanca

Abstract:

The research question in this project was, what type of Chitin shell (lobster, crab, shrimp) and what type of filter design will best remove nitrogen from water? Using spectrophotometry, it was determined that lobster shells worked best to remove nitrates (approximately 70%), more so when they had more time to interact with the water. Second, a PVC filter was designed and created to test chitin crustacean shells as a filtration method. Adding sand to the chitin filter increased nitrates removal (53%) likely because sand slowed down the water flow as it ran through the filter. This would give the chitin more time to interact with the nitrates in water. Chitin might be a promising method in the future to remove amounts of nitrates from heavily contaminated areas.

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

EV 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

201

Fair Category

L8

Project Number

2523

Title: The effectiveness different diets have for reducing heart disease factors.

Student Name(s): L. O'Neil

Abstract:

On average, about 610,000 people die each year of heart disease alone, and over 30% of men and women are obese, once again, only in the U.S. To no longer be obese, generally, people go on diets in conjunction with exercising. There are hundreds of different diets and lifestyles each with their own rules, all of them claiming to lower the risk of diseases, heart, or otherwise.

The purpose of this investigation is to evaluate the effectiveness different diets have on limiting risks of heart disease. Specifically, this project aims to answer the question: Which diets are better for losing weight and decreasing the risk of heart disease? To answer the question, an analysis of existing research papers was conducted. Such sources include the American Heart Association, U.S. Library of Medicine, etc. To lower the risk of heart disease, the diet would have to lower the test subjects' cholesterol and blood pressure. The conclusion drawn from this analysis was that diets low in carbohydrates and red meats, while high in fruits, vegetables, and whole grains. Within the three diets studied, Atkins, Plant-based, and Zone, the Plant-based was most effective for weight loss and lowering the risk of heart disease.

**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

246

Fair Category

L8

Project
Number

2524

Title: Gases and Beverages

Student Name(s): I. Seara

Abstract:

My project is called Gases and Beverages. What I am testing is, how does the amount of gas that is produced in a certain type of beverage affect your stomach? For my experiment, I got four empty water bottles and poured an equal amount of each beverage into each bottle. Each bottle had a different beverage. I used Dr Pepper, Ginger Ale, fruit punch, and orange juice. Then I poured three teaspoons of vinegar into each bottle to represent your stomach's acid. Next, I placed a deflated balloon on top of each bottle. I warmed up a pot filled with four cups of water. Once it was at about 165 degrees Fahrenheit, I put all four bottles in it and placed the pot on a cool stove top. After the balloons stopped growing, I measured the width of each balloon by placing a pencil on each side of the balloon and using a measuring tape to measure the space in between. I conducted four trials. The average width of the Ginger Ale was 4.6 centimeters, Dr Pepper was 3.8, fruit punch 3.2, orange juice 3.3. My hypothesis was proven, because the balloon attached to the bottle with Ginger Ale grew the most. If the balloon is filled up more than the others, then it affects your stomach the most, because it produces more gas. I can conclude that Ginger Ale affects your stomach the most by producing the most gas and causing you to burp more.

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

271

Fair Category

L8

Project Number

2525

Title: The Use of Chemical/Natural Substances on Apple Cider

Student Name(s): M. Mathew

Abstract:

The results of chemical preservatives on food preservation have been concluded to extend the shelf life of food. However, there is still a puzzle on how chemical preservatives affect the human body in long term. By answering how the use of natural/chemical preservatives affect the shelf life of natural (unpasteurized) apple cider, it allows disclosure on understanding components of a preservative that can be a strength in sustaining the life of food. To understand this topic, an investigation was held with sodium propionate (3% solution), cinnamon (3% solution), sodium benzoate (3% solution), and citric acid (3% solution) by being implemented on apple cider to test the preservatives strength. In the matter of 3 trials by utilizing pour plates to analyze bacterial growth with serial dilutions (10^0 , 10^{-2} , 10^{-3} , 10^{-4} , and 10^{-5}), results came through in the control (10^0 - 449, 10^{-2} - 2912, 10^0 - 832, 10^{-4} - 41, 10^{-5} - 1, 10^0 - 4432), sodium benzoate (10^{-5} -0, 10^{-4} -912, 10^{-3} - 29 (more bacterial growth), 10^{-2} - 23), sodium propionate (10^{-4} - 12, 10^{-5} -3, 10^{-2} - 16 [more bacterial growth], 10^{-3} - 0), citric acid (10^{-5} - 6, 10^{-4} - 15, 10^{-2} -16 [more bacterial growth], 10^{-3} - 25, and cinnamon (10^{-5} - 1, 10^{-4} - 203, 10^{-2} - 15 [more bacterial growth], 10^{-3} - 11). With these results, it supports that natural and chemical substances have an equal amount of strength in preservation. Cinnamon and citric preserved in a natural way, meaning that when using natural preservation regularly, it will maintain the life of food efficiently like chemical preservatives but it will also be healthy.

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

MI CB

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

149

Fair Category

L8

Project Number

2526

Title: Wifi harmful or harmless

Student Name(s): O. Tuccinardi

Abstract:

For my project I experimented to see if a wifi router is harmful to plants. I thought, based on my research that when the seeds are placed next to a Wifi router it would stunt its growth. To test my hypothesis, I placed two trays, with alfalfa seeds in one and Cress seeds in the other, in a room where they were exposed to Wifi radiation. I also placed two trays with the same and put them in a room where they were not exposed to Wifi radiation. I gave each the same amount of sunlight and water over a course of 12 days. I observed the changes everyday. At the end of the experiment, I determined that the Wifi router did not affect the plant as much as I thought it would. The seeds exposed to radiation and the seeds not exposed to radiation grew about the same.

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

180

Fair Category

L8

Project
Number

2527

Title: How distance from compost affects the soil nutrient levels

Student Name(s): A. Tripp

Abstract:

In this experiment, the effect of distance from a compost source on soil nutrient levels was compared and tested. The purpose of this experiment was to see if location of compost makes any impact on the soil composition around it. Composting is supposed to be great for the environment, and make the soil surrounding it healthier and more fertile. Samples at different locations around a compost bin and in a compost pile were taken. Measurements of pH, nitrogen, phosphorus, and potassium levels were compared in order to draw conclusions on which areas were producing the healthiest soil. After collecting data, the results showed that the farther away from the compost bin, the less concentrated the nutrients tended to be. This occurred because the nutrients leach out of the compost bin and stay relatively close to the source. In the compost pile, nutrients tended to be uniform because there was a relatively even spread of compost throughout. Anyone who is an environmental advocate or owns a farm or piece of land that contains a compost source would benefit from these results.

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

EV EM

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

254

Fair Category

L8

Project Number

2528

Title: Saving Crops from Cold Snaps – The Effect of Gamma-Aminobutyric Acid (GABA) on Freeze Tolerance in Wheatgrass

Student Name(s): G. Flynn

Abstract:

Freeze events or “cold snaps” following milder than average winter temperatures can devastate crops, resulting in billions of dollars in agricultural losses and other economic consequences. Gamma-Aminobutyric Acid (GABA), a non-protein amino acid, has been shown to mitigate salt and drought damage to plants. The purpose of this experiment was to test if a solution containing 0.05% GABA could protect plants from cold snap damage.

The experiment tested if wheatgrass plants exposed to a GABA solution would survive a cold snap and keep growing afterwards. Wheatgrass was used for its quick germination. The experiment used a six-hour exposure to cold in a -14 degree Celsius freezer to simulate a cold snap. Three four-pot trials were watered twice daily with 20ml of untreated water or a GABA solution. Two control groups “A” (watered with untreated water) and “B” (watered with the GABA solution) were not exposed to freezing temperatures. Group “C” plants (watered with untreated water) and group “D” plants (watered with a GABA solution) were exposed to a cold snap. Plant height and other observations were recorded twice daily for seven days. The results of the three trials proved the hypothesis that plants treated with GABA will survive a cold snap and continue to grow. After the freeze, “C” group plants (watered with untreated water) withered an average total of -4 centimeters or -0.70 centimeters per day, while “D” group plants (watered with a GABA solution) continued to grow an average total of 4.5 centimeters or 0.32 centimeters per day.

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

PS EM BI

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

L8

Project Number

2529

Title: The Effects of Microwave Rays on Life

Student Name(s): W. Doran

Abstract:

My experiment was to test if microwave rays would have a specific effect on different life forms. I chose this experiment because I wondered if microwave rays could be harmful to life. At first, I thought that direct exposure to microwave rays would have a lethal effect on life like marigold and basil plants, along with yeast. Yeast has reactivity with water, one of its chemical properties. I thought that exposure to microwave rays would slow down this reactivity. I conducted this experiment in two parts. For the first part, I microwaved the seeds of basil and marigold plants for different times. Afterwards, I potted them and observed their growth for over two months, from 23 September to 1 December. I measured the number of stems and height in each plant. Part two involved microwaving packets of fast-rise yeast for different times, and dumping them in equal amounts of water. Over 75 minutes, I recorded observations of the yeast rising. In the experiment, I found mixed results. Some things did not agree with my hypothesis. In conclusion, I have found in this experiment that some living things are affected by microwave rays differently. This experiment was a success in the sense that results were found, but a failure, due to an incorrect hypothesis. Not all living things suffered under the microwave rays. If I were to change my experiment, I would try doing either only plants or a full diversity, with samples from different types of non-animal life forms.

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

PS

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- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

5. 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

L8

Project Number

2531

Title: The Effects of X-ray Radiation on the Growth of Radish Seeds

Student Name(s): C. O'Keefe

Abstract:

This experiment attempts to discover if X-ray radiation has an effect on the growth of radish seeds. I choose this experiment because of a previous experiment I conducted in which I researched the effects of X-ray radiation on yeast and I wanted to see if I would get similar results using radish seeds. The experiment was completed by X-raying four packets of radish seeds with different amounts of X-ray radiation. One packet of seeds was not exposed to X-ray radiation this was the control group. In this experiment the other controlled variables were the amount of sunlight, water, and heat each group received.

The independent variable was the amount of X-ray radiation delivered to the radish seeds. Each grouping of radish seeds received a pre-determined amount of X-ray radiation.

There were two dependent variables the first was the seed germination rate. The germination rate was the amount of time for the radish seed to break through the surface of the soil. Germination rate is measured in days. The second dependent variable was plant height. Plant height was measured in centimeters. Measurements for plant height were taken once a week for four weeks.

My results indicate that all seeds appeared to germinate at the same rate. The seeds that received higher doses of radiation grew more.

My conclusion is that the radish seeds that received the greater amounts of radiation grow consistently more. This is a similar result to what I received when using yeast.

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

178

Fair Category

L8

Project
Number

2532

Title: The Invisible Enemy That Kills

Student Name(s): J. Atehortua

Abstract:

I chose to do this project to raise awareness about the importance of the air quality in the life of the living things. Now that from it the behavior and the health of them in the everyday life depend on it. This is why it is necessary to make aware the human beings about the effect air quality has on their life. And this is the only way we all contribute to the decrease of the contamination of the world in which we all live in. I examined the Air Quality in 3 cities taking the average of each one over the course of two months. I researched the effects Air Quality has on people and the how the sources affect the amount of pollution we breathe. And I found it doesn't just affect the physical aspect but the mental aspect as well. I think the only way to decrease this issue which will also help Global warming is to talk to governmental leaders to make a mechanism to decrease the effect it has on our human lives.

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):

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

5. 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

L8

Project
Number

2533

Title: Metabolic Touch

Student Name(s): K. Natarajan

Abstract:

The research question was which component of Metabolic Syndrome correlates with Sensory Neuropathy. Metabolic Syndrome is a cluster of 5 disorders; high levels of triglyceride (natural body fats/oils), fasting glucose(blood sugar), systolic and diastolic (blood pressure), abdominal obesity and low levels of HDL Cholesterol. Blood drawing was required for some of the disorders, so to eliminate drawing blood, we measure triglyceride and low HDL Cholesterol with the body fat percentage, fasting glucose with BMI. Blood pressure was measured using a standard blood pressure monitor and abdominal obesity was measured with a measuring tape. The sensitivity was measured with a reusable monofilament. My hypothesis was that people who have an increased body fat percentage are more prone to sensory neuropathy. This happens because an increased body fat percentage leads to chronic inflammation, and sensory neuropathy is driven by this. First, I measured the BF% and BMI using a body fat analyzer, blood pressure standard form, and abdominal obesity with a measuring tape in inches. The total number of people tested was 31;22 with metabolic syndrome; 9 without. Analyzing the data, I found that there was no correlation between metabolic syndrome and sensory neuropathy. However, there was an indirect correlation between abdominal obesity and the sensitivity of the person's skin. This makes logical sense because abdominal obesity occurs when there is insulin resistance, which happens in Diabetes and sensory neuropathy and Diabetes are directly correlated with each other.

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

244

Fair Category

L8

Project Number

2534

Title: The Effect of Bacteriophage on E.coli Bacteria

Student Name(s): K. Krishnamurthy

Abstract:

Antibiotic resistance is a problem when it comes to fighting bacterial infections. In past years, the likelihood of resistance developing in a bacterial strain has increased. As doctors and scientists have mainly relied on antibiotics to combat bacteria, concerns arise when the use of antibiotics can become problematic. The research project that was conducted evaluated the use of a bacteriophage virus in inhibiting E.coli growth. If any were found successful, they could be used as alternatives to antibiotics. It was hypothesized that if different dilutions of bacteriophage were applied to E.coli, the most concentrated dilution would kill the bacteria most effectively. Five broth dilution tubes were pipetted with broth dilution; one was labeled control and the concentration of the other four decreased by 90% as they were pipetted. The phage dilutions were then poured on top of E.coli colonies grown in agar plates. The plates were placed in an incubator until a countable number of plaques existed on each. As expected, the plate labeled "Control" remained clear. The plate labeled "10-6" had three plaques. Upwards of 60 plaques were counted on the "10-7" plate, more than 85 on the "10-8", and more than 200 plaques on the plate labeled "10-9." The data indicated that the higher concentration of phage killed the bacteria more effectively, proving the hypothesis correct. The next study would be to test safety limits of bacteriophage treatment in order to confirm phage as a valid way to combat E.coli bacterial infections.

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

235

Fair Category

L8

Project Number

2535

Title: How Pigments Leaf The Plant: Leaf Chromatography And Growing Basil Indoors

Student Name(s): P. Kindblom

Abstract:

Over the course of about seven weeks, I grew four basil plants indoors, each under a different color light: red, green, blue, and sunlight. I made sure all of the plants received the same amount of water and light. After the weeks were done, I took basil leaves and ground them up with isopropyl alcohol and used a coffee filter to absorb the pigments. I waited five minutes, checked on and charted the progress, waited another five minutes, and so on. I found that the green light and sunlight plants produced the most and tallest plants, while the red light grew a lot of short plants, and the blue light grew about half as many as the green. I determined that the pigments of the leaves with two different colors of coffee filters: white and brown. The pigments did show on both filters, but they were more visible on the white filter, because it was so light which allowed the pigmentation to stand out more. There were only two visible pigments on the filter: green and yellow-orange. I have concluded that green light will grow your plants the same way as sunlight would and that blue lights will stunt the growth and production of leaves. Finding the pigments took much longer than expected. It was said to take anywhere from 15-30 minutes, and it took about five hours for the results to appear completely.

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):

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

5. 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

L8

Project Number

2536

Title: Seed Germination With Different Liquid

Student Name(s): I. Patrick-Oliveira

Abstract:

I chose to do this project because growing up, my family and I grew a lot of plants that took quite some time to grow. The work I did in my project found different ways to grow plants not only taller, but quicker with different liquid solutions such as lemon juice, salt water, sugar water, and my constant distilled water, which can affect daily lives of those who study and or are interested in plants and wildlife. The hypothesis that I investigated was how different liquids effected a plants growth. My inference was that the plant fed sugar water would live to be the tallest, and the plant fed salt water would die quicker from dehydration. To conduct my experiment, I took 4 clear plastic containers, divided potting soil equally among them, and then made a small crater from the surface of the soil. I then planted 4 bean seeds into each container and sprayed each plant daily with their assigned liquid solution. By the third day was when I finally obtained answers. My hypothesis was proven. The plant fed the sugar water lived to be the tallest, and the plant fed the salt water ended up dying first. The tallest plant was 8 inches tall, and the shortest plant was the plant fed the salt water which died.

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

PS 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

237

Fair Category

L8

Project Number

2537

Title: Transforming Trash Into Treasure: A Sustainable Approach To Oil Spill Cleanup

Student Name(s): K. Kathir

Abstract:

Oil spill cleanup is a colossal and pressing problem in our world today. About 1.5 million gallons of oil are spilled each year and millions of dollars are spent to cleanup the spilled oil. These spills also harm marine animals and pollute drinking water. Due to these detrimental environmental effects, cleaning up oil spill is imperative. Finding an effective method to combat these oil spills will greatly reduce the amount of damage and the cost of oil spill cleanup. The aim of this project was to test natural sorbents' oil retention under different conditions. The plant based biodegradable sorbents such as salvinia minima and milkweed were tested. The hypothesis was that milkweed fibers would be more effective for oil spill cleanup due to its hydrophobic, oleophilic nature and its tubular structure than salvinia minima. The sorbents' retentions were tested and compared in fresh water and salt water. In addition, milkweed was tested for recovery and reusability by recovering the adsorbed oil using a vacuum filter unit. Results from this study indicate that milkweed was a more effective sorbent than salvinia minima and could be reused multiple times. Milkweed is a biomass that has 'super power' of cleaning up oil spill up to 40 times of its weight. Hopefully, the results from this study will help to find an eco-friendly and cost effective solution for oil spill cleanup using natural, biodegradable sorbents that can preserve the world.

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

EM 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

224

Fair Category

L8

Project
Number

2538

Title: The Impact of Antibacterial Soap on Daphnia Magna: Implications for the Environment

Student Name(s): A. Lichtenberg

Abstract:

Antibacterial soap has been shown to be toxic to the environment. Historically, triclosan, an organic compound, was used in antibacterial soap, but it has fallen out of favor and the FDA banned it in hand soap in 2017, but is still available in clinical settings. Benzalkonium chloride, an organic salt, has replaced it in many consumer antibacterial soaps. In this experiment, the impact of triclosan, benzalkonium chloride, and non antibacterial soap has been tested to see the toxicity of these chemicals on Daphnia Magna, an invertebrate that lives in ponds and is a good barometer of how chemicals impact the environment. Daphnia Magna were added to solutions containing either 5 % of antibacterial soap which contained triclosan as the active ingredient, antibacterial soap with benzalkonium chloride as the active ingredient, non-antibacterial soap with no active ingredient or a no soap condition. Both types of antibacterial soap killed the daphnia magna on average within a minute from each other. The antibacterial soap killed the daphnia magna faster than the soap with no active ingredient. No Daphnia Magna died in the condition where no soap was added. The results imply that the bacterial soap with Benzalkonium chloride is just as bad as triclosan which is a banned ingredient and both were toxic to the daphnia magna. The implications of antibacterial soaps on the environment are discussed.

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

EM 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

175

Fair Category

L8

Project Number

2539

Title: Erosion Commotion

Student Name(s): E. Quinn

Abstract:

Preventing erosion is important because erosion leads to loss of landforms, reduced soil quality, degraded farmlands, dangerous landslides and water pollution. For my project, I wanted to determine which natural cover is best for preventing erosion. I wanted to use materials that naturally blend in with the surrounding environment because they look better than artificial materials. I designed and built a test apparatus consisting of four rain gutters filled with soil tilted at an angle representing a slope of a hill. I covered them with several naturally available coverings, poured a liter of water over them with a flower watering can, and collected the soil that ran off. One of the trials only included soil, without a covering, which was my "control." The runoff soil was placed in the oven to evaporate moisture and weighed. The data collected showed that the order of most effective to least effective coverings was: Leaves, Moss, Stones, Wood Chips, Plants, Bare Soil, and lastly, Sand. By using the best natural coverings identified, erosion can be reduced and nearly eliminated.

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

EM EA 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

148

Fair Category

LS

Project Number

3001

Title: Effect of Weather Patterns on Migraines

Student Name(s): J. Cayer

Abstract:

get migraines almost daily, and have been for two years. However, I have yet to find a cause for them. The purpose of this experiment was to investigate whether or not weather has an effect on my migraines. A Raspberry Pi mini computer was programmed to collect weather data, including temperature, humidity, and barometric/atmospheric pressure from the WeatherUnderground database. I tracked my migraines using the app Migraine Buddy on my phone. The start and end time, severity, intervention/medication taken, start location, and any other notes/circumstances were tracked. Twelve tracked migraines were analyzed, and ten of them showed that there was a drop in humidity sometime in the 24 hours prior to the start of the headache. The drop was not always the same time before the headache, nor was the significance of the drop. There was no other visible correlation between the weather and migraines.

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

ME EA 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

249

Fair Category

LS

Project Number

3002

Title: Thermal Optimization of Nutrient Levels in Vermicomposting Leachate and Soil with Eisenia Fetida

Student Name(s): R. Wagner

Abstract:

Societies worldwide depend on agricultural bases for economic and population sustenance, emphasizing crop cultivation's importance. However, rising temperatures make fertile soil scarce. Because of increased temperature, augmented decomposition has led to severe leaching in biomes like tropical rainforests. The resulting soil lacks limiting nutrients nitrogen and phosphorus (Lehmann, J., and G. Schroth, 2003).

This research sought to determine temperature's impact on leachate quantity and nutrient levels, hopefully restoring collected nutrients to soil. This research suggests alternative methods of reinstating nutrient levels in inadequate soil and ideal temperatures to optimize soil nutrients for ecosystem and societal health. Eisenia Fetida decomposed vermicompost. After collecting leachate, noting quantity and temperature, a dilution was performed. A colorimeter quantified chemical levels for phosphorus, nitrogen, and baseline samples. Insoluble phosphorus showed virtually no presence in leachate, regardless of temperature. Nitrogen deviated from baseline though without statistical significance in regards to temperature. This suggests NO₂⁻, NO₃⁻, NH₄⁺ didn't easily dissolve into leachate. However, this experiment correlated (0.47), with statistical significance, temperature and leachate quantity.

This experiment sought to discover P and N in soil due to absence in leachate. Phosphorus' precipitation tendencies lowered leachate presence. Samples from different soil levels were taken and tested at Connecticut Agricultural Experiment Station with a Morgan Test. The results showed high levels of NO₃⁻ and very high levels of P at 20°C in the mature vermicompost (CAES, 2018), suggesting nitrates and phosphates haven't leached at this temperature. More tests are needed to understand temperature's effect on these high nutrient levels.

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):

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

5. 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

3003

Title: Modeling Origin Of Blood Via Patterns In Stain

Student Name(s): A. DeGunia

Abstract:

Bloodstain pattern analysis has been used in criminal investigations for more than 100 years. Analysis has been made faster through methods of measuring bloodstain patterns. However, since the dawn of forensic science, the basic principles of the analysis and the conclusions drawn have not changed. In this study, simulated blood was used to determine the effect of height and angle on blood spatter size and dimension. Height measurements ranged from 20 -160 cm. Angular measurements were completed at four different measurements. Blood droplets were completed triplicate (n=3) and mean blood diameter was calculated. The shape of the resulting blood spatter was recorded. After the data is analyzed it is very easy to see the relationship between the height and angle and how it affects the pattern of the stain. As the height increases the diameter of blood does as well. As the angle increases, the diameter of the stain also increases. When the simulated blood is dropped from 60 cm and a 90° angle it formed a circular stain with a diameter of 13 cm. When the blood fell from a height of 160cm and from a 20° the diameter of the stain was 40 cm and the pattern was very elongated. This shows a strong relationship between the height and the angle blood falls and how it affects the pattern and diameter. In summary, this study supports past research and can be used in criminal investigations and other forensic studies to determine the height and angle of blood spatter.

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

ME 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

250

Fair Category

LS

Project Number

3004

Title: Observing the reaction of Naegleria Fowleri, alias the Brain Eating Amoeba's augmentation subsequent to being stirred with the conglomeration of colluvium sediment attained in a body of fresh water.

Student Name(s): R. Vipparla

Abstract:

The purpose of this experiment is to observe which type of colluvium sediment in a body of freshwater best restrains the maturation process of Naegleria Fowleri. Prior to starting my project, I hypothesized that the sedimentation which will result in the least augmentation of the Naegleria Fowleri is gravel. In order to begin my project I needed to collect three colluvium sediment samples that made the most frequent appearances in fresh bodies of water. Mixing these samples with the amoeba proteus, I simulated a lake environment by combining them with warm water, as Naegleria fowleri is a thermophilic organism. Using 1 ml droppers, I placed water under a microscope to observe the number of amoeba shown in the sample taken from the simulation. The objective of this project is to observe which sediment type results in a significantly less amount of amoeba when tested under a microscope, in order to prove that the sedimentation has an impact on the growth of Naegleria Fowleri. However, after completing the experiment, I learned that my hypothesis was incorrect and the mud led the least growth in the amoeba. While the mud showed the least amount of amoeba present, one amoeba shown, the gravel also had a significantly less amount as well, 3 amoeba on the slide. However, the sand sedimentation had the highest amoeba rate with 11 amoeba in the sample. based on the experiment I can conclude that mud is the safest colluvium sediment and restrains the augmentation of Naegleria fowleri the best.

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

MI EV CB

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

LS

Project Number

3005

Title: Combating Food Deserts with Urban Agriculture:
The Effect of Greenhouse Conditions on Seed Production and Bean Yield

Student Name(s): J. Lee

Abstract:

This study seeks to find a model plant that will produce the highest yield of food in the shortest amount of time to combat the occurrence of food deserts in densely populated cities. 52 different bean varieties were planted and observed for 16 weeks at UC Berkeley's Ecology Department's Oxford Tract. All seed varieties were planted and stored in a greenhouse at 18° C for 10 days and watered twice daily. On week 2 the plants were then transplanted into Oxford Tract for the remaining 12 weeks. Seed yield and potential seed production was calculated by using the following equations:

Seed Yield = Number of Seeds x Avg Mass of Seed

Seed Production = Avg Pods/Plant x Avg Seeds/Pods.

The greatest potential seed production was Mountaineer White with an average of 404.24 seeds per plant. The greatest potential mass production was Hopi Dry with an average of 122.27g of potential food per plant. The plant with a combined high potential mass (average of 115.77 g) and high seed production (average 235.72 seeds), was Lima Jackson Wonder bean. The best bean candidates were Hopi Dry (greatest mass production), Mountaineer White (greatest seed production), and Lima Jackson Wonder bean (best combined mass and seed production). These three beans will feed the most people, in the shortest amount of time, at the lowest possible price. Future studies should improve on this investigation by increasing the amount of available land and testing beans from different regions in the world.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

238

Fair Category

LS

Project Number

3006

Title: Creation of a Screening Tool for Assessing Baseball Pitching Biomechanics

Student Name(s): C. Vernal

Abstract:

One of the most common injuries in baseball pitchers is a tear of the ulnar collateral ligament (UCL), which can sideline a player for at least a full season. Previous studies have identified biomechanical flaws in the pitching motion that contribute to UCL injury. A scoring system, the Baseball Pitching Analysis Tool (BPAT), was created to evaluate baseball pitching biomechanics in relation to UCL injury risk. The purpose of this study is to evaluate the reliability and validity of the BPAT in identifying UCL injury risk. Using YouTube and Google, twenty videos of collegiate and professional pitchers were found. Ten had suffered UCL tears and ten remained healthy. Two raters, blinded to the injury status of the pitchers, evaluated the pitching mechanics of each pitcher on two occasions one week apart using the video analysis application, Hudl Technique, and the BPAT. Rater 1 demonstrated excellent reliability, while Rater 2 demonstrated moderate reliability. For both sessions, interrater agreement demonstrated moderate reliability. However, the Mann-Whitney U Test and ROC Curves demonstrated the BPAT cannot discriminate between injured and uninjured players. Because of this, despite its reliability, the BPAT cannot be recommended as a screening tool for UCL injury risk at this time. Future research includes analyzing each scoring system item and, based on the results, making changes to the BPAT in order to improve the validity of the tool, along with conducting a study with a larger sample size.

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

161

Fair Category

LS

Project Number

3007

Title: A Meta-Analysis of Polymorphisms in the Genomes of Breast Cancer Patients

Student Name(s): A. Smith

Abstract:

Bioinformatics uses computational algorithms to collect and analyze complex biological data such as genetic code. The use of these technologies is becoming more prevalent, as their purposes become more widespread. Breast cancer is the most prevalent cancer type for women, and one of the leading causes of death among women in developed countries. Most often breast cancer cases are not detected until stage 2 or higher, but with the increase of bioinformatic technologies, this has the potential to change. My experiment addressed the issue of earlier detection of breast cancer, through genetic screening with a meta-analysis of single nucleotide polymorphisms in the genomes of breast cancer patients. The experiment was conducted by compiling data and research and on polymorphisms in breast cancer patients and looking for trends among the genome sequences. Based on the meta-analysis of the data available on breast cancer genomes, certain polymorphisms are more commonly mutated in different racial groups of females affected by breast cancer.

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

CB CS BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

255

Fair Category

LS

Project Number

3009

Title: Comparing Biofilm Formation on Naturally Occurring Antimicrobial Nanostructures from *Squalus acanthias*, *Cicadidae* sp., and *Nelumbo nucifera*

Student Name(s): M. Dobosz

Abstract:

Infections acquired in hospitals around the world pose an evolving challenge to medical professionals everywhere. Nosocomial infections, or infections originating in a hospital, often appear on surgical sites, regions damaged by burns, and temporary entryways to the body such as catheters. *Escherichia coli*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* are just a few of the many bacteria that colonize in these vulnerable places (P.A. Lambert, 2002)(M.U. Rasheed et al.2014)(S. Chang, 2003). Advancements in nanostructures and biomimicry are inspiring novelty engineered surfaces to stop the spread of resistant bacteria. Shark scales, cicada wings, and lotus leaves are just a few biological structures that have nanoscale mechanisms with which they inhibit biofilm adherence and penetration. This experiment was conducted using non pathogenic bacteria species with similar behavior to those causing nosocomial infections. *P.putida*, *S. epidermidis*, and *E.Coli* were isolated and lawn streaked on a nutrient agar plates along with an organic sample type. Each sample was imaged before and after bacterial exposure using the Phenom ProX microscope. This revealed, in some capacity, how effectively they avoid bacterial adhesion and the progression of the biofilm. It was hypothesized that the cicada wings would be the most effective at preventing bacterial adherence because of their nanopillars which destroy particles with shear stress forces(T.Diu et.al, 2014). This study's preliminary data shows that the shark skin was the most effective at preventing bacterial adhesion and penetration. These qualitative observations and conclusions will be supported by future work using desiccation methods to better quantify the bacteria growth on each sample type.

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

198

Fair Category

LS

Project
Number

3010

Title: Teen generations
Stress levels and its sources

Student Name(s): D. Hernandez

Abstract:

The purpose of this lab is to find out what sources of stress existed for teens one or two decades ago, what are the sources of teens stress now, and how have the stress levels changed because of it. It was hypothesized that if the generations of teens from one or two decades ago did not have as much access to the internet or electronics therefore having their stress and anxiety levels lower than the teens today. This would result due the rise of the internet, electronics, and all the social media that are so common today, increasing the stress sources that are causing this generation's high stress and anxiety levels. To confirm this idea there was a survey distributed, based on five stress areas including the internet, school, family, relationships and school. The surveys were created for two different groups of ages of test subjects from ages 12-19 and from 20-30 in both english and spanish. The survey subjects that had more points were the subjects that had more stress and those who had less points were the subjects who had less stress. In conclusion the hypothesis was determined to be unsupported because the results did not .

Technical Disciplines Selected by the Student
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BE 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

247

Fair Category

LS

Project Number

3011

Title: The effects of multiple bloodmeal induced apoptosis on midgut basal lamina integrity on *Aedes aegypti* mosquitoes.

Student Name(s): A. Menta

Abstract:

Arthropod borne arboviruses are the cause of significant morbidity worldwide. After mosquitoes take an infectious bloodmeal it enters the gut and replicates within the midgut epithelial cells and eventually escapes the gut through the virus-impermeable basal lamina, but the mechanisms used to escape are still unknown. Therefore, we hypothesized that bloodmeal induced apoptosis compromises the integrity of the basal lamina, facilitating virus escape. This hypothesis pursued two sub aims, the first determined if multiple blood meals alter basal lamina integrity. The independent variable was the different feeding backgrounds, and the dependent variable was the integrity of the basal lamina. Basal lamina midguts were dissected and put into glutaraldehyde solutions, OsO4 buffer, and degraded through an ethanol series and then imaged using an scanning electron microscope. Sub aim two determined if bloodmeal induced apoptosis causes breaks in the basal lamina. The independent variable was the induction or inhibition of apoptosis and the dependent variable was the integrity of the basal lamina. The inhibitor (AeIAP) and initiator (AeDronc) genes were suppressed using RNA interference by intrathoracically injecting individual mosquitoes with dsRNA. A non-specific gene, such as the bacterial encoded lacZ gene served as a control. It is hypothesized that if apoptosis is induced then the basal lamina will be compromised. SEM images have shown that multiple bloodmeals increase virus escape and data shows that bloodmeal acquisition increases permeability of the BL with more “breaks”. Also shown is the prevalence of basal lamina breaks when apoptosis is induced.

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

EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

209

Fair Category

LS

Project
Number

3012

Title: The Stimulation of the Capitae Peg Neuron A in Mosquito Larvae

Student Name(s): N. Oickle, N. Oickle

Abstract:

The purpose of this experiment is to determine the allurement capabilities of cyclopentanone on mosquito larvae, and the effectivity of cyclopentanone at stimulating the Capitae Peg Neuron A. The experiment was conducted using 100%, 50%, and 25% cyclopentanone solutions with distilled water as a control. The mosquito larvae were exposed to 10 drops of the solutions and their presence before and after the drops was measured. The control showed that the initial drop of the liquid frightened the mosquito larvae, so the allurement capabilities were best determined by the number of mosquitoes that returned to the site after the drop. With the control the number of mosquitoes that returned after the initial drop decreased with an average allurement percentage of -67%. With the 25% solution the average percentage of mosquitoes allured was 333%. The 50% solution had an average allurement percentage of 417%, proving to be most effective. I concluded that the 100% solution over-stimulated the larvae's neurons and as a result no movement was detected, with an average allurement percentage of 0%. The results of this experiment could provide a possible luring system for mosquito larvae into a chemical trap to rid the environment from mosquitoes while decreasing the spread of poison or insecticide to other animals.

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

AS BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project
Number

3013

Title: The Decline of Fraxinus americana as a Result of Ca⁺²/Mg⁺² Depletion in Soil Composition

Student Name(s): S. Mullin

Abstract:

White ash tree, Fraxinus Americana, has shown significant rapid decline in the past several years due to the invasive emerald ash borer (EAB) beetle. The ash trees resistance mechanisms and photosynthesis can possibly be linked to Ca⁺²/Mg⁺² for functionality, specifically the secondary phloem, which is the feeding substrate for the invasive EAB. Extreme weather conditions due to climate change have been shown to contribute to deficiencies in the soil nutrients required to maintain a healthy line of defense in the bark. These important cations were studied to determine the availability in trees located in Redding, CT. Soil from various trees with different levels of drainage was analyzed via colorimetric assays for concentrations of Ca⁺²/Mg⁺² and compared to their vigor (determined by quality of the leaf canopies, the condition of the bark and branches, epicormic sprouting, and bark damage). Analysis of the canopies, bark, and extreme weather in relationship to the presence (or lack thereof) of Ca⁺²/Mg⁺² indicates the overall ability of this tree to come back from decline. Therefore, if the ash tree's ability to maintain its defenses and nourishment hinges on its utilization of Ca⁺²/Mg⁺², possible efforts for remediation of these trees might involve enriching the content of these nutrients in their soil. Otherwise, the failing ash population will continue to drop considerably, putting a dent in the overall tree population in the U.S. that may eventually not be able to be recovered from.

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

EV CH 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

220

Fair Category

LS

Project Number

3014

Title: The Effect of Light Intensity on Planarian Regeneration

Student Name(s): J. Statchen

Abstract:

The purpose of this experiment was to identify the optimal light conditions for planarian regeneration. Planarians maintain a large number of neoblasts, or pluripotent stem cells, throughout their lifespan allowing individuals to regenerate completely from almost any damage sustained. Changes in environmental stressors, such as light conditions on planarians was tested by cutting individuals into three pieces and placing half of the resulting body tissues into a pitch-dark environment and the other half into a light environment (approx. 5,000 lumens). After two weeks planarians were observed in order to determine how many segments regenerated into new organisms. Data showed that in the light environment 43.3% of body segments regenerated whereas in the dark environment 60% of segments regenerated. Planarian neoblasts function using similar molecular and chemical processes that allow for somatic stem cell growth in vertebrates. My results support the use of planarian models coupled with advancements in molecular biology in the development of stem cells and gene therapy. Scientists are interested in how regeneration occurs both at a gross structural and genetic level. The study of how light affects the regeneration of planarians applies very much to the research of stem cells because it lends itself to understanding the optimal conditions for artificial growing conditions, making planarians and their stems cells more accessible to people who need them.

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

AS 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

251

Fair Category

LS

Project Number

3015

Title: Investigating the Efficacy of Selenium and Manganese for Controlling Pneumococcal Infections

Student Name(s): A. Narayanan

Abstract:

Streptococcus pneumoniae is a pathogen in children, causing infections of ear, lungs and the brain. Globally S. pneumoniae causes one million deaths in children annually. S. pneumoniae colonizes the nasal cavity, where it attaches to epithelial cells and spreads to the ear causing infection, or through bronchi disseminates to the lungs, resulting in pneumonia. Although antibiotics are used for treating S. pneumoniae, emergence of resistance to most of the antibiotics has been reported. Thus, there is a need for effective strategies for controlling S. pneumoniae infections. Since ability of S. pneumoniae to colonize host tissue is a pre-requisite for successful infection, my research determined the efficacy of two essential minerals, manganese and selenium for controlling bacterial colonization in nasal, middle ear and bronchial epithelial cells. Human nasal and bronchial cells and murine middle ear epithelial cells were inoculated with S. pneumoniae in the presence and absence of sub-inhibitory (SIC) and minimal inhibitory concentration (MIC) of selenium and manganese. S. pneumoniae attachment and invasion of above cells was determined. Additionally, the effect of selenium and manganese on transcription of S. pneumoniae genes required for infection was studied using real-time PCR. Both minerals significantly decreased S. pneumoniae attachment and invasion of epithelial cells of the nostril, ear and respiratory tract ($P < 0.05$). Moreover, selenium and manganese downregulated S. pneumoniae genes necessary for infection in the host ($P < 0.05$). Collectively, results indicate that selenium and manganese could be used for controlling S. pneumoniae infection, but follow up animal studies are needed.

Technical Disciplines Selected by the Student
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MI ME AS

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- Yes No

CSEF Official Abstract and Certification

Word Count

241

Fair Category

LS

Project Number

3016

Title: Finding and Comparing the Ethanol Yield of Connecticut Invasive Plant Species

Student Name(s): G. McGonagle

Abstract:

Invasive plant species are currently recognized as a possible source of biofuel. While these species can damage the environment, economy, and public health, the consumption of these species could reduce or eliminate harmful plants to the ecology, replace the use of beneficial plants (medicinal plants and crops) for biofuel production, and provide an alternative energy source. This study assesses the efficacy of CT invasive plant species (bamboo and spearmint) and corn in biofuel production to understand whether invasive plant species should be considered in the production of biofuels. Each plant was finely chopped, crushed, processed, and denatured enzymatically. Yeast was added and the plant mixtures were fermented at 30-32 oC for 3 days. The plant matter was then removed to stop the reaction. Finally, 100 mL of each plant mixture was fractionally distilled to extract the ethanol. Density was measured to confirm that the substance was ethanol. Bamboo was shown to have the purest and highest ethanol yield (1.6 mL), followed by Spearmint (.8 mL) and Corn (2.3 mL) had a density of .97, indicating water was also present. This data indicates that invasive plant species could be effective as a viable source of biofuel. To improve this study, future tests will include using Paper Chromatography to observe impurities in addition to the measurement of density. Also, azeotrope distillation equipment would be more effective in the separation and would better account for the positive azeotrope created by the ethanol-water mixtures.

Technical Disciplines Selected by the Student
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EV CH PS

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CSEF Official Abstract and Certification

Word Count

233

Fair Category

LS

Project
Number

3017

Title: Can probiotic yeast be used to decrease the severity of type 2 diabetes symptoms in a drosophila melanogaster disease model?

Student Name(s): G. Roche

Abstract:

Type 2 Diabetes is the most common type of diabetes. It causes blood glucose levels to be higher because the glucose is not being brought into cells from the blood. This happens because the body cannot use insulin properly. Recently, a *D. melanogaster* model of Type 2 diabetes was developed based on feeding flies a high carbohydrate diet. There is evidence that the gut microbiota play a large role in the development and severity of this disease, either by altering food metabolism or signalling pathways.

The purpose of my experiment was to determine if the probiotic yeast, *S. boulardii*, can decrease symptoms in flies raised on a high carbohydrate compared to the flies who were not fed probiotics. This was measured based on free glucose and fecundity assays. Diabetic flies are known to have higher free glucose concentrations and lay fewer eggs compared to flies raised on control food. We found that the *S. boulardii* treatment helped increase the fecundity in the diabetic flies over 400% and decreased the free glucose concentration by approximately 18%. We did not observe any effect of *S. boulardii* treatment in flies raised on control food. Thus demonstrating that the *S. boulardii* treatment helped decrease the severity of Type 2 Diabetes symptoms in this disease model. Future studies will investigate the effect of *S. boulardii* on other symptoms and explore its use in treating Type 2 diabetic humans.

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

ME MI BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

252

Fair Category

LS

Project Number

3018

Title: Testing the Effectiveness of Various Shading Materials on Mock Leatherback Sea Turtle Nests

Student Name(s): A. Colao

Abstract:

Leatherback sea turtles are a critically endangered species in the eastern Pacific, especially due to climate change. When sand temperatures increase above 29.5 degrees Celsius, the hatchlings produced are predominantly female due to an enzyme aromatase in the egg causing testosterone to change to estrogen. To decrease sand temperatures to increase males hatching, I implemented shading structures on Penfield Beach in Fairfield, CT. I tested four materials: agricultural plastic, biodegradable plastic, burlap, and palm fronds. I stapled the materials around and on top of the four wooden stakes, which were hammered into the sand over the mock. I buried three tennis balls in the nest 75cm deep. I attached a thermometer to twine and buried it along with the balls. I conducted the experiment over two days, recording the temperatures every two hours from 8am to 6pm. I tested the permeability of the plots by pouring two liters of water on each material. I dug into the sand and measured with a ruler how deep the moisture reached, compared to the control. Palm fronds were most effective in maintaining a low sand temperature of 29°C. They let in the most water after the control. The control plot with no shading material yielded a temperature of 37°C by the end of the day. Results were favorable because palm fronds are in high abundance in the eastern Pacific and thus a cost-effective strategy to shade sea turtle nests, particularly at man-made turtle nesting hatcheries where humans constantly monitor the site.

**Technical Disciplines Selected by the Student
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EM EV

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- Yes No

CSEF Official Abstract and Certification

Word Count

222

Fair Category

LS

Project
Number

3019

Title: Spice It Up: The Use of Turmeric to Preserve Milk

Student Name(s): S. Montazer

Abstract:

The special committee of the United Nations is always talking about providing affordable and reliable energy in the near future. Yet, as the remaining population who lack the conveniences that come with electric power, such as refrigeration, await these improvements, what are they to do? This study investigates whether the popular household spice, turmeric, truly has antibacterial properties that can preserve a common source of nutrition, milk, without refrigeration. Whole milk was used as the test bed. Turmeric powder and turmeric extract powder (from capsules) were used in an experimental setup that was observed during three-hour intervals. Whole milk, not containing any powder, was used as a control. The amount of time it took for the milk concentrations to spoil was the dependent variable. The solutions containing 0.02 grams of turmeric powder or turmeric extract powder averaged to last approximately 6 hours longer than the control, while the solutions containing 0.04 grams of the powders averaged to last around 8 hours longer than the control. This study helped to prove that turmeric slows the rate of bacteria growth, and that one of its main ingredients, curcumin, has a major role in this unique antibacterial property. Based on the findings of this experiment, the use of turmeric, to limit food waste or to preserve nutritious foods, such as milk, is highly recommended.

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

249

Fair Category

LS

Project
Number

3020

Title: The Effects of Coffee Extracts on Viable Cells of Staphylococcus Epidermidis Biofilm Colonies

Student Name(s): B. Koenigsberg

Abstract:

Bacterial biofilms are an emergent form of bacterial growth, forming in dense aggregates and adhering to surfaces, ranging from internal human tissue to surfaces of medically implanted devices such as prosthetics or intravenous needles. They are bound by a self produced extracellular matrix, which provides its structure and protection against host immune response and many antimicrobial agents. Medical devices such as catheters and intravenous needles are particularly susceptible to these biofilms, and approximately 60-70% of nosocomial infections arise from biofilms. Increasingly resistant to antibiotics and other conventional treatments, these biofilms are difficult to remove from such devices and go on to harm immunocompromised patients. One line of research has focused on plants as a source of alternative antimicrobials, specifically, secondary metabolites. In this study, Coffea Arabica, most commonly known as coffee, containing the secondary metabolite caffeine, was investigated for its effects against Staphylococcus Epidermidis biofilms. Two experimental groups were studied: Coffee, brewed at the ratio suggested by the manufacturer, and coffee extract. Biofilms were grown for 48 hours, in the presence of either brewed coffee or coffee extract. After the 48 hour incubation period, the biofilms were resuspended and diluted using 10-fold dilutions to obtain discrete colony forming units per milliliter. Preliminary analysis of the CFU's of brewed coffee and controls indicate that for brewed coffee biofilms, the viable cell counts decreased by 48.06% from the control at a dilution factor of 10-5. This data indicates that brewed coffee may be an effective inhibitor of Staph. Epi. biofilms.

**Technical Disciplines Selected by the Student
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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

248

Fair Category

LS

Project Number

3022

Title: THE DEFINITION OF THE MEDITERRANEAN-STYLE DIET AND STANDARD MEANS TO MEASURE ADHERENCE

Student Name(s): J. Mikolaitis

Abstract:

The Mediterranean diet (MD) is proven to be an effective diet pattern to combat detrimental health problems such as obesity and metabolic syndrome. However, promotion and execution of the MD have been limited due to discrepancies over specific definitions of the diet, and a lack of consensus on effective measures of diet adherence.

This project aims to create a universal definition and measurement of adherence to the MD. Preliminary literature was systematically analyzed to perform a review. A protocol was developed to extract information regarding methods utilized in determining adherence to the diet and each researcher's MD definition based on several predetermined variables including specific food groups, serving size and macronutrient percentages. The systematic review showed that the MD can be widely defined by high consumption of fruits, vegetables, and seafood, and an emphasis on fats from olive oil as opposed to red meat. Whole grains, nuts, legumes, and red wine were mentioned in the literature, although not consistently, and the literature did not mention eggs or fruit in relation to dessert consumption. To measure compliance with the diet, the majority of studies utilized non-standardized food-frequency questionnaires and/or a food journals with dietary counseling, which could not yield generalizable results on effectiveness.

While a more extensive literature will be conducted, these preliminary results act as a foundation for future studies to explore benefits of a more standard MD. The newly defined diet may be implemented in regions facing major health problems and lacking nutritional guidelines.

**Technical Disciplines Selected by the Student
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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

250

Fair Category

LS

Project
Number

3023

Title: Human-Human Interface: The Effect of Using Different Nerves on Involuntary Movement.

Student Name(s): S. Nair

Abstract:

Understanding involuntary movement can lead to breakthroughs, especially in the field of prosthetics. In the Human-Human Interface experiment by the BackYard Brains, two test subjects are controlled by electrodes such that the voluntary movement of the “controller” is converted into a stimulus that triggers involuntary movement in the “controlled” subject. The controller has an extra electrode on the back of their hand. The electrode sets are connected by wires to a TENS (Transcutaneous Electrical Nerve Stimulation) device. The TENS device interprets the electrical impulses being sent from one person and transmits them to the other one. When the TENS device is on, if the controller moves their wrist, the other person’s wrist involuntarily moves.

This investigation was centralized around the idea of involuntary movement occurring in different parts of the body, specifically, the popliteal fossa nerve (located at the back of the knee). Electrodes were set immediately below the back of the knee for both participants. The controller had an extra electrode above the back of the knee. The TENS device was turned on and the intensity was increased until the threshold was surpassed and involuntary movement occurred. The process was repeated 4-5 times with each pair of subjects. The result, as predicted, showed successful movement occurring in all trials. The minimum amplitude needed and the extent to which the leg moved varied from participant to participant. A future endeavor regarding this research can include an investigation on ankle size and its effect on the extent of involuntary movement.

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

250

Fair Category

LS

Project Number

3024

Title: The Effect of Misophonia on Selective Attention Control

Student Name(s): H. Rappaport

Abstract:

Misophonia is a newly-recognized disorder where sufferers react to specific everyday sounds (trigger sounds) in a similar way to the 'fight or flight' response. This study looked into whether these reactions are due to deficiencies in attention control or conditioning as for danger sounds. It was hypothesized that misophonics and control participants would perform equally well in attention tasks and that misophonic participants would have similar reactions between trigger and danger sounds. This study focused on selective auditory attention using one baseline trial of a binaural listening task with a passage and no other sounds and three trials with a sound set (control, danger, or trigger) and a passage. Participants were told to focus on the passage. The Galvanic Skin Response (GSR) test was used to measure emotional arousal and was a proxy for attention to the sounds. Attention control was measured through scoring of WIAT listening comprehension tests (attention to the passage) and analysis of sound questionnaires (attention to the sounds). It was found that people with misophonia did not vary from the control group in their listening comprehension, however they reacted more strongly to trigger and danger sounds based on the GSR data. If it is shown that misophonics do not have a deficit in attention control or salience, other roots of misophonia in the brain should be researched. As approved therapy methods for misophonia are lacking, this study may contribute to knowledge on the basis of misophonia to be able to develop more targeted therapy methods.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

128

Fair Category

LS

Project
Number

3025

Title: The Effect of Dopamine on Zebrafish Embryo Biological and Social Development.

Student Name(s): R. Nowinski

Abstract:

In many vertebrates, such as zebrafish (*Danio rerio*), dopamine serves as a very important neurotransmitter in the brain. Dopamine is responsible for many functions including positive reinforcement. Therefore increasing or decreasing amount of dopamine that zebrafish are exposed to could have effects on their biological development and their social development. What is the effect of increasing dopamine on zebrafish embryo development? With the guidance of my advisor, Dr. Aramli, 0 mg/mL, 5 mg/mL, 10 mg/mL, and 15 mg/mL of dopamine will be added to zebrafish embryos. Morphological observations and activity of embryos will be observed and documented over a period of 6.5 days. Based on these results a better understanding of the effects of dopamine on the activity of developing organisms will be gained.

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

BI AS 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

175

Fair Category

LS

Project Number

3026

Title: Low to Zero Cost Water Filtration Using Common Fungi

Student Name(s): A. Boudreau

Abstract:

Mushroom mycelia has been attempted to be used to clean water of pollutants and bacteria. White bottom mushroom mycelia was purchased and placed in burlap bags with hay and coffee grounds. A Brita filter was also used as a separate filtration method. Water from the Naugatuck and Mill Rivers was collected and tested for nitrites, nitrates, phosphates, and coliform bacteria. I hypothesized that the fungus mycelia filter will do a better job at purifying the water of contaminants and bacteria than the Brita filter. Once the initial tests results were gathered, I filtered the 2 river waters. One liter of the Naugatuck River water was passed through the Brita filter. A second liter of Naugatuck River water was passed through the mycelia filter. The same technique was also used for the Mill River water. Once the water was collected in a clean container, the same tests were again performed. In the end my hypothesis was proven, the mycelia filter did in fact clear the water of both bacteria and contaminants better than the Brita filter.

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

152

Fair Category

LS

Project Number

3030

Title: The Effect of the Influenza Virus in a Computer Simulation on Different Family Structures and Age Groups

Student Name(s): I. Benson-Clarke

Abstract:

This experiment addresses the problem of whether or not family structure has an impact on the spread of the influenza virus. The hypothesis was that if certain family structures are then the results will show the most effective way to vaccinate the population because the program used measures the effect of family structure on the spread of the influenza virus. This experiment is implemented through the use of a computer program. The program, written in python, was designed for this experiment to be an accurate way to determine the effect of the influenza virus. Every possible family type possible was inputted into this program accounting for parents, grandparents and up to six children. Each family member was accounted for with either a one or a zero. If they exist for the particular family structure being tested, they are put in as a one, if not a zero is used in their place

**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

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- Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

LS

Project Number

3031

Title: Amplifying Heat Shock Protein Expression in Glycine max for Cross Protection Against Substandard Growing Conditions

Student Name(s): E. O'Keefe

Abstract:

In previous studies it has been shown that Heat Shock Proteins (HSPs) have a cross protection characteristic for conditions such as high salinity, heavy metals, and anoxic conditions. HSP expression expands the capability of plants to grow in general substandard growing environments; however, this project focused on extraterrestrial agriculture. Load capacity on missions to space is limited; eliminating the need to bring Earth soil into space would significantly reduce the weight. This experiment is testing the effect of four different treatments on Glycine max, soybeans. HSP expression was stimulated through a two hour 40°C water bath. The four experimentation groups were planted under a grow light that operated on a 14 hour cycle. Samples were collected from each plant and run through a protein electrophoresis to determine HSP expression. The protein electrophoresis showed distinctly different bands in the 20, 30, and 70 kilodalton range. A significant increase was observed in the survival rate of the plants grown in Martian regolith from the non shock, 62.5%, to the heat shocked group, 87.5%. No change was observed within the control Earth soil test groups. In both soil types the growth rate was increased after heat shocking. The growth rate in Martian regolith increased 15.12% while the Earth soil had an increase of 19.70%. Testing using Fourier-Transform Infrared Spectroscopy verified the differences in chemical components within the soil samples. More research is necessary to determine the effect of utilizing fertilizers in addition to the heat shocking protocol.

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

BI PS 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

232

Fair Category

LS

Project
Number

3032

Title: Plants With Cognitive Retention and the Inner Workings of Memory

Student Name(s): E. Heaphy

Abstract:

The way in which the plant realm functions and behaves has always been a mystery to the scientific community. Until a few years ago, the inner workings of a plant and the 'code' which directs these plants in how to function was mostly unknown. However, in 2015, Dr. Monica Gagliano discovered plants have a way of learning, through her observations of the Mimosa Pudica plant, more commonly known as the sensitive plant. This project will further investigate her work and make new connections between plant cognitive retention and the human brain, allowing a better understanding of plants as living organisms. The human brain is made up of billions of neurons which are not found in plants. These neurons are vital for the complex storage of memories in humans. It is possible that, in plants, these instincts are a result of chemicals found in the plant or an even more complex system. For example, during the experimental process, when a loud noise was played without a base or vibration, the Mimosa leaves did not close like they do in response to touch. This suggests that touch is the only sense these plants have. Using this knowledge, along with detailed research, the scientific world will come closer to understanding a plant's experience of its world. If it is possible to train plants, then it might possible to improve agriculture or do further lab experiments.

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

PS EV MI

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

267

Fair Category

LS

Project
Number

3033

Title: Localized Tkv Degradation Mechanism Maintains Germline Stem Cell and Gonialblast Populations in Drosophila Testes

Student Name(s): S. Ladyzhets

Abstract:

Drosophila germline stem cells (GSCs) divide asymmetrically to produce one GSC (stem cell self-renewal) and one differentiating gonialblast (GB differentiation). Overabundant GSCs could cause cancerous tumor formation, while insufficient GSCs could promote tissue degeneration. Thus, asymmetric GSC division is crucial for maintaining healthy tissue. GSC self-renewal requires activation of Decapentaplegic (Dpp) ligand secreted by neighboring niche (hub) cells. Dpp receptor Thickveins (Tkv) localizes to GSC microtubule-based (MT) nanotubes. MT-nanotubes protrude into hub cells and facilitate Dpp signal reception. Since Tkv receptor amount remains minimal in GSCs, even during gene overexpression, I decided to investigate the mechanism of Tkv protein degradation as a means of preventing signal overactivation and GB non-differentiation, which leads to tumor formation. My preliminary study demonstrated that preventing MT-nanotube formation increases Tkv concentration within GSCs. Additionally, I often observed that Tkv transfers over MT-nanotubes into hub cells and associates with hub cell lysosomes. Therefore, I hypothesize that GSCs utilize an unconventional MT-nanotube-mediated mechanism of Tkv protein degradation within neighboring cells, instead of own cells (as in other cell types). I found that hub lysosomes, rather than GSC lysosomes, are responsible for Tkv degradation. Tkv-containing vesicle transfer from MT-nanotubes to hub cells is dependent on Smurf-mediated ubiquitination. Furthermore, preventing MT-nanotube formation caused a GSC-like tumor, which indicates that signal specificity is impaired. Taken together, I propose that this novel mechanism of membrane-protein degradation contributes to the short-range nature of niche-stem-cell signaling. These findings create a more complete pathway of Tkv degradation and strengthen understanding of GSC division.

Technical Disciplines Selected by the Student
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CB 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project Number

3034

Title: Genetic Mechanisms Regulating Expression of Tor and EGFR Genes in Eusocial and Primitively Social Insects

Student Name(s): M. Clarkin

Abstract:

The topic of convergent evolution concerning insect sociality questions whether or not organisms of similar social complexity evolved in the same way. My research explores the genetic regulatory mechanisms that have influenced the social development of bees and ants in the order Hymenoptera.

This research analyzes differences and similarities in transcription factor binding sites within the promoter regions of the target of rapamycin (Tor) and epidermal growth factor receptor (EGFR) genes in various bee and ant species. These two genes are key to cell growth and development, and depending on their regulation, an organism may lose or gain phenotypic plasticity.

More complex social insects show division of labor and the formation of distinct behavioral subcastes that have distinguishable physical characteristics. Greater flexibility with physical morphologies is thus a characteristic of socially complex insects, whose distinct categories and responsibilities within a colony cause all members to rely on one another. Potential physical morphologies, impacted by regulation of Tor and EGFR, include leg size, ovary size, and even the development of pollen baskets, which are exclusively seen on the legs of worker bees.

My mentor and I retrieved the DNA sequences of the Tor and EGFR promoter regions of ants and bees that were highly social, semi-social, or primitively social, then created alignments to see where the DNA sequences were similar and different. We further analyzed the DNA sequences to find transcription factor binding site motifs that would help illuminate how each insect's Tor and EGFR regions are regulated.

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

CB 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

253

Fair Category

LS

Project
Number

3035

Title: Autonomously Killing Cancerous Cells by the Detection of up to Single Nucleotide Mutations

Student Name(s): C. Marino

Abstract:

One of the most challenging aspects of cancer, from a medical perspective, is that every cancer is different on the molecular level. However, in every type of cancer there is always a mutation which will mark the difference between a healthy and tumorigenic cell in the patient. The purpose of this research was to design a system which could exploit this fact by selectively killing cells which contain any specific mRNA sequence. This was achieved by cutting the core of a 9DB1 deoxyribozyme and adding two more binding arms at the ends of each cut. This allows any nucleic acid sequence of choice to behave like an allosteric activator whose T_m value can be calculated to allow for single base affinity. When the 9DB1 complex forms on this regulatory sequence, it is made to ligate a polyadenylated, protein-coding RNA to a 5'-7-methylguanosine capped RNA. In this way, the protein cannot be translated in vivo without the RNA having first been ligated. In a clinical trial, this resulting protein would be used to kill the cell. However, in order to prove the system functional, the system was designed to target telomerase mRNA and selectively translate green fluorescent protein (GFP). This system was then transfected into HeLa cells and IMR90 cells where fluorescence was only observed in cells containing the targeted region of the telomerase mRNA. This shows that the system is capable of selectively killing targeted cells, as another protein could be used in place of GFP to kill the cell.

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

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

LS

Project
Number

3036

Title: Development of a Mucin Based Biomedical Adhesive Gel

Student Name(s): B. Duffy

Abstract:

Current medical adhesives demonstrate limited efficacy in scenarios that require it to adhere to biological tissue. The proposed mucin based adhesive gel consists of extracted mucin from *Limax maximus*, iota-carrageenan, and amylose pectin to form a pliable adhesive gel. The adhesive characteristic of the gel was tested using simulated skin with a glycerin base. A dual-range force sensor was used to detect the force required to separate the adhesive from the simulated skin. The shearing adhesive required an average of 0.582 newtons to be separated from the simulated skin when compared to the control, and an average of 0.630 newtons in direct adhesion. Part of the adhesive gel was then removed to make two separate samples, one of which was coated with silver nanoparticles to serve as an antimicrobial agent within the matrix. These samples were tested against the growth of *Escherichia coli* in a petri dish. The adhesive with silver nanoparticles prevented growth of *E. coli*, a zone of inhibition of 320 millimeters, whereas the control petri dish containing the adhesive sample without silver nanoparticles had a zone of inhibition of 1 millimeter. This biomedical adhesive gel demonstrates efficiency in medical applications such as closing wounds, and being the base for skin grafts. Future research will explore other medical applications in which the biomedical adhesive gel could be applied.

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

EN BI 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

221

Fair Category

LS

Project Number

3037

Title: The Functional Impact of RBP2 on Cellular Senescence and Pluripotency in Murine Breast Cancer Cell Lines

Student Name(s): N. Alindogan

Abstract:

Cellular senescence is a newly discovered metabolic state of a cell where a cell reaches its full size and stably exits the cell cycle. This state is the new goal of cancer treatments, because instead of proliferating uncontrollably, senescent cells stop multiplying and secrete proteins that induce senescence in other cells. Because of this secretory phenotype, Dr. Sabine Lang and I made a lentiCRISPRv2 lentiviral delivery mechanism to knock out RBP2, the gene regulator protein strongly correlated with lower tumor free survival rates, to try to induce senescence, turning cancerous cells into regularly metabolizing cells. Using the CRISPR-Cas9 system, we successfully knocked out RBP2 which induced senescence in our cell lines. In doing this knock-out, we created a new in vitro system that eliminates genetic factors that vary between mice and can affect experimental validity. After establishing that RBP2 was eliminated by the sgRNA using western blotting, I used a quantitative polymerase chain reaction to test the differential expression of the RNA of the different genes affected by RBP2 deletion. From this, we were able to conclude that our hypothesis was supported—absence of RBP2 induces senescence in cancer cells and therefore, viral delivery mechanisms containing the gene edit are viable options for future cancer treatment because personalized therapy targeting RBP2 is advantageous to radiation, chemotherapy, and invasive surgery.

**Technical Disciplines Selected by the Student
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ME 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

253

Fair Category

LS

Project Number

3038

Title: Mean Platelet Volume as a Possible Diagnostic Marker for MPN Disorders

Student Name(s): T. Mehta

Abstract:

Myeloproliferative neoplasms (MPNs) are blood cancers in which the bone marrow produces an excessive amount of white blood cells, red blood cells, or platelets. If the diagnosis of this disorder is delayed, this blood cancer could lead to acute leukemia which lowers patient survival considerably as reflected in a 10-year study. Past research has indicated that a high Mean Platelet Volume (MPV) could be a possible diagnostic tool for this disease because a higher MPV signifies that there is an influx of young, immature platelets. To analyze the correlation between MPV and MPNs, this study analyzed 139 blood samples from 86 patients of the three MPN types: polycythemia vera (PV), essential thrombocythemia (ET), and primary myelofibrosis (PMF) with the Cell Dyn 1800 Hematology Analyzer. Using the TI-84 Plus calculator and Analysis Toolpak from Excel 2003, histograms and a T-test were conducted to determine if there was a statistically different MPV value between the MPN and healthy patients. This study also determined whether there were notable differences in the MPV between the three types of MPN patients. The results of this study indicate that the MPV value of PV patients are in the low to normal range (7-10 fL), ET patients in very low range (6-7 fL), and PMF patients in mostly normal range (6-9 fL). This study suggests an inverse correlation between platelet activity of MPN disorder and MPV (more platelets, lower MPV), indicating that MPV value could be a biomarker for MPNs quickening the diagnosis and treatment of them.

Technical Disciplines Selected by the Student
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ME CB 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

174

Fair Category

LS

Project Number

3039

Title: The Effect of pH on Euglena sp. in a Closed Freshwater System

Student Name(s): K. Heard

Abstract:

Carbon emissions have long been documented to have detrimental environmental impacts. Recent climate change studies have tied this carbon loading increasingly to anthropogenic activities. This study aimed to evaluate a potentially even more harmful impact to freshwater micro algae as they are known to sequester this atmospheric carbon, and they provide a critically sensitive base of aquatic ecosystems. This was done by analyzing replicated cultures of Euglena sp. kept at a gradient of environmental pH (4.0, 5.6, and 7.0). These cultures were analyzed at regular intervals for both physiological and behavioral changes. In the end the cultures raised in the most acidic or extreme concentration were dead. The Euglena in the acidic concentration (which was the same pH as the average of acid rain) were showing slight physiological and behavioral changes or differences. The Euglena in the neutral pH or control showed no physiological or behavioral changes or differences. This data suggests that constant and continuous emissions of CO₂ into the atmosphere will have a large effect on a freshwater system and micro algae.

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

EM CB 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

198

Fair Category

LS

Project
Number

3040

Title: A comparative analysis of the efficiencies of hydroponic and aeroponic systems

Student Name(s): W. McLaren

Abstract:

The purpose of this project was to discover if hydroponics or aeroponics would be a better alternative for field farming. It was hypothesized that the aeroponic system would provide a greater yield, use less water and energy and have less pesticides present, and that the hydroponic system would be more sustainable, cost less, taste better, be easier to use and more practical, and have greater root vigor. One of each systems were used to compare the amount of water being used, crop yield, energy used, sustainability, cost, ease to use, and health. This data was taken in accordance with data from certain areas in need of new farming methods. Crops mass were measured each week when the nutrient basin was replaced, the amount of water used was noted each week when the basin was replaced, health was measured with a brix refractometer, and the ease to use factor was objectively observed in each case, and energy used was measured by a power meter plug. Preliminary observations and conclusions show that the aeroponic provides a greater yield, uses less water, energy on a system per plant basis. The aeroponic system was also easier to use and more sustainable.

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

EA EE 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

257

Fair Category

LS

Project Number

3042

Title: Controlled-Release Delivery of Ovarian Anticancer Paclitaxel via Vortex Ring, Donut-Shaped Hydrogels

Student Name(s): E. Philippides

Abstract:

Ovarian cancer affects countless women worldwide. Unfortunately, systemic chemotherapy for treatment of ovarian cancer necessitates one-time super dosing, leading to the onset of severe side effects, and like radiation therapy, causes the destruction of neighboring, healthy cells. A method where chemotherapy is temporarily implanted at the cancer and subsequently time-released would be preferred, to adhere the drug to the tumor, and minimize side effects associated with immediate overdosing. Here, such a device is engineered, via donut-shaped hydrogel vortex rings that are formed and loaded with a chemotherapy agent. Specifically, 750 μ g of paclitaxel (PAC) is dissolved in 1ml aqueous 2% sodium alginate, a droplet of which is then injected into a 5mM CaCl₂ and 95mM MgCl₂ buffer to create a 1mm vortex ring hydrogel, with a 7.5 μ g drug load. Under simulated ovarian conditions, each sticky, PAC-loaded vortex ring steadily releases its chemotherapy, so that 50% is released in 4hours, with up to 5.4 μ g delivered in a maximum of 20hours (72% release), post-application. Simulation of pointed placement of the PL-VRH donuts, their adherence to a cancerous tumor in the ovarian cavity, resistance to movement due to aqueous conditions, and subsequent release of the paclitaxel, was carried out using a porcine intestine membrane model. For delivery of a localized PAC dosage that concurs current IP-injection (342 μ g for a typical 57cm² ovary), it was determined that ~60 hydrogel vortex rings can be directly delivered to the ovarian site via 600 μ l injection of medicated precursor, ensuring direct and extended interaction of the chemotherapy and cancer.

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

5. 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

3043

Title: The Effect of Mushroom Spores on Atmospheric Condensation

Student Name(s): T. Filiato

Abstract:

Several studies have been done to analyze the effect of biological particles on condensation in the atmosphere. The paper Mushrooms as Rainmakers looks into the effect of mushroom spores on droplet formation. The study found evidence that spores act as nuclei for raindrop formation. This project looks to expand on the work in that paper and expand the understanding of mushroom spores and the atmosphere.

The goal of this research is to determine whether spores from mushrooms have a significant impact on the condensation of water. It is expected that spores do have a significant impact on condensation, and that the relationship between spores and weather may affect the climate of many areas of the planet.

First, a mushroom will be placed over a microscope slide in a container to prevent air currents from disrupting the spores. The beakers will be placed in a tank that's ten gallons (38 Liters). Each slide will be placed over a beaker. Each slide will be recorded by a mounted camera. The recordings will take 45 minutes each. The amount of water that forms on each slide will be measured every minute. There are no significant safety risks associated with this project.

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

209

Fair Category

LS

Project Number

3044

Title: Investigation of the Effects of Weak Electric Fields on Bacillus subtilis Biofilm Formation

Student Name(s): A. Bhura

Abstract:

There is a growing health issue of increasingly antibiotic resistant bacteria capable of causing infection. Biofilms composed of resistant bacteria can cause dangerous infections that cannot be easily treated with current methods. Therefore, new non-antibiotic methods to kill biofilms are necessary to circumvent excessive use of antibiotics to prevent further development of antibiotic resistance. This research focuses on using a weak electric field to explore effects on growth and formation of Bacillus subtilis biofilms. A microtiter plate biofilm assay is used to study adhesion of bacteria in forming biofilms through enumeration of bacteria adhered to surface of plates. The biofilm colony assay is used to study cohesion of bacteria during formation and growth stages using poly-carbonate membranes as platforms for bacterial cohesion. The assays are incubated within a parallel-plate capacitor with an electric field of 500 V/m over 5 days for the biofilm colony assay and 48 hours for the microtiter plate assay. Through understanding the effects of weak electric fields on the biofilms, ways to prevent biofilm growth on medical equipment can be developed and new treatments for biofilm infection can be investigated. Further research would be required in investigating the exact mechanism of effect electric fields have on biofilms to fully develop applications.

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

CB ME

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

241

Fair Category

LS

Project Number

3046

Title: deca-pods

Student Name(s): C. Brescia

Abstract:

Atlantic land hermit crabs, *Coenobita clypeatus* along with their relatives are threatened by pollution and a shortage of usable shells. In an attempt to create a solution to the issue of shell shortage in more threatened *Coenobita* populations various artificial shells were created as an attempt to provide supplementary shelter to these populations. The viability of these shells was evaluated through a behavioral experiment testing the shell preference of a “naked” *Coenobita clypeatus* when provided both 3d printed artificial shells of various materials along with shells native to their wild habitat. The crab started the experiment in the wild type shell it was imported with, this shell was then fastened within a clamp and submerged about an inch underwater with the crab still inside. The crab would then be left alone until it exited its shell to avoid drowning. The now shell-less crab would be transferred to a small container with both a native pica shell and a moon snail shell, along with two 3d printed shells. Preliminary testing has indicated that 3d printed shells are preferred with promising acceptance in high density filament among the crabs which were tested, but it is also observed the crabs have tended to migrate back to natural shells after a few days. This means these shell at the very least provided a proper shell for hermit crabs and do serve as a viable option for a crab which would otherwise have no shell.

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

EN 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

248

Fair Category

LS

Project Number

3047

Title: Development of a Migration Model For *Morone saxatilis* Based on Thermal Shifts in Long Island Sound

Student Name(s): C. McGoldrick

Abstract:

Morone saxatilis, Striped Bass, follow a historical migration pattern along the East coast from North Carolina to Maine. Since 1960, average water temperatures of Long Island Sound have risen 5°C impacting the migration patterns. In an effort to predict the environmental impacts of these migration shifts, historical angler survey data has been analyzed to develop a regression model of the migration timing throughout the years. Historical water temperatures have also been correlated to formulate a prediction model of migration as impacted by temperature shifts in Long Island Sound. Based off this model it was found that for every thermal shift of plus 1°C there is a 11.8 day shift in migration timing. To judge the historical accuracy of the model a calculation was used to find the standard of error. It was found that there is a 36% standard of error in the ratio between water temperature and migration timing. This standard of error is strong being as that most standard of errors calculated for meteorology is are between 30% and 50%. After primarily working with the migration timing of *M. saxatilis*, time was taken to see how the rise in water temperatures have affected the health of *M. saxatilis*. More specifically the condition factor of *M. saxatilis* was examined over the years. Using regression analysis, a negative correlation with a correlation coefficient of -0.74 was calculated solidifying evidence that the function of rising water temperatures over time have affected the migration timing and health of *M. saxatilis*.

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

BE AS EA

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

231

Fair Category

LS

Project Number

3048

Title: The Effect of the Altering of the Light-Dark Cycle on the Mass (g) of Leafy Green Algae (*Ulva lactuca*) Eaten by Periwinkle Snails (*Littorina littorea*)

Student Name(s): N. Mongillo

Abstract:

Research shows exposure to artificial light at night blocks the natural light cycle for marine invertebrates, impacting their behavior and biological processes. Also, the natural light cycle determines organisms' activity levels and predation. Therefore, this study examined the effects of artificial light exposure on the mass of leafy green algae eaten by periwinkle snails. It is hypothesized that snails exposed to no artificial light at night will consume the most algae. The independent variable was the time per night that the snails were exposed to artificial light (0 hrs, 4 hrs, 8 hrs, and the whole night). The dependent variable was the mass (g) of algae eaten after the testing period. Fifteen snails were collected per experimental group, and 2 trials were conducted collaboratively with a mentor. Tanks were set up outdoors. Artificial lights on timers were placed in each tank and each automatically shut off after a set number of hours. One gram of algae was blotted dry, massed and placed in each tank. After two weeks, all algae was blotted and massed again. The difference was calculated between the mass before and after the testing period. Results were analyzed using an ANOVA test and supported that there was no difference between experimental groups. Overall, the 8 hour group ate the least while the 4 hour group ate the most. This was different than what was anticipated from other research.

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

AS 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

110

Fair Category

LS

Project Number

3049

Title: Use of Regression Analysis to Predict Future Outbreaks of Malaria

Student Name(s): J. Meindl

Abstract:

The objective of this project was to design a computer program that uses regression analysis and machine learning to predict future malaria risk and find major factors which affect these outcomes. Using various data points from countries around the world, including climate, population, and other general statistics, a computer program was designed using Python. The program used these data sets along with historical malaria cases to analyze which characteristics are the most important in the lead up to malaria outbreak. Using this analysis and the coefficients generated from the machine learning algorithm, future changes to malaria outbreaks were predicted based on potential changes in variables such as temperature and population.

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

239

Fair Category

LS

Project Number

3050

Title: The effect of outside life on school life

Student Name(s): H. Qian

Abstract:

Education plays a large role in any successful person's life. However, what makes someone more successful in school than someone else? What factors outside of school affect a person's performance?

It was hypothesized that a student who stressed over sleep would also perform the best in school because they would lose sleep over studying and school work.

This research was conducted on students from Trumbull High School ranging from 9th to 12th grade. Participants were distributed an academic, 10 multiple-choice test and a questionnaire on top stressors in the subject's life, which were completed to the best of their ability.

The results did not align with the original hypothesis, as 24% of participants who scored 5 or below signified sleep as a top three stressor in their life while 23% of participants who scored 6 or higher also signified sleep as a top three stressor. It was concluded that students attending high school were across the board stressed about sleep rather than only the top performing students. In addition to sleep, low scoring students and high scoring students ranked sports and insecurities among their top three stressors similarly at around 18% and 16% respectively. However, deviations between the two scoring groups occurred in ranking physical health and friends among top three.

There are many recurring trends among both low and high scoring participants, but there are also deviations which may explain why some students perform better than others.

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

226

Fair Category

LS

Project
Number

3051

Title: Regulation of Lemna minor Reactive Oxygen Species through Iodide and Tyrosine Antioxidant Treatments to Maximize Biofuel Yield

Student Name(s): A. Aguilar

Abstract:

Species of Lemnaceae (duckweed) have potential for a biofuel source due to high storages of starch, and when put through a nutrient starvation period starch accumulation is amplified. However, during this starvation period the plant releases reactive oxygen species (ROSs), which can be harmful to macromolecules in large quantities. These ROSs limit the amount of time the plant can be starved, thus plateauing the biofuel potential. It is proposed that iodide and tyrosine treatment can control ROS release and extend the nutrient starvation period, translating to a higher starch accumulation and maximizing the biofuel potential. The reduction of ROSs is quantified through peroxidase analysis. To validate the proposal, the duckweed was put through a 12 day starvation period. The peroxidase activity of the duckweed treated with iodide and tyrosine was .003, while the peroxidase activity of the untreated duckweed was .013. The iodide and tyrosine addition was successfully able to lower the peroxidase activity by 77%, and therefore lower the ROSs substantially as well. The treated duckweed also showed a higher starch accumulation than the untreated duckweed after an 18 day starvation period. The iodide and tyrosine solution was proven to lower the ROSs and maximize duckweed biofuel candidacy. In the future, research should be conducted applying the same methods to Landoltia punctata to investigate lengthening the starvation period and accumulate more starch for biofuel production.

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

ET PS 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

247

Fair Category

LS

Project Number

3052

Title: Cellular Reprogramming to Grow Kidney Tissue: Novel Insights from Computational Biology

Student Name(s): K. Frier

Abstract:

Kidney transplants account for 83% of all waitlisted organ transplant needs, with over 96,000 people queued. In recent years, to meet that demand and avoid allograft rejection of the transplant, growing kidney tissue by re-programming one's own cells has been highly researched. Cellular re-programming through transdifferentiation converts one cell type into another directly through selective regulation of specific transcription factors (TFs) to avoid a pluripotent state. Tissue-specific TFs control cell identity. This project explores transdifferentiation options for human kidney tissue by determining a starting cell type and analyzing TF expression data using R programming. That TF expression profile was compared to the candidate TFs for transdifferentiation to kidney tissue, calculated by three advanced computational biology platforms: CellNet, Gene Regulatory Network atlas based strategy, and Mogrify. Those TFs were then assessed for kidney specificity and cancer/disease risk.

Fibroblasts were determined to be a promising candidate starting cell type. Of the 25 TFs calculated by the computational models, only 2 were common to all 3 models and only 1 was highly kidney-specific. According to these analyses, 5 of the 25 TFs (20%) were highly kidney-specific, and all but 5 (80%) had some association with disease. This project successfully identified TFs that were known for reprogramming to kidney tissue, and proposed new ones. Future enhancements to the work include consideration of the route of transcriptional changes (similar to Waddington's epigenetic landscape) and the most effective times for manipulating regulation during the cell conversion process.

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

ME 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

252

Fair Category

LS

Project
Number

3053

Title: The Effect of Teaching Through a Research-Based Curriculum Vs. Traditional Methods on Education Outcomes

Student Name(s): C. Papotto

Abstract:

STEM expertise is extremely important and demand for it is increasing rapidly in today's society. Thus, it is important that classes in both high school and college be efficient at teaching the curriculum and inspiring people to enter STEM careers. The United States was historically at the forefront of STEM-related fields, but recently has been falling short of its competitors in Europe and other parts of the world, because of the high demand for new experts and the lack of interested youth pursuing STEM careers. My project was to try to determine a more efficient way at teaching a STEM class so that the students retain the information, raised class participate, create a overall better attitude towards STEM, and to maybe spark a interest in STEM-related fields outside of high school. For my experient the students were divided into two groups. In one group they were taught the information through traditional methods while the other group was taught through a research-based curriculum. Both groups were given knowledge tests and attitude surveys before and after instruction. The results show that that the independent group's knowledge retention test improved slightly, while the dependent class actually had a decline, with the overall test grades being lower than what they were initially. For the STEM attitude survey it showed that the females swayed more towards wanting to go into a STEM field. In future studies it would preferable if there were more groups with equal number of students with a longer time frame.

**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

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

- Yes No

CSEF Official Abstract and Certification

Word Count

242

Fair Category

LS

Project Number

3054

Title: Are plants underrated heroes?

Student Name(s): A. Evans

Abstract:

This project was done to test the ability of aquatic plants to filter unsanitary water. The purpose of this project is to find effective ways to improve the water systems in third world countries. Most countries don't have access to clean water, so to find effective ways to improve the water will save millions of lives. My hypothesis was - If aquatic plants are used to filter water then the amount of bacteria will be decreased because, as water passes through a plant's roots or leaves, the water is absorbed into the plant's tissues and then cleansed. The materials used varied from 8 water Hyacinths, petri dishes, and 50 liters of pond water. I conducted this experiment by first collecting samples of the pond water, then taking the rest of the pond water and placing it into 4 separate buckets. In each of the separate buckets, two Water Hyacinth were placed inside. The next step was to wait two weeks, after the two weeks I placed all the samples into petri dishes, to collect bacteria. Lastly, I counted the bacteria and recorded the data into a chart. The data showed that the experimental group had less bacteria than the control group, which did not have the plants. The data provided supported my hypothesis. In total, the experimental group had 343 colonies less than the controlled group. In conclusion, aquatic plants do play a factor in decreasing the amount of bacteria in a water system.

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

MI EM PS

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project
Number

3055

Title: The Effect of Biotin (Vitamin H) on Regeneration in Planarian

Student Name(s): O. Kerr

Abstract:

Experiments have shown that biotin (vitamin H) promotes cell growth and rejuvenation. There have also been studies that have shown a lack of biotin depletes skin of nutrients needed to stay healthy. Biotin is also associated with regulating of processed that require enzymes. The field of regeneration could also benefit through an understanding of regeneration in planaria. The scientific community has only fairly recently realized their significance in understanding how regeneration works. Planarian research can be beneficial in understanding how stem cell regeneration can be perfected in order to regrow limbs, organs, and damaged tissues and to give patients a renewed vision for their life. The use of biotin is predicted to aid in the speed of cellular regeneration due to the fact that it has a role with natural enzymes.

This project will infuse liquid biotin into the natural spring water of planarian and see how long it takes for them to regenerate with and without the presence of biotin. After a feeding cycle, the planarian will be cut and photographed daily while they regenerate. This is an approximately month-long project that will observe the overall effectiveness of biotin in regeneration.

Due to a temporary budget freeze the order of materials for this project was delayed and results from the project are inconclusive at the moment. Over the next month, however, the experiment will be conducted and each of the photographs compared to determine whether or not the planarian exposed to more biotin are regenerated at an accelerated rate.

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

CB AS 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

262

Fair Category

LS

Project
Number

3056

Title: Role of miR-433 in osteosarcoma initiation, progression, and drug resistance

Student Name(s): S. Menta

Abstract:

In children and young adults, approximately 400 new cases of Osteosarcoma (OS) are diagnosed in the United States each year, making it the eighth most common malignancy of childhood (Ottaviani & Jaffe, 2009). It is believed that microRNAs play a key role in cancer processes like bone homeostasis, orchestration of bone programming, and apoptosis. Differences in microRNA-433 expression are present in a number of cancers including ovarian, gastric, and lung cancers. In normal bone cells, miR-433 has been shown to promote differentiation and specialization. The aim of this project was to analyze expression levels of miR-433 in OS cell lines and then manipulate its expression in conjunction with anti-tumor drugs to find the most effective treatment. The steps of this project include isolation of miR-433, analysis of miR expression, and manipulation of miR-433. As of now, I have completed the isolation and analysis of levels of expression of miR-433 using qPCR. After analysis, I determined that miR-433 was under-regulated in both OS cell lines, so I plan to increase the expression of miR-433 through the means of transfecting a plasmid into the OS cells and seeing whether that kills the cancer. To go even further, I will test how different chemotherapeutic drugs like methotrexate affect miR-433 expression or if the presence of miR-433 affects the effectiveness of these drugs. Essentially, I will be looking to find the best combination of treatments to attack this disease. This research can potentially change how OS is treated and will inspire cancer-related miRNA research.

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

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

259

Fair Category

LS

Project Number

3057

Title: Detection of Early-Stage Alzheimer's Disease via Hierarchical Classification of Proteomic and Clinical Profiles

Student Name(s): S. Sundaram

Abstract:

Alzheimer's disease (AD) is a neurodegenerative, fatal brain disease characterized by impairments in memory, language, reasoning, and cognition. Identifying AD in its earliest stages of Mild Cognitive Impairment (MCI) allows patients access to the best possible treatments, and time to make crucial caregiving and financial decisions. Currently, no accurate diagnostic tests exist for early-stage AD; internationally just one in four patients are diagnosed. In this study, the development of a machine learning tool to accurately diagnose AD and identify high-risk MCI patients is proposed, using neuropsychological and blood proteomic profiles. A novel two-layer hierarchical framework was designed: The first layer diagnoses patients as healthy, MCI, or AD, and the second layer analyzes healthy/MCI patient profiles to predict future AD onset. A database of 560 patients was used to build the first model. A subset of 368 patients was used for the second model, using multiple observations per patient across a 12-month time-span. For each classification layer, a multi-pronged approach was developed to extract the most relevant biomarker data from patient profiles, integrating both univariate and multivariate methods. Upon evaluation, the first model diagnosed patients with a 90% overall accuracy, based on linear components extracted from proteomic profiles. The second model then predicted future AD onset for current MCI patients with a 92% ROC accuracy within a 6-48-month timeframe, using biomarkers selected from both proteomic and neuropsychological profiles. These results far outperform prior research and indicate that this tool will provide a low-cost, minimally invasive method of detecting early-onset AD.

**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

254

Fair Category

LS

Project
Number

3058

Title: Using stable isotopes to estimate the trophic position of Atlantic sharpnose sharks
(*Rhizoprionodon terraenovae*)

Student Name(s): A. Davis

Abstract:

Populations of sharks have been decreasing due to human activity. Studies on shark diet are often facilitated through stomach content analysis, which does not give an accurate representation of long-term feeding behaviors and requires a necropsy. The purpose of this study is to use stable isotope analysis, a computational study of carbon and nitrogen ratios, to assess the feeding patterns of Atlantic sharpnose sharks (*Rhizoprionodon terraenovae*). Blood was sampled from sharks caught and released from the University of North Carolina at Chapel Hill's Institute of Marine Sciences' (UNC-CH IMS) boats. Approximately .7cc of blood was taken from the caudal vein of the sharks using 25 gauge 1-1.5" needles before being put into collection tubes with lithium heparin. Samples were centrifuged and freeze dried at the University of North Carolina at Wilmington's Center for Marine Science (UNCW CMS). Of the freeze dried samples, .5 mg were processed using a mass spectrometer. The resulting isotopic ratios ($^{13}\text{C}/^{12}\text{C}$ and $^{15}\text{N}/^{14}\text{N}$) expressed as δ values provide valuable information on the differences between the diets of juvenile and adult sharks. Two sample, two-tailed T-tests determined that there was little variability between the two age groups, and calculations of their trophic positions suggested they eat at the same trophic level. Overfishing is a great threat to sharks, and in order for researchers to understand the evident importance of sharks in marine ecosystems, more studies need to be done on shark diet. A better understanding of shark feeding patterns will more successfully protect shark population.

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

BI AS EV

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

239

Fair Category

LS

Project Number

3059

Title: Do rewards affect bio-electrical resistance?

Student Name(s): C. Eswarakumar

Abstract:

My research project is on understanding how biological-electrical resistance works, these are the biological signals our body gives off when there is a change in emotional, cognitive, active state. Throughout this research project, I have been engineering three devices that will measure the bio-electrical resistance, through brain wave, heart rate, and sweat gland activity. The devices are an electroencephalogram (EEG), an electrocardiogram (EKG), and an electrodermograph (EDG –which measure the slightest differences in sweat gland activity). These simply need skin contact with electrodes in their corresponding areas, and the changes in biological resistance will be measured on an oscilloscope. Each electrode will be connected to a headband/wristband with protruding wire, and the wires will be attached to a stereo plug and then feed into each device. The process of building these three devices required operational amplifiers, some resistors, capacitors, mono, and stereo-compatible audio jacks and breadboards. The stereo plug would come from the electrodes and then its information would be feed through one of the three devices. Then a mono plug would be the device's output information, which is then inserted into an oscilloscope. These three devices give variable information on what changes are occurring naturally in the body when affected by stimuli. In this experiment the stimulus is rewards. I will be testing on student volunteers and their bio-electrical resistance reactions to food rewards. These graphs will be presented during the science fair.

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

BE EE 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

258

Fair Category

LS

Project
Number

3060

Title: Non-Invasive Colorimetric Biosensor for Early Diagnosis of Prostate Cancer Through DNA-Mediated MicroRNA Detection

Student Name(s): R. Subramaniam

Abstract:

Prostate cancer (PCa) is one of the most common cancers in men, affecting millions worldwide. Early detection is critical to survival, with a survival rate over 99 percent for local tumors, but below 30 percent for metastatic cancer. Recent studies have identified specific microRNA (miRNA) biomarkers in the blood as novel early detection markers for 8 cancer types, including PCa. One drawback of a PCR type detection from a single blood sample is that the number of detectable miRNA molecules is limited by the volume of blood drawn. Capture and accumulation of passing miRNA molecules in flowing blood across a suitable area of the body will dramatically improve sensitivity. This study aimed at developing a non-invasive biosensor that can effectively diagnose PCa using this principle. The biosensor utilizes capture and transdermal retrieval of magnetic nanoparticles carrying a G-quadruplex DNA reporter probe that specifically hybridizes with the desired miRNA marker in blood. In vitro, miRNA hybridization with the probe and resulting reporter activation were detected visibly as a clear-to-green color change within 10 minutes, caused by G-quadruplex peroxidase activity on ABTS. To characterize transdermal extraction by magnetic field, magnetic nanoparticles were coupled to the G-quadruplex reporter and successfully captured and accumulated through a porcine skin mimic using a field of ~0.8T, generated by a self-constructed electromagnet. Nanoparticles were similarly accumulated at the skin in simulated blood flow using a custom-designed flow cell. Sandwiching the peroxidase reagent in a patch between magnet and capture point enables in situ detection of PCa miRNA.

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

ME CB

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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

174

Fair Category

LS

Project
Number

3061

Title: Prevalence of Green Crabs and Asian Crabs on Fishers Island

Student Name(s): C. Toldo

Abstract:

The purpose of this experiment was to determine the prevalence of invasive green crabs and Asian crabs. I conducted my experiment by setting four different crab traps around the west-side of Fishers Island. I rotated them around the west side and was able to collect water temperature, salinity, and the water conditions. Each crab trap was baited with a raw chicken wing. At the locations with a salinity concentration of 26 ppt, there were 60% more Asian crabs than green crabs. Then where the salinity concentration of 25 ppt, over 50% of the crabs present were green crabs. Allowing me to draw the conclusion that green crabs prefer to be in the more brackish water, rather than a more salty environment. By also noting down the environmental conditions, I made an observation between dinoflagellate concentration and the type of invasive crab. I found that with a higher concentration of dinoflagellates, there was a higher concentration of green crabs. Allowing me to also draw the conclusion that green crabs and dinoflagellates prefer similar ecosystems.

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

AS EV EA

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- Yes No

CSEF Official Abstract and Certification

Word Count

231

Fair Category

LS

Project
Number

3062

Title: Using Artificial Intelligence Through a Machine Learning Algorithm (CART) to Predict the Malignancy of a Breast Tumor

Student Name(s): A. Murali

Abstract:

Breast cancer is responsible for causing the greatest number of cancer-related deaths among women, impacting 1.5 million women every year (WHO). One way to reduce the number of deaths caused by breast cancer is to perform early diagnosis to detect the presence of a malignant tumor before the tumor gets too harmful. While there are several methods of diagnosing and testing a tumor, they all have their own sets of problems: they are time-consuming, expensive, and limited in their ability to diagnose a variety of tumors. In this study, a machine learning algorithm was developed to predict if someone has breast cancer. The diagnostic model uses ten different parameters received from a mammography, a screening, or an ultrasound test of the breast tumor to output its prediction. The model returns whether or not the tumor is malignant or benign and the accuracy of the prediction. Prediction accuracy was between 90 and 93%. In addition to machine learning, the Point-Biserial Correlation Coefficient was used in conjunction with a t-test to examine the strength of association between each of the ten features and malignancy. By using machine learning to assess a breast tumor, there will be a rapid, non-invasive, and inexpensive way to detect breast cancer. This algorithm can help thousands of women get early treatment and provide a way to address any type of binary classification problem.

**Technical Disciplines Selected by the Student
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CS MA

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- Yes No

CSEF Official Abstract and Certification

Word Count

248

Fair Category

LS

Project
Number

3064

Title: Biomimetic Degradation of Persistent Pollutants Using Common Wax Worm *Ideonella sakaiensis* Bacteria

Student Name(s): B. Hawley

Abstract:

Most plastic bags are used for only 12 minutes, yet have a life expectancy of hundreds of years. Existing methods of handling plastic waste are inadequate: only 9% of the 9 billion tons of plastic waste produced by 2017 have been recycled, with 79% finding its way into a landfill or the environment. This research presents an environmentally friendly method, inspired by biomimicry, to degrade common plastic pollutants, via wax worm's *Ideonella sakaiensis* bacterial degradation. In initial experiments, wax worms were placed atop of high and low-density polyethylenes (HDPE and LDPE), and degraded 5% and 8.8% of the polymers, respectively. The best results occurred for the largest physical sample of polymer tested. In phase two, *I. sakaiensis* bacteria was isolated from the wax worm gut, cultured in tryptic soy agar and tryptic soy broth, and introduced to LDPE, HDPE, Polystyrene (PS), and aluminum foil. The liquid culture was more successful than an agar-based culture, especially if the samples were completely submerged. SEM analysis suggests that the bacteria is able to grow on all tested material types using PETase and MHETase to facilitate growth. For the polymeric waste which lost 37% of its initial 6.5mg mass in only 7 days, ethylene glycol, a known product of the bacterial decay was confirmed via FTIR analysis. This bioengineering method for plastic and aluminum waste disposal has numerous benefits, the most significant being a reduction in the time needed to biodegrade or bioremediate pre-existing polymer waste in large landfills.

**Technical Disciplines Selected by the Student
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EM EN BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project
Number

3067

Title: The Effect of Overexpression of Mir-24 on Cell Mortality

Student Name(s): U. Dubovik

Abstract:

Chronic obstructive pulmonary disease (COPD) is the third leading cause of death worldwide. It is caused when the respiratory alveoli are exposed to external stressors that are no longer mitigated by cellular stress responses, thus leading to chronic bronchitis and emphysema. Chronic bronchitis is the continued inflammation of the bronchial tube lining, and emphysema is when the alveoli, or the air sacs in the lungs, get stretched out and are unable to properly function. Mir-24 is a small non-coding RNA molecule that regulates gene expression. It has been shown to regulate the expression of two vital cell cycle control genes. This research was done to see in what way Mir-24 affects the cell behavior and viability of cells exposed to cigarette smoke extract, modeling the lungs' response to a specific oxidative stressor. It was hypothesized that when exposed to cigarette smoke (CS), cells with overexpressed Mir-24 (IV) will respond with higher percentages of dead cells (DV). This was tested by culturing four sets of cells. A cell count was done every other day to identify the cell growth curves and percentages of dead cells. To do this, a hemocytometer and a trypan blue assay were utilized. The trypan assay dyed blue the dead cells, in order to yield comparable percentages. This research contributes to the goal of seeing what precise mechanism contributes to the development and exacerbation of chronic obstructive pulmonary disease. Being such a frequent cause for death, understanding of the mechanisms is crucial for counteractive its effects.

Technical Disciplines Selected by the Student
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CB BI ME

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CSEF Official Abstract and Certification

Word Count

179

Fair Category

LS

Project
Number

3068

Title: Archaeological soil samples taken from Native grave sites may allow anthropologists to further understand northeastern Native American burial culture and ritual

Student Name(s): F. Jones

Abstract:

By researching archaeological soil samples, my goal was to learn more about a generally unknown topic- northeastern Native American grave rituals. I am using soil samples taken from the Morgan Site, a Native grave site in Rocky Hill, CT, that was dug from the mid 1980's to early 1990's. I have sifted, organized, and statistically analyzed over 50 soil samples from one particular feature of the site, labelled Feature 68. This was the grave site of a Native American man who lived in the mid 1300's, and died when he was about 55 years old. Along with the notes and artifacts I have accessed, the compiled information is important for one main reason: increased cultural preservation for Native peoples. Research in this field could bring more attention to the mistreatment of cultural and burial preservation and make for more laws around this topic. An increased knowledge in this field of study, one that is mostly unknown, and further brought upon by my research, could make way for better laws surrounding Native American rights and grave repatriation.

**Technical Disciplines Selected by the Student
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BE

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CSEF Official Abstract and Certification

Word Count

234

Fair Category

LS

Project Number

3069

Title: Discovering the Pathogen Responsible for Gorgonian Wasting Syndrome on the Gorgonia ventalina Sea Fan

Student Name(s): O. Brown

Abstract:

Corals are important ecosystems because fish live and feed on them, while people in the fishing and tourism industries rely on healthy reefs for their livelihoods. Over the past few decades, coral cover has decreased at extreme rates because stressors like climate change have led coral reefs to become vulnerable to pathogens that cause coral disease. Currently, an outbreak of the coral disease "Gorgonian Wasting Syndrome," identified by lesions of decaying necrotic tissue, has affected the Gorgonia ventalina sea fan species in Puerto Rico. This experiment ultimately aims to identify the pathogen responsible for Gorgonian Wasting Syndrome. During the summer of 2017, I created a physical and electronic library of possible pathogens by crushing, diluting, and spreading both healthy and diseased samples of Gorgonia ventalina on agar plates. After incubation, I counted colonies and picked out isolates differing in size, color, and shape, resulting in 140 isolated colonies. The colonies were placed in nutrient broth and glycerol for long term storage. The sample's DNA was manually extracted to run a PCR and Gel Electrophoresis, the results were then processed into an electronic pathogen library. After analysis of the bacterial communities, it was found that pathogens from the Vibrio genus may be responsible for Gorgonian Wasting Syndrome because the Vibrio genus is prevalent on both healthy and diseased samples. Future work testing each of the pathogen isolates on healthy Gorgonia ventalina samples needs to be completed.

**Technical Disciplines Selected by the Student
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EV MI

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CSEF Official Abstract and Certification

Word Count

223

Fair Category

LS

Project
Number

3070

Title: Honeybee Melittin Apitherapy for Targeted Cancer Cell Suppression and Decimation

Student Name(s): D. Minichetti

Abstract:

Chemotherapy continues to play an important role in treating various cancers; however, during the course of treatment it is often challenging to differentiate between cancerous and healthy tissue. This research investigates a new and more viable peptide found in honeybee venom, melittin, to demonstrate a selective mechanism for inhibiting cancer cell proliferation. Giant unilamellar vesicles (GUVs) were created to simulate healthy and cancer cell lipid bilayers using an integrated ITO glass chamber to assess the peptide's discriminatory properties. Honeybee melittin (0.11 mM) was introduced to the cancer and control GUVs. Confocal microscope images and ATR-FTIR scans of the GUV samples provided compelling evidence in support of melittin's selectivity. The cancer lines PA-1, MCF-7, and SKMG-4 were then subject to various concentrations of melittin (0–10 $\mu\text{g}/\text{mL}$). Fibroblast cells were tested under similar conditions as the control. A high concentration of melittin (10 $\mu\text{g}/\text{mL}$) was required to observe any noticeable influence on the fibroblast controls. Comparatively, all cancer cells were affected by the melittin treatment at much lower concentrations, as low as 2 $\mu\text{g}/\text{mL}$. The PA-1 cancer line was most dramatically affected by the treatment, while MCF-7 and SKMG-4 showed minor resistance. The results suggest that melittin induces cell death in PA-1, MCF-7, and SKMG-4 cancer cells, while leaving fibroblasts unharmed.

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ME EN CB

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- Yes No

CSEF Official Abstract and Certification

Word Count

241

Fair Category

LS

Project Number

3071

Title: A Novel Approach To Holistic Medicine For Dog Allergies While Helping Aid People With Low-Income Gain Benefits From Having Pets

Student Name(s): L. Serrano

Abstract:

Objectives/Goals:

This project was designed to find out what breed of dogs are more prone to allergies, possible factors, and their symptoms. Also, determine the possible home-remedies and the associated costs. Helping the allergy while saving money will help people with low-income benefit from having pets.

Methods/Materials:

This experiment was performed without actual testing on dogs. I did a combination of meeting a veterinarian and research online to determine what breeds of dogs more prone to allergies, factors, the possible home-remedies, and the proximal costs and differences between the home-remedies and vet treatment costs.

Results:

Based on the data collected, the breeds of dogs that are more prone are mainly large long haired dogs but short haired as well. such as golden retrievers, German shepherds, cocker spaniels, boxers, bichon-frise, and Labrador retriever. The possible home-remedies that are effective are hypoallergenic shampoo, vitamin E/B, omega 3/fatty acids 6, garlic which helps blocks certain enzymes associated with allergy. The average differences in costs are vet treatment \$100-1000 and the home remedy treatment costs average are \$5-150.

Conclusions/Discussions: The hypothesis was to find possible home-remedies that can help people with low-income while finding what dogs are more prone to allergies. Pet ownership is proven to reduce stress and increase longevity helping people be educated in caring for pets. Therefore, pet ownership will be beneficial and affordable for people with low-income.

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

AS AS AS

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Word Count

230

Fair Category

LS

Project Number

3072

Title: Potential of Macrochlorophytes (*Ulva* spp) and Sugar Kelp (*Saccharina* spp) to Remove Carbon Dioxide Levels in the Atmosphere

Student Name(s): K. McCord

Abstract:

Arguably one of the most important ecosystem services provided by seaweed in our coastal environment is to convert environmental CO₂ to usable oxygen via photosynthesis. Recent studies have also shown that CO₂ removal is a possible carbon sequestration pathway. It is critically important for us to better understand the variables that affect and control CO₂ removal rates due to this Field collections of local macroalgae were acclimated to laboratory conditions. The leaf area index was measured and compared as a proxy for potential photosynthetic activity. *Ulva* spp. had a higher LAI (*Ulva* spp. 25.5 vs. Kelp 17.75) CO₂ levels were measured every five minutes in replicated samples of each species to determine CO₂ removal. Dry weights were also compared to assess biomass. Averages were recorded for dry weight. Average CO₂ removal data showed significantly higher rates for *Ulva* sp. versus kelp (3854.5 ppm v. 1959 ppm.; $p = 0.0001$, $\alpha = 0.05$) Similar patterns were shown in longer temporal datasets (2 days, 7755 ppm *Ulva* sp. v. 4462.25 ppm for kelp; $p = 0.03$). What this suggests is that Chlorophytes are more efficient at converting CO₂ from the atmosphere to the aquatic environment. Recent studies have put more focus on the abiotic controls of this process. This study suggests that there should be more focus on the biological variations of how this process is controlled because this will be extremely important moving forward.

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EV CH EM

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Word Count

215

Fair Category

LS

Project Number

3073

Title: A comparison of arbuscular mycorrhizal fungal colonization of three common native plants across a historically wet region at higher altitude and drier valley region on O'ahu

Student Name(s): A. Landler

Abstract:

Arbuscular mycorrhizal fungi (AMF) are obligate biotrophs that form a symbiosis with about 80% of vascular plants upon colonization, or penetration into the host plant's root cortex. In exchange for the plant's carbon, the AMF's hyphae extend past the plant root system and gather vital nutrients such as nitrogen and phosphorus. The dynamics of this symbiosis are important, as the rhizosphere is one of the most commonly overlooked regions that could contribute to restoration of soils and increased crop production. Mycorrhizal communities are a method to improve plant survival without the detriment to the environment that is often imposed by alternative solutions such as application of artificial fertilizers, which causes eutrophication. Additionally, they could be important in the success of restored habitats. The purpose of this experiment is to evaluate if historical wetness or dryness contributes to a preference for or against AMF based on observations of three native plants: *Plumbago zeylanica* (iliee), *Cordyline fruticosa* (ti), and *Scaevola taccada* (naupaka), which has implications for agriculture and restoration in drier and wetter areas. Samples were retrieved from UH Manoa (dry) and Lyon Arboretum (wet), stained, and analyzed for percent colonization of the roots by AMF under a microscope. Levels of colonization were then compared. No concrete trend was evident in the data for this specific experiment.

**Technical Disciplines Selected by the Student
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MI EV PS

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- Yes No

CSEF Official Abstract and Certification

Word Count

236

Fair Category

LS

Project Number

3074

Title: Diagnosis of Breast Cancer Based on Native Tissue Fluorescence Using Wide-Field Multispectral Fluorescence Imaging

Student Name(s): A. Tom

Abstract:

In the United States, nearly one in eight women will be diagnosed with breast cancer sometime in their lives. In addition, breast cancer is the most common type of cancer for women. As such, early diagnosis is key. Current biopsy methods are invasive, time consuming, and depends on the judgement of the pathologist. Fluorescence has been identified as a possible alternative for this diagnosis which could be non-invasive, quick, and effective. Photos of breast cancer tissues were collected using a wide field multispectral microscope under three channels, DAPI, Rhod, and FITC. The slides of breast cancer tissues included normal and cancerous tissues. Using non-negative matrix factorization (NMF) the spectral data of the of the images was analyzed. The spectral data consisted of intensity values for the pixels in the photos. From the NMF, spectral basis components were collected and could be attributed to intrinsic metabolites of the tissue such as reduced nicotinamide adenine dinucleotide (NADH) and flavin adenine dinucleotide (FAD). This produced relative weights of the components of NADH and FAD which were used to determine a redox ratio which could then be used with support vector machine learning theory (SVM) to distinguish normal and cancerous tissues. An accuracy of 77.6% accuracy was accomplish for the correct identification of tissues as malignant or healthy using a mean pixel intensity value while when shrinking and then running the same tests found an accuracy of 61.4%.

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ME CB BI

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CSEF Official Abstract and Certification

Word Count

256

Fair Category

LS

Project Number

3075

Title: The Design and Fabrication of a Smart, Medicated Gel Bandage to Deliver Antibiotics to a Draining Wound

Student Name(s): R. Orlando

Abstract:

For adhesives and wound dressings, consumer options are limited. Besides flexible Band-Aid strips, the only other inexpensive option for wound coverage is a liquid bandage. Although liquid bandages are better than their solid counterparts at covering an affected area, as their contact interface is more complete, they are still plagued by a common deficiency: the wound receives little to no assistance to fight initial-trauma bacterial infection, other than coverage from outside contamination. In this research, a Smart, medicated gel bandage was created that would release antibacterial agents into the wound while solidifying, then provide hardened protection, and subsequently release antibiotics only during additional periods of drainage, when it is needed most. To create the novel dressing, 65mg of tetracycline (Tc) was embedded into 210mg of HydroMed-D, an ether-based hydrophilic, biocompatible urethane, creating a gel-like formulation that is applied via a squeeze tube. When administered, the Smart bandage dries in 5 minutes, releasing Tc during that time of initial wound drainage. Once dry, it provides durable structural support for a cut/abrasion that is far improved relative to a stick-on cloth bandage. During the subsequent dry healing (scabbing), the Smart bandage retains significant Tc load, and can release it should drainage reoccur, further increasing the effective life and infection-fighting ability of the bandage. For a cut that is covered with a traditional Band-Aid, 210mg of the Smart bandage will deliver up to 42µg of tetracycline to the localized area as needed, as a function of (cut) bleeding, or drainage.

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ME EN CH

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- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

LS

Project Number

3076

Title: Effects of Bt Insecticides on the Mortality Rate of Juvenile Horseshoe Crabs

Student Name(s): J. Goll, J. Mattei

Abstract:

A long term study, Project Limulus, has revealed a recent decline within the horseshoe crab population over the past 3 years. The effects of commercial grade *Bacillus thuringiensis israelensis* (BTi) insecticides on nontarget organisms are widely unknown. The recent decline within the horseshoe crab population in Long Island Sound could be associated with the increased use of BT based insecticides which are used to control mosquitoes. When ingested by mosquito larvae, BTi causes their intestines to rupture, leading to death due to starvation or infection. The objective of this study is to determine if BTi has an effect on the mortality rate of juvenile horseshoe crabs. 10 holding tanks, each with 10 horseshoe crab larvae, were exposed to concentrations of 0, .1, .3, and .4 (g/L BTi). The results show that small concentrations of BTi insecticide have little to no effect on the mortality rate of juvenile horseshoe crabs. Another experiment was conducted using Monterey Bt biological insecticide in which 10 groups each containing 55 juvenile horseshoe crabs in 30mL of water were exposed to different percent concentrations of 0, 1, 2, 2.5, 4, 5, 7.5, 8, 10, and 16 (% Btk). This revealed a direct link between Btk and juvenile horseshoe crab mortality rate. The direct cause for the recent decline in the horseshoe crab populations is still unknown and may include hypoxia, pollution, overharvesting and habitat destruction. More research needs to be done in order to better understand the recent decline in horseshoe crab populations.

Technical Disciplines Selected by the Student
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- Yes No

CSEF Official Abstract and Certification

Word Count

240

Fair Category

LS

Project
Number

3077

Title: Effects of Construction Vibrations on Stomata Function in the Common Bluegrass, *Poa Pratensis*

Student Name(s): L. Castillo

Abstract:

An experiment was conducted to determine if ambient noise pollution from construction of houses affects the form and function of landscaping through a plant's stomata. Stomata are tiny openings in plant tissue that allow for gas exchange. This experiment was conducted by obtaining three plastic bins where a monoculture of grass were grown. Grass was watered every other day. To collect stomata, the bottom of the grass was painted with clear nail polish and left to dry. A strip of tape was placed on top of the nail polish, then peeled off and placed on a slide. This was done four times for every sample of grass. The stomata count was then determined by placing the slides under a microscope with a drop of oil and then observed under the microscope (x500 magnification). Data was obtained by playing construction vibrations on the three samples of grass for 50-min. Results showed that the number of stomata opened increased after the construction vibrations were played to the samples. For example, day-3 of the control group showed that on average, 23.5% of the stomata were open but on day-3 of playing the construction vibrations, 131.7% of the stomata were open. Knowing that construction vibrations causes the plants stomata to open can really help places that suffer from dry land by modifying the noise landscape and then watering the plants right after to allow the entering of water into the cells.

**Technical Disciplines Selected by the Student
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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

201

Fair Category

LS

Project
Number

3079

Title: A Comparative Analysis of the Aerobic Capacity and Antigen-Response of Saccharomyces and Brettanomyces yeast in the presence of Dimethylglycine.

Student Name(s): L. Darrin

Abstract:

The purpose of this project was to test if dimethylglycine (DMG), a natural metabolic enhancer, increases aerobic performance in yeast, by analyzing ethanol levels and carbon dioxide concentrations. This project also tested dimethylglycine's immunization properties with the use of an enzyme-linked immunosorbent assay (ELISA). It was hypothesized that if dimethylglycine was added to a sugar solution with Saccharomyces and Brettanomyces yeast than it would aerobically respire longer and produce less ethanol than the solution with an absence of DMG. Also, it was hypothesized that the quantity of antigen in each well of the ELISA kit would increase proportionally to the amount of DMG, using richness of color as means of identification. The data for testing DMG's aerobic properties was collected by measuring the time until anaerobic cellular respiration occurred as well as the ethanol content during anaerobic respiration in the mixture. When testing DMG's immunization abilities, an ELISA kit was used. Wells across the plate were filled with various amounts of DMG (50 mg - 1000 mg) combined with the appropriate antigens and antibodies necessary to conduct an assay, and the saturation color of each well was compared. The data indicates a correlation between DMG and increased aerobic capacity in yeast.

**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

240

Fair Category

LS

Project
Number

3081

Title: Investigating the aesculapian advantages of the quotidian garden weed *Plantago Major* by disseminating extracts drawn from different components of the plant and observing their effectiveness to inhibit bacterial proliferation.

Student Name(s): M. Cheela

Abstract:

In this experiment I will be conducting an experiment to investigate if a common garden weed, *Plantago major* also known as broadleaf plantain, has aesculapian advantages. Investigating the effects of *Plantago major* on bacteria could lead to medical breakthroughs and new discoveries not only in medicine, but in science as well. This experiment was conducted through a thorough procedure that lapsed over the span of ten days. During this experiment, I collected bacteria from different every day locations and objects and allowed it to grow. Once the bacteria had grown, I applied three different extracts made from different parts of the plant onto the petri dishes and observed the bacterial growth for the following five days. The goal during this experiment was to ascertain a conclusion about which part of the plant is better at inhibiting the growth of bacteria, thus having the most medicinal benefits. At the end of the experiment I received results that contrasted with my hypothesis. On average, the stem extract inhibited 93.4% of the bacteria, the flower extract inhibited 45.03% of the bacteria, and the leaf extract inhibited 49.15% of the bacteria. From these results, I can conclude that the stem is the most effective in killing bacteria, proving to have the most aesculapian advantages as well. This information could be used by doctors and scientists all over the earth so that they can incorporate these extracts into homeopathic medications for different diseases and conditions.

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

PS ME

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

228

Fair Category

LS

Project Number

3082

Title: Investigating the Role of Sodium Chloride on Pathogenic B Cell Function in Multiple Sclerosis

Student Name(s): N. Luo

Abstract:

Multiple sclerosis (MS) is an autoimmune disease characterized by destruction of myelin. Sodium chloride (NaCl) has been shown to drive proinflammatory functions in T-cells which attack protective myelin. High salt conditions promote proinflammatory T-helper subsets and proinflammatory protein production. Defining how environmental factors affect B-cell function is crucial because they present antigens (APCs) for T-cell activation. This study investigated whether NaCl primed B-cells for pathogenic functions in MS. Because sodium intake intensifies inflammatory T-cell activity, and B-cells act as APCs, it was hypothesized that if NaCl was added to B-cells, then there would be higher expressions proinflammatory molecules IL-6, CSF2, and CD80. Extracted B lymphocytes were cultured with media for 96 hours, measuring the gene expression; ELISAs quantified cytokine emissions. q-PCR and ELISAs yielded relative gene expression and protein concentration in treated and untreated samples, answering whether treatment conditions affected B-cell function. Results for SGK1, IL-6, and CSF2 were statistically significant, indicating that NaCl prompted greater production. CD80 expression results were inconclusive. Continuation of this research can contribute to a greater understanding of how environmental factors impact communication in the immune system and the consequences of dysfunctional B-cells. In future experiments, treated B-cells can be co-cultured with T-cells to see if T-cell function is directly altered when B-cells are exposed to salt.

**Technical Disciplines Selected by the Student
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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

253

Fair Category

LS

Project
Number

3083

Title: Expression & Localization Mapping of PLEKHA7 & RNAi-Associated Proteins in HUVEC Cells

Student Name(s): P. Hager

Abstract:

Cancer caused over eight million deaths in 2016, and nearly one billion people worldwide suffer from some degree of high blood pressure. While treatments for both conditions have become increasingly effective in recent years, reliable diagnostic and interventional options remain elusive. PLEKHA7 is an adherens junctional binding protein in epithelial and endothelial cells. A mechanism by which the loss of PLEKHA7 contributes to cell cycle deregulation and anchorage-independent growth (AIG), two hallmarks of cell transformation that contribute to cancer and hypertension, has been identified in Caco2 epithelial cells. Specifically, the interaction of PLEKHA7 with the cellular microprocessor complex (which includes Drosha and DGCR8) has been implicated as an important regulatory event, in the absence of which epithelial cells may undergo tumorigenesis and cell transformation. It was hypothesized that a similar mechanism exists in endothelial cells with implications for tumorigenesis, angiogenesis, and hypertension. Immunofluorescence assay and western blot were used to elucidate the role of the key agents of the Caco2-regulatory pathway in HUVEC cells. Analysis of immunofluorescence micrographs revealed extensive colocalization of proteins consistent with the Caco2 model, and western blot confirmed similarities in the protein contents of these two different cell types. These data suggest major similarity in the regulatory pathways of these two cell types. While further analyses of protein and RNA contents, as well as cellular response to PLEKHA7 knockdown, are called for, preliminary investigation points to the existence of a PLEKHA7-dependent pathway of miRNA regulation without which endothelial cells may undergo tumorigenic or endothelial-mesenchymal transition.

**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

221

Fair Category

LS

Project Number

3084

Title: Mirrors Affecting Human Behavior with Respect to Personality Type

Student Name(s): A. Packard

Abstract:

The purpose of this study was to investigate how mirrors affect human behavior. This investigation aimed to document behaviors seen during different activities, like speaking, performed in front of a mirror. Fifteen Trinity students were asked to complete a demographics survey and perform a brief hearing test. Then, they were asked to complete three tasks in front of a mirror while being videotaped. These tasks were to wait, tell the story of Goldilocks and the Three Bears, and say how they used to celebrate their birthday as a child. Finally, they were asked to fill out a personality test. Eye gaze location and body language were recorded along with the total time doing each activity. Preliminary analyses have shown that participants' eye gaze locations were not random. For example, the participants spent significantly more time looking at the mirror than anywhere else during the waiting task, but during the two story telling tasks, looks were more evenly split between the mirror and other locations. Additionally there was a trade off between looking time at the floor and at the mirror. And in particular, if the participant looked at the floor a lot when they were waiting, they were less likely to look at the mirror when speaking about their birthdays. There were no strong correlations between look locations and personality types.

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

263

Fair Category

LS

Project Number

3085

Title: Discovering the Anti-Inflammatory Pathway of Desmosterol in Heart Disease

Student Name(s): A. Dixit

Abstract:

Ischemic heart disease and atherosclerosis are the number one cause of death worldwide. Recent results from large clinical trial called CANTOS has established that inhibition of pro-inflammatory cytokine IL-1 β reduces incidence of death in patients with atherosclerosis. The goal of this project is to understand how losses of protective desmosterol lipid intermediate in macrophage foam cells remove the anti-inflammatory breaks leading to chronic inflammation. The NLRP3 inflammasome, expressed in macrophages is the primary regulator of production of IL-1 β and IL-18. It was hypothesized that desmosterol, a precursor of cholesterol, controls NLRP3 inflammasome activation, and increasing the amount of this anti-inflammatory lipid will lower the development of atherosclerosis via reduction in IL-1 β . The enzyme 3 β -Hydroxysterol Δ (24)-reductase (DHCR24) was overexpressed specifically in macrophages of mice. DHCR24 catalyzes the conversion of desmosterol to cholesterol and hence depletes the cardioprotective lipid desmosterol. Compared to control littermate mice, the DHCR24 TG mice developed enhanced atherosclerosis, as seen through increased plaque burden in cross-sections of the aortic root stained with H&E and Oil Red O. The increased inflammation and disease is linked to increased activation of NLRP3 inflammasome activation, as analyzed by caspase-1 cleavage and processing of inactive IL-1 β into bioactive cytokines. Thus suggesting that the NLRP3 inflammasome is the pathway desmosterol lowers when protecting against atherogenesis. Take together this work provides new insights into previously unknown mechanism whereby desmosterol controls inflammasome dependent development of heart disease. Future research based on these findings will investigate whether elevating desmosterol through pharmacological means can protect against atherosclerosis.

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

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

234

Fair Category

LS

Project
Number

3086

Title: The Effect of the Consumption of Organic vs. Non-Organic Lactuca Sativa on the Growth and Health of Cynthia Caterpillars

Student Name(s): R. Paine

Abstract:

This project is a study of how the growth of Cynthia caterpillars is affected when fed organic versus nonorganic romaine lettuce. There is much research and speculation concerning the effects of organic and nonorganic food on different aspects of human health and development. This experiment looks at how this affects the growth and development of Cynthia caterpillars. Two groups of caterpillars were fed organic and non-organic lactuca sativa over a period of two weeks. Their growth was measured and they were observed for their general apparent state of health and development each day. The aim was to discover whether the caterpillars being fed an organic diet or those being fed a non-organic diet would grow faster and if their diet affected their overall apparent state of health. It was expected that the caterpillars fed a non-organic diet would be larger in size but not as healthy in appearance due to fertilizers, pesticides, and herbicides given to the non-organic lactuca sativa. The caterpillars fed an organic diet would be smaller but most likely healthier due to the lack of these products. In the event, the caterpillars on an organic diet reached an average maximum length of 3.88 cm. Those on a non-organic diet reached an average of 3.52 cm. This contradicted the original hypothesis, and appears to indicate that an organic diet causes faster growth than a non-organic one.

**Technical Disciplines Selected by the Student
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AS 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

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

- Yes No

CSEF Official Abstract and Certification

Word Count

267

Fair Category

LS

Project Number

3087

Title: Non-Invasive, Low-Cost Diagnosis of Chronic Obstructive Pulmonary Disease (COPD) via Smartphone Breath Analysis

Student Name(s): H. Hussain

Abstract:

Chronic Obstructive Pulmonary disease (COPD) is expected to become the third largest killer worldwide by 2030. Current diagnosis mechanisms are time-consuming and costly, highlighting the need for a more accessible and rapid diagnosis so that the disease can be treated at its earliest stage. In this research, a rapid and simple smartphone-based detection of COPD was created. Single-walled carbon nanotubes (SWCNTs) were combined 2-hydroxy -1,1,1,3,3,3-hexafluoropropyl)-1-naphthol (HFIPN) in a 2:1 mass ratio, to create a COPD-breath gas specific PENCIL powder. When integrated into a Texas Instruments NFC Tag, and exposed to COPD breath gases isoprene, octadecane, hexanal, and undecane, conformational change in the PENCIL-HFIPN selector was realized by an increase in the material's resistivity. Exposure of the PENCIL-on-NFC tag to 1ppb and 1 ppm COPD breath gases caused an increase in PENCIL resistance from 13-13.7k Ω and 12.7-27k Ω , respectively. Change in PENCIL-on-NFC tag resistivity produces changes in current usage drawn from a Smartphone, when read by the device, and acts as the basis for COPD detection. After 1 minute of exposure to typical 1ppb concentration of COPD breath gases for an afflicted patient, Smartphone read of the PENCIL-on-NFC tag drew only 1.5mA of current, which is 3.5mA less than current used under normal, ambient conditions. Increase in PENCIL resistance, and subsequent Smartphone current reduction was found to be COPD gas specific and was used to train a new Smartphone application to provide a 4-minute diagnosis for COPD, based on calibration of the circuit's current usage, and its effect on the phone's battery usage.

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

ME 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

253

Fair Category

LS

Project Number

3088

Title: The Bioaccumulation of Methylmercury in Atlantic Silversides

Student Name(s): A. Swift

Abstract:

Atlantic silversides are a key foraging species in coastal bays along the North Atlantic from Florida to the Magdalen Islands, Canada. These fish are prey to piscivorous fish such as tunas, sharks, and other fish commonly caught in the Long Island Sound. Anthropogenic sources, such as coal burning and the mining of iron, causes methylmercury to accumulate at high concentrations in Atlantic silversides, and through bioaccumulation, it ends up in these marine predators, and then the humans eating these fish. Growth is a known factor of methylmercury bioaccumulation in fish; however, this relationship has not been supported by empirical data thus far. Hence why it is difficult to quantify the significance of growth on the process of methylmercury bioaccumulation. Fish are caught in Mumford Cove in Groton, CT, as research is already being carried out here, and scientists are attempting to make it a model base for research. Atlantic silversides produce daily rings on their otoliths, the 3 small calcareous ear bones that help to sense gravity and movement. Otoliths are used to determine the fish's growth rate, which is then compared to the fish's methylmercury concentration. Methylmercury concentrations and growth rates of juvenile Atlantic silversides are inversely correlated. Otolith-based growth rates and total mercury--a proxy of methylmercury--are useful in demonstrating the relationship between growth and methylmercury bioaccumulation. Furthermore, Atlantic silversides that grow at faster rates accumulate less methylmercury compared to their slower growing counterparts. This research will be useful in protecting humans, and the ecosystem, from mercury's harmful effects.

Technical Disciplines Selected by the Student
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EV BI 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

251

Fair Category

LS

Project
Number

3089

Title: The effect of the faah gene of alcohol consumption and inhibition in *C. elegans*

Student Name(s): R. Stollman

Abstract:

Alcohol is one of the most widely accepted and abused drugs. Many genes have been linked to addiction, among which is the faah gene, which has been shown to affect other types of substance addiction. However, its role in alcohol addiction remains unclear. The fatty acid amide hydrolase (FAAH) protein breaks down neurotransmitters in the brain. In this experiment the role of the FAAH protein in alcohol addiction will be tested in a *C. elegans* model system. *C. elegans* is a type of nematode that is used widely as a model organism for its genetic similarity to humans. An RNAi construct will be used to lower the expression levels of the faah gene. Lines of *C. elegans* with two different mutations in the Slo-1 protein (JPS383 and JPS428) will be used as positive controls while using the wild type as a negative control. The *C. elegans*' alcohol preference, as well as their levels of intoxication, will be gathered and quantified as data for the mutant and wild type *C. elegans* strains. It is expected that all of the *C. elegans* will absorb and become addicted to the alcohol in the food, but the mutant *C. elegans* will want to eat less and exhibit a lower sensitivity to the effects of the alcohol. The goal of this experiment is to learn something about the involvement of the faah gene in the alcohol addiction pathway, and to explore possibilities of using it as a drug target to genetically prevent addiction in human models.

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

BI BE ME

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

271

Fair Category

LS

Project Number

3090

Title: The Effect of Different Melanoma Treatments on Surface Protein Expression of Innate Immune System Cells

Student Name(s): T. Lu

Abstract:

During an immune response, T cells express immune checkpoints (PD-1, CTLA-4), suppressing their functions and activation. Immune checkpoint blockades are a treatment used in cancers that block checkpoint inhibitors to increase T cell activity. A study by Spencer Wei investigated how anti-PD-1, anti-CTLA-4, and a combination therapy impacted T cells in melanoma skin samples. This study did not examine how non-T cells were affected by the treatment. The current project aimed to investigate the change in non-T cells in the tumor microenvironment between treatments using data from Wei et al. The independent variable was the treatment (anti-PD-1, anti-CTLA-4, or combination). The dependent variable was the percentage of non-T cells in samples (significance measured by t test). It was hypothesized that different treatments would impact types of non-T cells at the tumor site. Non-T cells were isolated and clustered based on similarity. Clusters that were likely to vary between treatments were selected and identified. A graph was generated for these cell types to display its percentage in each treatment group. A t test determined statistical significance. The cell types prone to change were: a B cell subset, antibody secreting B cells, natural killer cells, and dendritic cells. There was statistically significant change in the percentage of antibody secreting B cells when comparing anti-CTLA-4 to the combination therapy, and anti-CTLA-4 to anti-PD-1. All other comparisons were statistically insignificant. Limitations may have impacted statistical significance of the data. The data partially supports the hypothesis, as antibody secreting B cells had a significant change.

**Technical Disciplines Selected by the Student
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CB 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

98

Fair Category

LS

Project Number

3091

Title: How different types of vitamin induced water affects plant growth

Student Name(s): A. Werenski

Abstract:

In this experiment, I tested how different types of vitamin induced water affect plant growth. From my 4 week testing period I concluded that the vitamin C induced water increased plant growth most. For my control group, the plant watered with no additives grew 1 in.. Compared to my vitamin A and E watered plants that grew 2 and 2 3/16 respectively. Lastly, my Vitamin C watered plant grew 3 in, proving that vitamin C benefited plant growth the most. In conclusion, based on the data collected, I can assume that vitamin C affected plant growth the most.

Technical Disciplines Selected by the Student
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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

205

Fair Category

LS

Project
Number

3092

Title: Implications for Increased Acidity for Metabolic Function for Freshwater
Microinvertebrates (*Daphnia magna*)

Student Name(s): P. Camacho-Leon

Abstract:

The recent trend of rain taking to higher acidity levels has the potential to alter the nature of the freshwater food chain. People seem to pursue constant talk about the gradual acidification of the ocean, but that same trend can also be found in freshwater around the world. This experiment seeks to look at the impact of water acidification on the metabolic function of freshwater invertebrate, *Daphnia magna*, a creature whose heart has been shown to have similar reactions to the same stimuli as humans and has, in turn, been used in several experiments, with the intention of predicting the possible effects of certain drugs on human hearts. The fear is that acidification of water may impact the health of these creatures, which can, in turn, have an affect on the rest of the food chain. Likewise, it was found that higher acidity of a pH of around 5 is linked to a slow down in the heart rate of the daphnia, with the daphnia tested coming out to have an average heart rate of 156 BPM, as opposed to 178 BPM at a pH of 7. The impacts of a slowed down heart rate, or bradycardia, may include decreased blood flow and general fatigueness.

**Technical Disciplines Selected by the Student
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EM AS EV

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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

252

Fair Category

LS

Project Number

3093

Title: Monitoring Northeastern U.S. Bat Populations for *Pseudogymnoascus destructans*, the Causative Agent of White Nose Syndrome

Student Name(s): C. Halabi

Abstract:

White-nose syndrome (WNS), a cutaneous fungal disease, has killed over 7 million bats since its introduction to North America in 2006. The associated fungus, *Pseudogymnoascus destructans* (Pd), is psychrophilic, or cold-loving, and strikes bats during their hibernation. When a bat enters hibernation, its body fat content is high to enable it to survive months without daily sustenance. As the fungus irritates the bat and affects its physiological processes, the bat interrupts its lethargic state of torpor frequently. This causes a premature depletion of body fat which ultimately kills the bat. WNS especially afflicts the little brown bat *Myotis lucifugus*, whose female adults migrate to summer maternity sites in May. We monitored seven such summer colonies in Vermont, Massachusetts, and New Hampshire. A population census was performed, bats were trapped, and individuals were assessed for the following: approximate age, sex, forearm measurement, weight, wing swab for Pd, and wing score (condition of wing). We focused on the relationship between the wing score, a visual assessment, and wing swab findings, a molecular assessment. Among bats given a wing score of 0 (no visual evidence of WNS damage), 95% tested negative for Pd in the lab. If wing scores are accurate, then DNA processing can be eliminated and accelerate WNS research. Additionally, we analyzed data from the most populous site, and found that the percentage of bats with Pd decreased over the summer. The ability of a population to recover from the effects of WNS over a single summer suggests gradual bat resistance.

**Technical Disciplines Selected by the Student
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AS MI 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

139

Fair Category

LS

Project Number

3094

Title: Genetically Modified Food Packaging

Student Name(s): E. Dalal

Abstract:

Genetically modified (GM) foods are very prevalent in an American's food supply nowadays. However, GM food packaging does not completely indicate the presence of the *Bacillus thuringiensis* gene all the time. I researched the degree in which GM food packaging indicates the presence of the *Bacillus thuringiensis* gene. A centrifuge was used to prepare the sample and isolate the target DNA sequence which was followed by polymerase chain reaction, which multiplies this DNA sequence. Gel electrophoresis was used to separate the DNA based on size and mass and clearly see the results. In the gel electrophoresis, 5 out of the 6 foods that were tested contained the *Bacillus thuringiensis* gene. Only 3 of these foods were actually labelled as genetically modified. Evidently, many foods can contain small traces of genetic modifications that are not actually labelled but still present.

Technical Disciplines Selected by the Student
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PS 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

273

Fair Category

LS

Project Number

3095

Title: Ultrasensitive, Microchip Detection of HIV via a Fluorescence-based, Europium-Doped Silica Nanoparticle Immunoassay

Student Name(s): J. Konno

Abstract:

Human immunodeficiency virus (HIV) causes acquired immune deficiency syndrome (AIDS) in its final stages, afflicting 36.7 million individuals globally. Early detection and effective antiretroviral therapy have been shown to vastly improve quality of life and prevent further transmission. However, in resource-limited settings, early detection is difficult due to the lack of proper diagnostic facilities. As such, a low-cost, sensitive test for HIV is highly desirable for point-of-care detection. Recently, researchers have described the design of a fluorescence-based, Europium-doped silica nanoparticle sandwich ELISA immunoassay, that is capable of detecting HIV p24 antigen in a controlled laboratory setting. Others have detailed the design of a portable, lab-on-a-chip immunoassay platform integrating such nanoparticles, where HIV p24 could be detected with commercial handheld fluorometers. This current research instead explores the development of an ultrasensitive, reagent-based microchip HIV assay, incorporating Eu-doped silica nanoparticles conjugated to streptavidin (Eu-NPs) as an ultrasensitive bioconjugated probe for portable HIV detection. Europium-doped silica nanoparticles were synthesized using the modified Stober method, and conjugated to streptavidin using the EDC/Sulfo-NHS method. A polydimethylsiloxane (PDMS) well-plate was fabricated and used as a platform for the micro-immunoassay, which could detect picogram/ml p24 antigen, measured by Eu-NP fluorescence. The fabrication of this easily stored and delivered ultrasensitive HIV microchip assay validates future exploration and potential use in resource-limited settings, as the assay is low-cost and is more sensitive than conventional colorimetric ELISA tests. Further development would increase the sensitivity of the portable, PDMS well-plate Eu-NP assay, so that it is viable in real-world settings.

**Technical Disciplines Selected by the Student
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ME BI 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

263

Fair Category

LS

Project Number

3096

Title: Development and Testing of an Effective Novel Copepod-Based Mosquito Ovitrap

Student Name(s): S. Wang

Abstract:

Mosquito-control systems that are inexpensive, environmentally-sound and low-maintenance are lacking. Cyclopoid copepods, small aquatic organisms that have the ability to destroy mosquito larvae, have been used in Vietnam and other places for mosquito control. Utilizing copepods' larvae-destroying ability, this project aimed to develop a copepod-based ovitrap for residential mosquito control and test its real-world utility. Both copepods captured from a local pond and ones purchased from a commercial supplier reduced 95% of the larvae population in 5 days; this rate was maintained even in the presence of copepods' natural food source, algae. These results show that effective larvae-destroying copepods can be sourced at low cost from local ponds and self-sustained with naturally occurring algae when larvae are absent.

Optimum ovitrap conditions, including black color and grass-covered pond water, were identified to attract the most egg-laying mosquitoes. An engineered upper layer of the ovitrap effectively prevented the loss of copepods during rain fall. Without rainfall, the evaporation rate of water in the ovitrap was measured at 0.21 cm/day, showing that a typical ovitrap (height = 25 cm) will not need water replenishment during the mosquito season. When the ovitraps were placed outdoors for mosquitoes to lay eggs in, the copepods inside destroyed 98.6% of larvae hatched. This project developed a novel copepod-based ovitrap that attracts egg-laying mosquitoes and destroys their larvae. Since it utilizes free, local copepods, which feed on algae in the absence of larvae, this ovitrap provides a cheap, environmentally-friendly and low-maintenance mosquito-control solution for residential communities.

Technical Disciplines Selected by the Student
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EM AS

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

LS

Project Number

3097

Title: Correspondence between the location of brain lesions and language behavior in aphasics:
A voxel lesion symptom mapping study

Student Name(s): S. Agrawal

Abstract:

Aphasia is a condition that affects approximately 1 in 300 people. This condition hinders language comprehension and production in a person upon the reception of brain trauma. The classic aphasia model reveals the relationship between the location of brain lesions, or tissue damage, and the corresponding behavior. This model has been used for quite some time now, but it is possible that this design is no longer consistent, which might result in misdiagnosis. In our experiment, we aspire to determine whether or not the classic aphasia model proves consistent to this day.

In the study, we will test the correlation between lesion location in Broca's and Wernicke's areas and speech behavior by conducting a case study with 15 total aphasics. First, we will map each participant's lesions using a program called MRIcron and calculate the percent lesion occupation in Broca's Area and Wernicke's Area. Then, we will evaluate each participant's speech characteristics using the Boston Diagnostic Aphasia Examination. We will record this entire data set and attempt to correlate each of the variables to find a relationship.

We found in our experiment that there is no significant correlation between Broca's Aphasia and expressive language disorder, nor between Wernicke's Aphasia and comprehension language disorder. However, there was a 0.2% correlation between the scores of expressive and comprehension aphasia. As a result of our data, we have deduced that if an aphasic has expressive language disorders, it is likely that he or she will have issues in language comprehension as well.

**Technical Disciplines Selected by the Student
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BE

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CSEF Official Abstract and Certification

Word Count

217

Fair Category

LS

Project Number

3098

Title: Correlations Between Car Make/Model with Emissions Footprint

Student Name(s): C. Silva

Abstract:

The EPA have set limits on leaving motor vehicles idle without a driver inside for a set period amount of time. The state of Connecticut has regulations that prohibits all types of vehicles to idle longer than three minutes. Becoming a recent car owner I decided to indulge myself in the automotive world so that I may be able to gain knowledge about cars. They placed these regulations that if violated you may be given a warning or fined. One of the main reason these regulations were made are to combat carbon dioxide emissions. I decided to researched how much carbon dioxide is released in a 5 minute idling period and if the make and model of the vehicle contributed to these levels. The way this was conducted was the vehicle was not turned on for eight hours to replicate the need to warm the car up. Then using a carbon dioxide monitor I will record the highest reading. Two model cars are tested in this experiment a 2006 Volkswagen passat and a 2011 Dodge charger. These two vehicles were chosen because each provide a different level of horsepower and have two significantly different engines. The results supported my hypothesis with the dodge releasing a high of 9613 PPM and the Volkswagen only having a 6544 PPM.

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

EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LS

Project Number

3099

Title: The Relationship Between Altitudes and Incidences of Skin Cancer

Student Name(s): L. Lawson

Abstract:

The purpose of my research study was to collect evidence proving the connection between altitudes and incidences of skin cancer. I selected this topic because I am intrigued by radiation and its effect on the world. During my research, I gathered data about the sun's UV rays and its effects on humans. I created a graph depicting (high altitude) Boulder, Colorado and (low altitude) New Haven, Connecticut's average annual count of skin cancer cases for both sexes. In addition, I found the degree of skin cancer typically found at high altitudes vs. low altitudes. My hypothesis was that individuals closer to sun's harmful UV rays, would be more prone to severe types skin cancer, and have more skin cancer reports than individuals who lived in low altitude areas. The research results support my hypothesis by showing human's risk of skin cancer increases when living in higher elevation areas because the protective ozone level depletes leaving the protective layer of UV radiation weaker; As a result, it allows radiation to penetrate the skin. This research study could potentially aid in health planning for cities at various altitudes. The study would also be instructive for health facilities, treatments, and insurance companies. For low altitude places, health insurance, as well as care of skin cancer, would be inexpensive and less intrusive because they have fewer incidences of skin cancer. On the other hand, high altitudes places would have heavy treatment, high quantities of medicine, and more doctors/staff resulting in a higher expense.

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

EV EA EM

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CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project
Number

3100

Title: Crystallization and Atomic Level Structural Analysis of Deubiquitinating Enzyme USP7 bound to a New Covalent Inhibitor for Cancer Drug Informatics and Development

Student Name(s): D. Morgera

Abstract:

In at least fifty percent of cancers, the cell cycle regulatory protein p53 is either malfunctioning or underactive, not adequately repairing DNA damage and monitoring the rate of cell division. Therefore, it has become a major target in the development of stabilizing drugs, but since it is non-enzymatic, its concentration cannot be increased directly. However, Ubiquitin Specific Protease 7 (USP7) is an enzyme with the ability to regulate p53 cellular concentration. In my study, I aim to determine the structure of the catalytic cysteine region of USP7 bound to the inhibitor P50429 in order to mediate the development of more effective cancer drugs, since current similar drugs are not potent enough and thus have harmful off-target effects. To do this, I have created and plated multiple 24 well assays, with each well consisting of a different solution. Within these solutions is the USP7 inhibitor complex, which I aim to crystallize for structural analysis. If precursors to crystals are found, I optimize the assay by making more plates based around those particular solutions. Thus far, I personally have obtained crystals, but I cannot confirm they are of the complex (rather than the solution) until analyzation. I am steadily progressing towards viable crystals which will be used with X-Ray Crystallography at the Brookhaven Laboratory. From this, we will see a diffraction pattern that will help us determine the complex's atomic structure. With structural knowledge, pharmaceutical companies can continue to perfect drugs, leading to human trials and novel, effective therapies for cancer patients.

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CB ME BI

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CSEF Official Abstract and Certification

Word Count

255

Fair Category

LS

Project
Number

3101

Title: Cystic Fibrosis Transmembrane Conductance Regulator Protein Misassembly in Correlation to Cystic Fibrosis

Student Name(s): M. Kish, n. n/a, n. n/a

Abstract:

The Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) protein functions as an ion channel within the cell membrane that regulates the transportation of chloride ions. Once the chloride ions are outside the cell, they attract a layer of water that moves mucus out of the airways and allows people to breathe. However, when a Delta F508 mutation occurs in the gene that produces the CFTR protein, it results in an abnormal protein that does not fold properly, making it a target for degradation or causing the channel to have a lower probability for opening. In result, the chloride ions are trapped inside the cell, water is not attracted to the surface of the cell, and the mucus in the airways of the lungs becomes dehydrated and thickens, making it difficult to breathe. Delta F508 is found in 90% of patients with Cystic Fibrosis. To address this issue, researchers have bound VX-809, a corrector molecule, to the first nucleotide-binding domain (NBD1) of the CFTR protein, resulting in enhanced functionality for the protein. To exhibit the manner in which VX-809 functions in conjunction with the CFTR protein, I have created 3D models of the CFTR protein and VX-809. The models demonstrate the allosteric relationship between the binding site of VX-809 and the intracellular loop of NBD1 and its significance in the functionality of the CFTR protein. The positions of the models in relation to one another reveal the possibility for other molecules to act as correctors on other surfaces of the CFTR protein.

**Technical Disciplines Selected by the Student
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CB AT EN

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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

179

Fair Category

LS

Project
Number

3102

Title: Echinacea's Effect on Stress Induced Immunodeficiency in Crickets

Student Name(s): O. Wallon

Abstract:

The purpose of this experiment was to research stress induced immunosuppression and investigate the effects of echinacea on immune system revitalization. The experiment tested crickets' immune integrity after experiencing a stress and immune challenge. A stress response was triggered through placement in a wind tunnel and their immune system was challenged through exposure to *S. marcescens*. Crickets were also administered echinacea in order to test the immune-boosting properties of echinacea. After, hemocytes were extracted and counted from each cricket to determine the effects of stress on the production of hemocytes and the immune-boosting qualities of echinaceas. Based on preliminary data, it is suggested that echinacea can help stabilize hemocyte counts, which dramatically fluctuate after stress and immune challenges. Data also suggests that echinacea does aid the immune system by preventing dramatic decreases in immune cell counts after stress and immune challenges. Research concludes that echinacea is a potentially effective immune-boosting supplement for those with compromised immune systems. Future experiments should investigate all possible immune-related impacts capabilities of echinacea and echinacea's biological effect on immune cells.

Technical Disciplines Selected by the Student
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ME MI 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

270

Fair Category

LS

Project Number

3103

Title: From Tobacco to a Chemical Cocktail: A Smoker's E-cigarette Alternative May Lead to Bronchiolitis Obliterans

Student Name(s): H. Goldenberg

Abstract:

E-cigarette use has become a widespread problem. Advertised as a smoking cessation aide, many believe that these devices pose different, far-reaching dangers, relative to tobacco cigarettes. While little is known about their contents, many have conjectured that their pod flavors contain diacetyl, a ketone that causes irreversible narrowing of the bronchioles (bronchiolitis obliterans). This research provides first-in-literature synopsis of the contents of e-cigarettes, and their migration tendencies when nebulized and inhaled. Analyses of a Kiwiberries Ice e-cigarette pod liquid and nebulized vapor revealed the presence of methanol, ethanol, diacetyl, propylene glycol (solvent), nicotine, and 50+ unidentified components; water was absent. To evaluate migration of the e-cigarette nebulized gas into the lung, a hollow 3D-model of an adult mouth-lung was inserted into a two-chamber vacuum system, to simulate human e-cigarette smoking. Analysis of the inhaled, nebulized vapor highlight the presence of all components of the original liquid, with 18ppm diacetyl inhaled in three puffs. Using fluorescein-doping of the pod liquid, UV-imaging of the mouth-lung (post-smoking) highlights re-condensation of the inhaled vapor throughout the oral cavity, and in the bronchial tree. These re-condensed liquid droplets contain nearly all 50 pod components; those within the oral cavity are ingested, while droplets in the bronchioles pose a threat to alveolar function. While the health risks for the 50+ unidentified inhaled/ingested e-cigarette vapor components are still unexplored, this research highlights the migration of e-cigarette toxins throughout the human lung, and details the threat of diacetyl, which is present in sufficient quantities to cause bronchiolitis obliterans.

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- Yes No

CSEF Official Abstract and Certification

Word Count

178

Fair Category

LS

Project Number

3104

Title: Study on the Effect of Weather Patterns and Events on the Nocturnal Migration of Birds

Student Name(s): J. Teltser

Abstract:

The goal of this experiment is to determine the weather conditions in which birds move in large numbers in coastal Southwestern Connecticut during nocturnal migration. It is predicted that a period of sustained strong southwesterly winds followed by a cold front in the spring will produce the highest concentration of movement. In the fall, the same conditions but with a period of sustained strong northwesterly winds followed by a warm front will also produce the largest movements of birds. One study tracked the bird flights in multiple coastal locations in the Northeast. The researchers attempted to understand how topography, winds, and the size of the migration movement affect morning flight (defined as the visible migration carried over from nocturnal movements in the very early morning) (Van Doren et al., 2014). The knowledge of which weather conditions produce large movements of birds can help predict when such movements will occur. More accurate measurements of these windows can help in the preservation and protection of birds in the Northeast, as well as across the country, specifically those threatened by extinction.

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BE EV EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

LS

Project
Number

3105

Title: The Effect of Certain Food Supplements on Angiogenesis

Student Name(s): T. Keyt

Abstract:

Cancerous tumors use the process of angiogenesis in order to gain the nutrients they need to grow and spread throughout the body. Many studies show certain natural substances can inhibit angiogenesis, however, none show multiple “food” substances using the same procedure. In this study; pomegranate extract, cinnamon extract, fish oil and ascorbic acid (vitamin C) were used separately and together to test their efficiency at inhibiting angiogenesis. These substances were chosen, in part, because they are commonly consumed in Niger, a country with one of the lowest cancer rates worldwide. Six chick embryos were used for each substance trial and the level of angiogenesis inhibition was measured by the amount of blood vessel growth of the embryos (viewed under a dissecting microscope) after the substances were applied to the embryos using filter paper and left to incubate for three days. This experiment found that pomegranate extract stopped nearly all blood vessel growth and was, therefore, the most successful in inhibiting angiogenesis. Any change in angiogenesis when treated with cinnamon extract or fish oil was imperceptible. Vitamin C was found to interfere with the integrity of the yolk, so the amount of inhibition was inconclusive. When the cinnamon extract, fish oil, and vitamin C were combined it was found that any and all development was stopped, including all blood vessels and the embryo itself. Further research is needed on the processes taking place and whether this combination of foods is interacting with the chemicals released during angiogenesis.

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CB

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- Yes No

CSEF Official Abstract and Certification

Word Count

262

Fair Category

LS

Project
Number

3106

Title: Magnesium Micromotor-Enabled Delivery of Oral, All-Natural Antibacterials for the Effective Targeting and Treatment of Urinary Tract Infection Causality in Infant Fatalities

Student Name(s): C. Hallisey

Abstract:

Urinary Tract Infections (UTI's), an infection in the bladder or urethra, pose a primary health risk in pregnancy. Approximately 10% of pregnant women contract a UTI, which if left untreated leads to intrauterine growth restriction, premature birth, and neonatal fatalities. Current oral antibiotic treatments are costly and prescribed, requiring concurrent use of a proton pump inhibitor and may be chemically altered by the acidic conditions of the stomach. A low-cost UTI treatment that is simple, widely available, and able to withstand gastric conditions, is needed. In this research, an all-natural UTI treatment, made from four combined natural antibacterial (CNA) components (Berberine, D-Mannose, Vitamin-C, and A-type Proanthocyanidins, 1:63:83:5, m/m) was devised. Unique oral delivery of the CNA is based in its integration atop Mg-micromotors that react with gastric acid to form H₂ gas, naturally depleting adverse stomach acid and concurrently propelling the new therapy towards the small intestine so that it is efficiently processed for treatment. Initial experiments, highlight 86% inhibition of pre-existing E. coli by 6mg CNA. To create the UTI therapy, 36µg CNA was combined with 1% PLGA, and added to 10mg Mg-micromotors, separated by a SiO₂ layer. Lastly, 10mg of the CNA-SiO₂-Mg microparticles are enclosed in a cellulose capsule. The new UTI therapy propelled through simulated gastric fluid and released the CNA inhibiting nearly 80% E. coli growth, the same as direct CNA injection. This new all-natural UTI therapy is over-the-counter, requires no special storage, and costs 50¢ per treatment, 70% less than current UTI antibiotics.

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CSEF Official Abstract and Certification

Word Count

253

Fair Category

LS

Project
Number

3107

Title: The Effect of Overexpression of CREB-Binding Protein (CBP) on Gene Expression of Tumor Suppressor p53 in Mus musculus Breast Carcinoma (BRCA) Cells

Student Name(s): R. Maitra

Abstract:

Second only to lung cancer, breast cancer is a leading cause of cancer death in the United States. The large population of those affected by breast cancer demonstrates the urgency to develop solutions to inhibit the growth and proliferation of breast cancer cells.

In several types of cells, protein p53 acts as a tumor suppressor; the p53 pathway induces growth arrest or apoptosis. However, when p53 is mutated, it loses tumor suppressing function, leading to unregulated growth and cell division. This mutation occurs frequently in breast cancer.

The protein CBP (CREB-Binding Protein) has been shown to be a critical regulator of p53 activity, including transcription, and, eventually, the p53 tumor suppressor pathway. Therefore, it is expected that the overexpression of CBP will result in the upregulation of p53 activity and gene expression, and subsequently, successful negative effects on breast cancer cell growth and proliferation.

This experiment tests the effect of overexpression (via transfection) of CBP on several markers of p53 gene expression and overall condition of cells. A lipid transfection reagent is used to transfect CBP plasmid DNA and a puromycin-resistant plasmid into the model organism, Mus musculus epithelial mammary cells and breast cancer cells. In order to determine successfully transfected cells, antibiotic selection and treatment of the experimental group with puromycin eliminate any non-transfected cells. After growing and maintaining the cell lines, western blot analysis is used to measure the expression of p53 in each group and compared with the results from the control, cancerous and noncancerous cells without overexpression.

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- Yes No

CSEF Official Abstract and Certification

Word Count

244

Fair Category

LS

Project
Number

3108

Title: Determining the Effect of Flow on Time Perception

Student Name(s): A. Gopal

Abstract:

This study tests the accuracy of the axiom “time flies when you’re having fun”. The purpose of this study is to determine if and how conducting activities that “flow”, or are considered enjoyable by a certain set of characteristics, and that one does not enjoy affects time perception. Fourteen high school students were asked to describe their interest in two activities, simple math problems and drawing. Based on their answers, they were placed into Group A or B (each activity). Each group had three sub-groups- neutral, like, or dislike. In a room with no time indicators, Group A conducted their activity for 16 minutes and 32 seconds and participants recorded their perceived elapsed time. For additional certainty, Group B did the same with the second activity. The data was analyzed by comparing the accuracy of perceived elapsed time between the three sub-groups. It was hypothesized that the perceived elapsed time of those neutral would be close to accurate, that of the like group would be less than the correct time, and that of the dislike group will be more. The independent variable is the flow sub-group; the dependent is the accuracy of estimated elapsed time. This study will help show how flow is achieved, how time can be used effectively, and how to maximize work efficiency. The data has too little significance to accept/reject the alternative/null hypothesis. However, it suggests that creative, right-brained activities stimulate lower perceived times.

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BE

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CSEF Official Abstract and Certification

Word Count

208

Fair Category

LS

Project
Number

3109

Title: Kinetics of Sucrose Conversion to Glucose Using Enzyme (Invertase) Across a Dietary Spectrum

Student Name(s): F. Smith

Abstract:

Diabetes is a difficult disease to sustain regarding the dietary choices you must make to maintain homeostasis. Studies have shown that the risk of developing diabetes has increased, making this a modern issue. People with glucose-related deficiencies or diseases have to be careful of what they eat, and make sure they keep their glucose levels up and keeping themselves from danger. Foods with high sugar contents will raise their glucose levels such as orange juice, cereal, fruits, etc. Foods that should be avoided are those with little amounts of glucose. Hyperglycemia is when there is abnormally high glucose levels in the blood. It is also similar to diabetes, where the blood glucose levels are high because the pancreas doesn't release insulin (Type I), or the insulin the body produces doesn't work (Type II). Foods to stay away from are foods high in glucose and starch like fruit juices, coffee drinks, french fries, etc. In order to test the enzyme invertase, 5 different foods were used to see if the invertase changed their glucose concentration. The 5 foods were chosen due to their array of glucose levels, ranging from high to low. They were each measured before the invertase, and then measured after 30 minutes of invertase activity.

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BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

LS

Project
Number

3110

Title: How Does Ambient Temperature
Affect the Egg Laying Rates in Coturnix Quail?

Student Name(s): R. Mueller

Abstract:

Objectives/Goals

The goal of this project was to see if there is a correlation between ambient temperature and the egg laying rates of coturnix quail. I expected optimal egg laying temperature to be somewhere around 50-60F based on data from chickens.

Methods/Materials

I have been conducting this experiment for more than four years and spanning three different groups of hens. My birds are kept in cages in an insulated hutch outside. I go out to the birds twice a day and record the number of eggs and the ambient temperature.

Results

I found that the optimal temperature is around 65F but is not very critical on the warmer side of the curve. The results were surprisingly somewhat different with each batch of hens I tested. The less birds there were, the more clear the trends appeared. The third set of hens were also fed a different feed and produced more eggs at higher temperature than the earlier two hen groups.

Conclusion/Discussion

There were clear trends visible in the data: the birds lay less eggs during the night than during the daylight hours; there is a temperature dependence with temperatures below 35F resulting in much reduced laying rates and temperatures above 75F also resulting in somewhat lower laying rates - although this trend is less evident in the third set of hens. To be able to make more definitive statements, this work will need to be continued with the

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AS

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CSEF Official Abstract and Certification

Word Count

244

Fair Category

LS

Project Number

3111

Title: The Effect of Sea Level Rise and Salt Marsh Change on the Population of the Atlantic Marsh Fiddler Crab

Student Name(s): N. Prinz

Abstract:

Atlantic Marsh Fiddler crabs (*Uca pugnax*) prefer to live in the low marsh area of salt marshes where burrowing into the ground is easier. Because of sea level rise, the low marsh area of New England marshes becoming limited while the high marsh area is becoming wetter and therefore easier for *Uca pugnax* to burrow. There is previous data on how the Atlantic Marsh crab population is increasing, but because of changes in salt marsh ecology, it is unclear if these population trends are still occurring. The research questions being addressed in this study are 1) Is the population trend of the Atlantic Marsh Fiddler crab still occurring with respect to changing marsh ecology? And 2) How does the population of crabs compare to types of vegetation in the salt marshes? It was hypothesised that the population of crabs will have increased compared to previous years because of the available high marsh. The independent variable is the time period when the population of crabs was sampled and the percent vegetation coverage in each section of salt marsh where the crabs were collected. The dependent variable is the population of crabs both in total and per section. Data shows a decrease in *Uca pugnax* population compared to previous years and a crab preference of short *Spartina alterniflora* in the high marsh. This study will provide insight into how organisms on New England salt marshes are reacting to increased sea level rise compared to previous years.

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EV AS

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- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LST

Project
Number

3501

Title: Isolating Bacillus Thuringiensis from Soil Samples in Order to Develop a More Effective Biopesticide for Agricultural Lepidopteran Pests.

Student Name(s): K. Williams, D. Rediger

Abstract:

Pests and disease are very common problems for agriculture. This has been a problem for all civilizations for thousands of years, but most found a way to control the issue of pests eating their crops. Bacillus thuringiensis, also known as BT, is a strain of bacteria that is the most commonly used pesticide for caterpillars, but it can be very hard to use effectively. BT works by perforating the caterpillars' intestines, so in order to work the caterpillar needs to eat something that has the toxin on it. This process destroys trees and other plants in the process because it can take a long time, but if we can reduce the time the BT needs to perforate the caterpillars' stomach this would be a valuable asset. This results in a slightly temperamental process that's very expensive and not the most effective. If we can isolate a strain of BT from soil microbes that is more effective, then we can test them against the currently used BT toxin strains. In our research, we are trying to find a new strain of BT from the soil. The strains will be analyzed to determine if we have found a new strain. The BT will then be tested on tobacco hornworms to determine the effectiveness of the new strain of BT. We will be measuring the effectiveness of what we find by how many caterpillar deaths we have and the amount of time it takes, then comparing them against the currently used BT strains.

**Technical Disciplines Selected by the Student
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MI EM

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CSEF Official Abstract and Certification

Word Count

245

Fair Category

LST

Project Number

3502

Title: Affect Commercial Use of Sodium Chloride to Treat Icy Roads Has on Surrounding Soil and Plant Life

Student Name(s): M. Gadomski, J. Wessner

Abstract:

To begin, we gathered six seed starter trays, each tray containing six individual cells. We prepared five different groups of soil, beginning with the control group, 2 mL of water per every cell in the tray. Group 1 used 1g of sodium chloride dissolved in 48 ml of water which distributed into 2 mL of solution per every cell. Group 2 used 2g of sodium chloride dissolved in 48 mL of water which was distributed into 2 mL of solution per every cell. Group 3 used 3g of sodium chloride dissolved in 48 mL of water which was distributed into 2 mL of solution per every cell. Group 4 used 4g of sodium chloride dissolved in 48 mL of water which was distributed into 2 mL of solution per every cell. Group 5 used 5g of sodium chloride dissolved in 48 mL of water which was distributed into 2 mL of solution per every cell. After five days, we planted three arugula seeds in each cell. A grow light was used for six hours daily, and each cell recieved 2 mL of water every other day. We ended our experiment on February 28th, 2018, and our results were as follows; On average, the control group had a sprout of 5.9 cm, group 1 had a sprout growth of 4.9 cm, group 2 had 4.5 cm, group 3 had 2.9 cm, group 4 had 2 cm, and group 5 showed no sprouts or signs of growth.

**Technical Disciplines Selected by the Student
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EM EV

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CSEF Official Abstract and Certification

Word Count

242

Fair Category

LST

Project Number

3503

Title: The Effects of Specific External Stimuli Designed to Disrupt the Behavioral and Foraging Patterns of Hemigrapsus Sanguineus

Student Name(s): A. Porphy, T. Saunders

Abstract:

Asian Shore Crabs (*Hemigrapsus sanguineus*) are an invasive benthic crab species that are overtaking the roles of natural crabs, have no natural predator in America, and are destroying carbon sinks in marsh grasses. The objective of this project was to create a habitat mimicking the niche of the Asian Shore Crab, observe the crabs' behavior, and utilize several external variables to measure their effect on the crabs' foraging patterns. Several crabs were caught in the marshes of Tod's Point in Old Greenwich, CT and their social and foraging behavior analyzed for 2 weeks. Several variables were then introduced and response measured based on the disruption it caused to their social and foraging habits in relation to specific time intervals. The variables included both high frequency sound and disrupting light. The crabs were exposed to sound through a small waterproof speaker and to light through a small blue strobe light. The crabs were heavily affected by the high frequency sound as they were slower to respond when exposed to food and more aggressive towards each other during that same period. The light, on the other hand, seemed to have little effect on the crabs as the little amount of light caused the crabs to be more inactive, not the strobe light itself. Future studies may include testing alongside other native species to measure the possible effect. At the end of our investigation, the crabs were returned to Tod's Point in Old Greenwich, CT.

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CSEF Official Abstract and Certification

Word Count

250

Fair Category

LST

Project
Number

3504

Title: Do the Stars Tell All?

Student Name(s): A. Sperrazza, J. Uzdarwin

Abstract:

Objectives/Goals

This project was designed to determine if astrological signs and zodiac could accurately provide a description of both an individual and a relationship involving two people. We hypothesized that since astrology is a belief system, the results would not be completely accurate.

Methods/Materials

We conducted our research through a series of online resources. We first developed a list of well known people whose traits could easily be recognized. To assist this process, we used various websites to further our knowledge of these people and their characteristics. In regards to the couples, we researched their history together and their current relationship status. We then conducted research to understand each zodiac sign and their traits to make it possible to compare and contrast with these celebrities actual traits.

Results

Based on the data collected, we found that compatibility can be swayed to fit any couple. We also found that individual traits compared to the traits based on zodiac, that there are some traits that can be perceived as accurate and some that don't show any correlation. For example in the case of Adolf Hitler, we found that he blamed others for his failures and mistakes, but also was determined and persistent. His zodiac, Taurus, agreed that he was persistent, but did not mention pointing fingers at others.

Conclusions/Discussions

Our hypothesis that the zodiacs would be inaccurate was proved partially incorrect. We can

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BE

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CSEF Official Abstract and Certification

Word Count

228

Fair Category

LST

Project Number

3505

Title: Perceptions Surrounding Mental Illness can be Diminished with Education and Knowledge about Dissociative Identity Disorder

Student Name(s): E. Cherwin, M. Carson

Abstract:

Introduction The purpose of the research study conducted was to stomp out the stigmas associated with mental illness and raise awareness about dissociative identity disorder (DID). Each individual shows different names, personal history, and characteristics. DID is a reaction to trauma or other forms of stress as a way to help those with DID avoid traumatic memories from the past.

Problem How does someone with DID feel if an individual knows about their mental illness?

Hypothesis If knowledge about DID will increase people's awareness then they will have more compassion around a person who is diagnosed with DID.

Method This quantitative study was conducted to raise awareness and education on the stigmas of DID. The participants attended a career technical high school. The four career technical trades were randomly selected by an online website titled Random Thing Picker. Both the control and the intervention groups took both a pre and post-survey. The intervention group were given an educational component that included a PowerPoint with videos to teach about DID followed by the post-survey.

Outcome Students demonstrated knowledge about DID after the educational component. The control group remained constant.

Limitation The biggest limitation was students not returning signed permission slips to be in the research study. Out of the 54 permission slips dispersed only 29 were returned.

Keywords: Dissociative Identity Disorder, Intervention, Control, Knowledge, DID, Understanding, Stigmas

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

246

Fair Category

LST

Project
Number

3506

Title: The Effects of Peppermint on Reaction Time and Performance

Student Name(s): E. Turchuk, F. Gomez

Abstract:

The goal of this experiment was to determine how peppermint affects reaction time and performance. The proposed hypothesis stated that peppermint would positively affect performance and improve reaction time. This was tested in three ways; the ruler test, an online reaction time test, and a simple math test. Twenty individuals were chosen for this experiment and the tests were conducted over a period of three days. There were five individuals per group. Each participant was assigned either peppermint candy, peppermint gum, peppermint oil or wintermint gum. On the first day, participants tested their reaction time with the ruler test. Reaction time was measured from each participant without their assigned product for three trials and then with their assigned product for three trials. On the second day, participants tested their reaction time with the Human Benchmark reaction time test. Their times were measured without their assigned product for five trials and then with their assigned product for five trials. On the third day, a simple math test was administered. Participants were given one minute to complete a multiplication test. They had one test without their assigned product and another test after they had their assigned product. At the end of the three days it was found that the overall data supported the hypothesis. On average peppermint caused participants' reaction time to quicken as well as improve their performance. The data can be used to help students improve test performances as well as improvement in more practical settings.

Technical Disciplines Selected by the Student
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BE

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- Yes No

CSEF Official Abstract and Certification

Word Count

248

Fair Category

LST

Project Number

3507

Title: The Application of Magnetotactic Bacteria for the Efficient Production of Energy

Student Name(s): E. Fraser, S. Balakrishnan

Abstract:

Objective: The project is designed to improve the energy output of magnetotactic bacteria (MTB) by altering the environmental factors that they are put in: glucose and water concentration, and temperature.

Materials/Method: To perform this experiment, collect the bacteria, build the energy generator, and change each independent variables.

Results:

Based on the data gathered on yeast bacteria, MTB that were placed in an environment that is 25 degrees centigrade would have a higher ATP production than MTB placed in higher or lower temperatures. Based on research on E-Coli bacteria, providing MTB with glucose would increase their growth rate. MTB is an aqueous bacteria and would work best at a DO Level of 0.02mg O₂L⁻¹ and at a DP rate of 38ugL⁻¹.

Conclusion:

Although our experiment failed due to inadequate technology, our hypotheses have been supported and proven to be true by other experiments. Therefore, a theoretical experiment was performed, if repeated stronger equipment would be necessary. An optimum temperature for bacteria efficiency has been tested with yeast bacteria. Experiments have supported that the optimum temperature is 25 degrees centigrade. Providing glucose to the MTB would increase their growth rate as it has done with E-Coli bacteria. This would result in a more sustainable and higher production of energy. Both E-Coli and yeast are similar to MTB as they live in similar environments. Experiments have also found that aqueous bacteria (such as MTB) perform the best with certain dissolved element levels. (Smith, Prairie, 2004).

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MI CB PH

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- Yes No

CSEF Official Abstract and Certification

Word Count

220

Fair Category

LST

Project Number

3510

Title: Emergency Water Filtration System

Student Name(s): M. Lopez, T. Batty, J. Tanski

Abstract:

In the world, there are over 780 million people without access to an improved water source or drinkable water. This project is about seeing what combination of water filters will create the best drinkable water while making the filtration system portable and energy efficient. The hypothesis is that with a combination of all the filters (chlorine filter, general filter, ultra violet filter and a de-chlorination filter) we will be able to produce the cleanest drinkable water for natural disaster victims. When the experiment began, It only used a general filter chlorine filter and a de-chlorinator. After, that an ultraviolet water filter was added, which purified the water a great deal more. After a second dechlorinator was added, the chlorine flavor and smell was removed, making it more palatable. Particles still came out in the final stage of our project, so a second general filter was added, which helped to get rid of the excess particles left from when the water went through the first general filter. The results from the experiment was that with the combination of filters that were used enabled the system to produce clean drinkable water for people that have no access to clean water. This experiment will help the world by providing a clean water supply to people that are in need of it.

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EM EA ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

254

Fair Category

LST

Project
Number

3511

Title: Using the Tidal Zone as a Renewable Source for Antibiotic-Producing Bacteria

Student Name(s): E. Russell, N. Padgett

Abstract:

The antibiotic resistance crisis is a fast-growing problem in the modern world. Previously treatable bacteria are becoming immune to most of the world's antibiotics, and has caused the appearance of diseases similar to MRSA, which has claimed the lives of 11,000 people in 2011 alone. This crisis was caused by the overuse of antibiotic medications, which has allowed bacteria previously treatable by these medications to become resistant to them. To compound the crisis, no new major antibiotics have been discovered recently. This project's goal is to search the tidal zone of oceans for antibiotic-producing bacteria. Because the tidal zone is a harsh environment, bacteria will need more defenses to ensure their own survival, and on the microbial level, these defenses will include antibiotics. To isolate these, we first performed dilutions of our samples, and plated them on cycloheximide plates, which would prevent any molds from growing. We then isolated any possible antibiotic-producing colonies onto patch plates, and observed their growth in isolation. From there, each bacteria was placed onto their own separate plates, so that they would not drift into other zones, and allowed to grow. Overlay assays were then performed using the Small World Initiative's ESKAPE model pathogens. Despite this, no antibiotic-producing bacteria were found this way. However, a chemical isolation procedure will be performed to find any antibiotics that did not appear on the overlay assays. In the future, any antibiotic-producing bacteria found will be DNA sequenced, and the exact properties of the antibiotic will be determined.

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MI CB BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

196

Fair Category

LST

Project
Number

3512

Title: Solar Powered Golf Cart: Go-Go Greenster

Student Name(s): D. Bonneau, M. Page, A. Breen

Abstract:

In the present environment where we are running low on nonrenewable resources, especially fossil fuels, it is imperative that we find innovative ways to make use of energy. That includes finding ways to harness renewable resources to run vehicles. Our team's goal was to design and build a solar-powered system and use it to power a golf cart. that could be used to power golf carts or other small vehicles. We designed a method to attach and wire photovoltaic panels on a golf cart so that it will efficiently operate purely from solar power. Mounting our panel to the roof of the golf cart we use a boost controller which converts the power that the solar panels generate to the power that charges the batteries. The battery indicator shows how much of a charge the batteries have. The relay and switch are in place to turn off the solar panel to take away the risk of back draw from the batteries to the solar panel. This system will help the environment by saving extraordinary amounts of fossil fuels on the golf course, but could potentially be adapted for use on small vehicles of all kinds.

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EE ET EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

LST

Project Number

3513

Title: Saving the Honey Bee Designing a Revolutionary Pollen Mineral Content Analysis Kit for Beekeepers

Student Name(s): J. Gleason, S. Wehelie

Abstract:

The purpose of this project is to design a pollen mineral analysis kit for commercial beekeepers. Currently, there is no quick, easy method for beekeepers to test pollen samples in order to determine what essential minerals the bees are taking in, that correlate with the bees' overall health and survival. If chances of survival are increased with this kit, then there will be both fiscal saving for the beekeeper and environmental benefits. The kit should test sodium, calcium, and potassium, the three minerals most prevalent in pollen. HORIBA LAQUAtwin meters will be used to determine the concentration of minerals within a sample. Supplements NaCl, CaCl₂, and KCl will be dissolved in water for bees to take in. The kit will be successful if 1) It can accurately test the mineral levels in the pollen 2) Provides instruction for the beekeeper to supplement minerals for the bees 3) Is quick, safe, and easy to use. Currently, due to expenses, no data has been collected, and construction of the kit has not begun. Pollen from local beekeepers will be tested to prove the concept of the kit. First, to test that the sensor can measure low ppm concentrations, pure solutions of each mineral at pollen's average concentration will be tested. If it's similar to pollen's true mineral content, the kit has passed. Then, the kit will be tested for practicality. The kit will also include proper doses determined by FDA regulation. If the kit passes all tests, the project is successful.

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AT EM CH

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- Yes No

CSEF Official Abstract and Certification

Word Count

241

Fair Category

LST

Project Number

3514

Title: Effect of Soil Acidity on Stomatal Quantity of Solanum lycopersicum

Student Name(s): S. Bouchard, O. Guijarro-Sines

Abstract:

Stomata are molecular organelles that facilitate in gas exchange among other biological processes. This study addresses the effect of soil pH on stomata function and quantity. A tomato plant (*Solanum lycopersicum*) was used as a model organism. The acidity of the water was manipulated. Forty-eight seedlings were split into groups of 24, 12, and 12. The first 24 were the control group; adding 20 ml of tap-water every weekday for four weeks. The remaining 24 plants were split into two groups; one exposed to acidic conditions and one exposed post-germination, so the plasticity of the phenotype can be observed. Stomatal samples were collected and measured in different groups at 2, 3 and 4-week intervals, each group only being tested once. The 2-week samples for the water exposed plants had the least stomatal concentration when compared to the plants exposed post-germination ($p < 0.01$). The 4-week sample for the water exposed plants had the largest stomatal quantity ($\bar{x} = 159.24$ stomata/mm²) while the acid plant's stomata quantity was the lowest ($\bar{x} = 59.71$ stomata/mm², $p < 0.01$). Our results suggest that acidic conditions impair stomata function and overall growth of the plant. In a world where sustainable food systems are becoming increasingly important and increasingly harder to maintain, and understanding that abiotic stresses may be driving genotype changes at faster rates than first thought should be a topic that garners much more literature attention than it's getting.

Technical Disciplines Selected by the Student
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EM PS EA

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- Yes No

CSEF Official Abstract and Certification

Word Count

130

Fair Category

LST

Project Number

3515

Title: Improving Durability and Strength of Bombyx mori Silk by Fortifying Silk Fibers

Student Name(s): L. Delgado, A. Burdick

Abstract:

The purpose of this project was to fortify the cocoons of silkworms in order to strengthen durability and resistance of produced silk. To achieve this, the cocoons were soaked in three different solutions. Those solutions were graphene, carbon nanotubes, and Sericin+ hand cream. It was hypothesized that the cocoons soaked in fortified solutions (monofilament graphene, carbon nanotubes, and sericin) would produce stronger silk than those which had not been soaked. Solutions were prepared in specific concentrations; and cocoons were massed, soaked, dried, and remassed. After the fortification process, the cocoons and their fibers were cut, flattened, and tested by the Verniers Material Tester in order to test efficiency and force withstood. Specialized clamps were designed to hold the cocoons in place. Data was collected and results analyzed for statistical relevance.

Technical Disciplines Selected by the Student
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AS

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- Yes No

CSEF Official Abstract and Certification

Word Count

256

Fair Category

LST

Project Number

3516

Title: Evaluating an LCHAD Deficiency Model System Created Using CRISPR/Cas9 and *C. elegans*

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

Abstract:

Long-chain 3-hydroxyacyl-coA dehydrogenase (LCHAD) deficiency is rare fatty acid oxidation disorder. In patients with LCHAD, long chain fats can not be converted to medium or short chain fats that make energy for the cell. This means that LCHAD effects the energy in a person's body. The purpose of our research is to create and evaluate the relevance of a *C. elegans* model for LCHAD. *C. elegans* can be grown more quickly than other LCHAD model organisms and its fat metabolism system is very similar to humans. We chose this project because LCHAD is a rare, under-researched disease that is chronic and degenerative. It would be practical to have another model for LCHAD deficiency to test any developing treatments and further study the effects of LCHAD.

In this project, we successfully recreated the LCHAD-causing mutation in *C. elegans* using CRISPR/Cas9 gene editing. We followed published procedures on the cloning-free use of CRISPR/Cas9 in *C. elegans*, including the co-CRISPR strategy, which introduces the roller phenotype to facilitate screening. After microinjection of the CRISPR/Cas9 microinjection mix into L4 worms, 12 P1 worms with roller or dumpy phenotypes were generated and isolated. Then, P2 worms are currently being screened using PCR/restriction digest. Once the desired edits are confirmed, will continue to evaluate this model using a TLC-based lipid assay to determine changes in fat metabolism and other phenotypic assays related to locomotion and longevity. This will help us determine its relevance for gaining insights into human LCHAD deficiency.

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CB ME BI

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CSEF Official Abstract and Certification

Word Count

248

Fair Category

LST

Project
Number

3517

Title: Solar Hybrid Organic Charger (SHOC)

Student Name(s): J. Ospina, D. Rivera, X. Santiago

Abstract:

Abstract :

We have recognized the issue in which many cases people have lost the ability to power their devices during times of natural disasters. We have developed a model or prototype that will transform organic fluids into usable energy.

The contents that we are going to insert in our model will create a chemical reaction when mixed together that will release energy. With that energy, the device will be able to charge devices such as flashlights, phones, radios, etc. This design was developed with the idea of having this model available for people who are going through the experience of hurricanes, tornadoes or any other natural disasters. This model can be portable and filled with contents you can find in your house.

This experiment will be conducted using different organic substances to identify which mixture(s) will be best to use to power the generator. The preferred contents that will power the generator in our perspective will last at least one hour and at most four. Some of the materials we will be using are baking soda, Epsom salts, spider fabric, Plexiglas, a hot plate, a reducer, Fernco cap, post connector, flex tube, and agent citric acid. Inside our prototype three columns will be inserted that have threads around the outside, in which the copper wire and zinc will also be wrapped around. These columns will act as three cells that will constantly be submerged in our mixture and will pick up the energy created by the substances.

Technical Disciplines Selected by the Student
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EA EM CH

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- Yes No

CSEF Official Abstract and Certification

Word Count

201

Fair Category

LST

Project Number

3519

Title: Education Increases Empathy Towards Autism

Student Name(s): K. Campbell, T. Plante

Abstract:

The quantitative research study was performed to test the question, if a fellow classmate or coworker had a better understanding of autism spectrum disorder (ASD) would they feel comfortable being around someone with autism and/or even being friends with them? The researchers conducted this study in a high school setting where the participants consisted of four different senior career technical trades (CTT). The selected participants were provided with a consent form that required a signature of their parent/guardian to grant permission to participate in the study. Those students who returned the consent forms signed were given a pre-survey in order to test their initial knowledge regarding ASD. Of the four trades, selected two were selected to become the intervention group. The intervention groups were administered an educational slideshow presentation after taking the pre-survey to educate them on ASD. A post-survey was then given to both the intervention and control groups. After the study was conducted and analyzed, results showed that the researchers hypothesis was supported, but the research study needs to be repeated multiple times. The goal was to increase the understanding of individuals with ASD and to create a more empathetic feelings towards these individuals.

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

145

Fair Category

LST

Project
Number

3520

Title: Living on Mars

Student Name(s): S. Guo, F. Meng, C. Li

Abstract:

To migrate to Mars, we first need to understand a concept -- alien geoenvironment. This word means "changing the environment of the alien environment, such as the gas in the atmosphere, so that we can get close to the natural environment of the earth". For Mars, the most important thing is to allow Mars to generate the oxygen that human beings depend on for survival. Especially, Hooking also give a confirm on the Mars is the only possible choice for people to survive in the future. Therefore, we made a project about the model of living place for human to immigrate to Mars. Oxygen is one of the conditions that need to be considered. Furthermore, human still need to build machine for providing electricity and food. Moreover, it is more important for proper to have technology to explore Mars in order to make a better living.

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

AT EN EA

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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

204

Fair Category

LST

Project
Number

3521

Title: Survivorship of Freshwater Crustacea (Thalassinidea sp.) in Temperature Extremes

Student Name(s): J. Potter, J. Potter

Abstract:

Global warming is a constant in the developing issue of climate change affecting life within various ecosystems. While every system endures different repercussions, each one starts with the smallest organism then works its way to the largest. In freshwater ecosystems, crustacea (Thalassinidea sp.) would be one of the first and most easily susceptible organism to climate change due to its low status on the food chain and its main role being a feeding crustacea. The results of this study models that temperature fluctuation in controlled freshwater has a negative side effect on the survivorship of Thalassinidea which can result in a disturbance in the freshwater food chain. Although climate change affects all ecosystems, the freshwater system was depicted in the following experiment due to the availability of freshwater crustacea. Three tanks with varying extreme temperatures were used to conduct this study: A cold extreme, a control tank, and a hot extreme. The tanks were observed over a week period to see how long the crustacea would last in their extreme, the crustacea died quicker in the hot extreme, and in the cold extreme showing how climate change of the slightest degree can cause the crustaceans living environment to become unstable and affect the ecosystem.

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

AS EM EA

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- Yes No

CSEF Official Abstract and Certification

Word Count

257

Fair Category

LST

Project
Number

3522

Title: Investigation of the Tenascin-X Protein and its Role in Ehlers-Danlos Syndrome

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

Abstract:

Ehlers-Danlos Syndrome is an inherited condition that affects connective tissues in the body. There are no universal tests for diagnosing EDS and no good treatments. Most treatments help the pain and other symptoms. There are 6 major groups of EDS including the hypermobility, classical, vascular, kyphoscoliosis, arthrochalasia, and dermatosparaxis types. New findings show that there are 13 types of EDS as of 2017. Another type that has been recently discovered is the tenascin-X deficient type. Tenascin-X deficient EDS is caused by alterations in the *tnxb* gene. This gene is the instructions for making the protein, tenascin-X. The deficiency of tenascin-X causes changes to the connective tissues resulting in the clinical features seen in EDS.

The purpose of this experiment is to study the function of the tenascin-X protein and its role in EDS. In this project, the tenascin-X gene was cloned and tagged with a His tag, which can be used to purify and identify proteins that interact with it. Oxtail will be used to find tenascin-X protein binding partners. So far, we have ran several PCR reactions to amplify *TNXB*, the bands were not the correct size so we kept redoing the PCRs until we finally contacted the company. We got their results back confirming that the plasmid that they gave us was the correct plasmid and continued on with our project. We will then screen transformants from ligation reactions to determine if our cloning was successful. We prepared bovine tissue lysates from and determined their protein concentrations.

**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

249

Fair Category

LST

Project
Number

3523

Title: The Effect of Turmeric on the Gene Expression of Breast Cancer Cells in Mice

Student Name(s): M. Madan, R. Nimmagadda

Abstract:

In many cultures around the world, Turmeric is used in all kinds of food, from curries to desserts. Turmeric, for decades, has been believed to have healing properties. In recent years, these healing properties have been researched and tested on as a possible preventive supplement for cancer patients. The main active ingredient in Turmeric is Curcumin, but further research has shown that the additional ingredients also have healing properties. For many cancer patients, it has been shown that Turmeric stimulates the tumor suppressor gene - p53. The purpose of our project is to test the effectiveness of Turmeric on the Gene Expression of Breast Cancer cells. We utilize many techniques including sterile practices, gel electrophoresis and western blot analysis to determine the effect of Turmeric on the p53 expression. The first step in our experiment was making cell media and then growing our two cell lines. We used normal cells as a control to be able to compare the results of how Turmeric works on both Breast Cancer cells and average, healthy cells. We will be using 75, 100, 125 micrograms per mL of Turmeric in each of the cell plates. This process can help us understand the change in gene expression of p53 and measure if the quantity of Turmeric is a factor. We are currently in the process of collecting data and have not come to any conclusions. We expect that Turmeric will increase the expression of p53 and decrease the number of cancer cells overall through p53.

Technical Disciplines Selected by the Student
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CB MI ME

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CSEF Official Abstract and Certification

Word Count

204

Fair Category

LST

Project Number

3524

Title: How will various acids affect the decomposition rate of an apple?

Student Name(s): D. Rivera, K. Torres

Abstract:

The purpose of the project is to prove how different acids may decompose fruits. We picked five different type of acids and made sure that they all had 1 molar concentration. We cut three apples in half and put them inside the containers with different acids in which was viewed up to 72 hours and pictures were taken every day to see the chemical and physical changes by the time. At first, we thought that the Hydrochloric acid was going to make a major change to the apple because once the acid was mixed with the water it had gotten warm. By the end of our project, the apple that was more decomposed was the one in the Vinegar. The apple was mushy and it grew size then what it was at first. We observed that the Vinegar acid was able to work faster by decomposing the bacteria in the apples because the acid is mild and it is known to be more environmental and a type of acid that can break down things as well as being too weak to burn you. In the Sulfuric and Hydrochloric acid, the bacteria wasn't able to grow because the acids were too strong for the apples.

Technical Disciplines Selected by the Student
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CH 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

217

Fair Category

LST

Project Number

3525

Title: Creating Renewable Light Source in *Dionaea muscipula* Using GFP

Student Name(s): H. Bill, E. Haller

Abstract:

Green fluorescent protein, otherwise known as GFP, is a protein composed of 238 amino acid residues that exhibit bright green fluorescence when exposed to light in the blue to ultraviolet range. The protein was initially isolated from the *Aequorea victoria* jellyfish. Due to its ability to be utilized without any accessory cofactors, gene products, or enzymes/substrates, it is a common gene used as a marker. In our research, we used enhanced GFP as our selection marker to see if the transformation would be successful. The subject that the research was conducted on was *Dionaea muscipula*. There is little information on these plants, as they have a complicated genome which makes it difficult to transform them. Our project was conducted by propagating the *Dionaea muscipula* in the laboratory. After, we performed different assays in order to insert the gene into the plant and determine if we would be successful in getting the plant to express the gene. These assays included subculturing, *Agrobacterium*-mediated transformation. In the transformation, we to use the binary construct PCAMBIA2301-5-AtEF1A that was transformed with the *Agrobacterium tumefaciens* strain GV3101. Afterwards, we had used electrophoresis to determine whether or not the gene was successfully transformed into the plant's genome. If successful the eGFP gene should express brightly in *Dionaea muscipula* under UV light.

Technical Disciplines Selected by the Student
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PS CB MI

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

LST

Project
Number

3529

Title: The Impact of Physical Activity on Human Reaction Time.

Student Name(s): B. Wilson, K. Englander, M. Sattan

Abstract:

In our desk-oriented society, we hypothesize people consistently lack focus in the school/work environment due to the stagnant positions we are constantly confined to. By testing the effect of exercise on reaction times, we can infer that a more active environment in the workplace will yield better results for people's productivity.

Test subjects ran on a treadmill for increasing intervals of time, and after each interval, were asked to take a reaction time test. Each test subject signed an informed consent form prior to participating in the experiment.

From our data we can see that after the first two intervals (1 and 2 minutes on the treadmill) there is generally an increase in reaction time After these intervals there is generally a decrease in reaction time

Although we have not completed our testing, we have been able to determine that physical activity does in fact yield faster reaction times. Biologically this makes sense as the more we exercise, the more we increase our circulation resulting in greater oxygen in our cells This helps aid in the efficiency of our cell processes and allows for faster nerve responses. We can apply our data to many segments of society. In schools for example, this could provide evidence that mandatory gym classes or sports would yield better student performance. In the workplace, we could infer that long lunch breaks where people can go out and exercise would increase productivity and concurrently: sales. Ultimately, the applications of our data are unlimited.

Technical Disciplines Selected by the Student
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BE BI 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

252

Fair Category

LST

Project Number

3530

Title: Radiant Heat Self-Contained Greenhouse

Student Name(s): C. Loiselle, T. Sherman, M. Belevance

Abstract:

We studied real world problems, like food scarcity, that affect the future sustainability of our planet. As the human population continues to explode food scarcity will become a serious problem and we wanted to come up with a way to efficiently grow our own food year round, a difficult task in New England. Our idea was to design a self contained greenhouse warmed using radiant heat powered by the sun.

We created a kind of solar panel out of a 4'x8' wooden frame covered with steel plating insulation and filled with copper tubing soldered together for water flow. The insulation would catch the sun's rays, heating the water in the copper tubing. We adapted a mixing valve which sent this warm water into a greenhouse we constructed lined Pex Tubing in the grow bed, warming the soil and the greenhouse. The water cycled back to the solar panel to be warmed again.

Our Greenhouse has worked too well! Within days the greenhouse temperature had reached 126oF, and on even freezing days with overcast the greenhouse still maintained a temperature in the 60's. The mixing valve would allow us to control the temperature of the greenhouse we think our solution lies there. Also, this green house is only 4'x8', a small prototype of a full sized version that we hope to build to go along with our E-House (an energy producing building that we've helped build at school), so in a larger building overheating will not be a problem.

Technical Disciplines Selected by the Student
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EE EM ET

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- Yes No

CSEF Official Abstract and Certification

Word Count

217

Fair Category

LST

Project
Number

3531

Title: Which Starch Plant Will Produce the Most Fuel?

Student Name(s): S. Hewitt, M. McClain, A. Ramirez

Abstract:

We decided to do this experiment because we wanted to find a way to change the way of making cars run. We have noticed that the planet is being contaminated and we want it to find out a way to help our environment. The way that we conducted the research was by using three different starch plants and leave them for a week in order to fermentate. We found out that none of the plants produced ethanol. The findings are important because we learned that it is hard to produce ethanol from starch plants and that is why we think it is less likely for people to use this resource. We are trying to understand whether of starch plants are able to produce ethanol under controlled conditions. Our hypothesis was that corn plant will be the one producing more ethanol but it was the one that dried first. Corn plant was the only plant that did not dry and was able to dissolve the yeast added. Our results are important because we want to find a way to decrease the amount of contamination that exists in nowadays. The planet Earth is our home and us as its population should take care of it in order to have a better environment for the next generations that will come.

Technical Disciplines Selected by the Student
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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

163

Fair Category

LST

Project Number

3532

Title: The Effects of Mental Stress on Physical Health

Student Name(s): A. Aquino, E. McMurry

Abstract:

The objective of this project was to determine with experimentation and research how stress can affect health. The experiment was conducted by administering two different tests of varying difficulty to 5 males and 5 females over the course of 10 minutes. Heart rate and body temperature were measured before and after testing to observe changes, since these are indicators of stress. Based on the collected data it was found that the easy test resulted in minor body temperature/heart rate changes, while the hard test resulted in an increase in both body temperature and heart rate. For the easy test, the average decrease in body temperature was -0.3°F compared to the hard test with an average increase of 0.11°F . The average decrease in heart rate for the easy test was -0.4 BPM compared to the hard test with an average increase of 1.3 BPM. In conclusion, it was found that increased mental stress can have negative effects on the body.

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ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

211

Fair Category

LST

Project Number

3533

Title: The applying the understanding of running for the improvement of runners.

Student Name(s): C. Rose, M. van Ginkel

Abstract:

In our experiment we were trying to figure out ways to improve peoples running speed with put build muscle mass or using illegal substances. All participants had to a stretch before starting the experiment which was advised by our supervisor to make sure no one got injured due to the experiment. We first started with having the people run normally with a standing start. this was followed by doing a three point start in which a way to describe it is as how the olympic runners start. the next was to increase strides by a reasonable amount to not harm the person but to be noticeable from an outsider's perspective. We dropped our third trial in which people would wear spikes and other things to give them more grip while wearing them, this was a problem to do because we didn't have a one spike shoe fits all nor does everybody own their own pair of spiked shoes. A major flaw in the experiment was how many people participated in it, since all people who did the experiment had to do it voluntarily many of the original people we asked dropped out, along with us not having any female participants and only have 7 people in total participate in the experiment.

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CSEF Official Abstract and Certification

Word Count

234

Fair Category

LST

Project
Number

3534

Title: Applying Educational Approaches to Reduce the Stigmas Associated with Attention Deficit Hyperactivity Disorder

Student Name(s): H. Baron, S. Hernandez

Abstract:

The quantitative research study was performed to test the question, "If a person understands the severity of mental impulses associated with ADHD, will they have a higher tolerance level for those individuals who have ADHD?" The researchers conducted this study in a high school setting where the participants consisted of junior and senior students, all from different career technical trade areas. The researchers wanted participants to increase their knowledge of ADHD and help stomp out the stigmas associated with ADHD. The participants were provided a consent form signed by their parents/guardians and themselves to allow participation in the study. Students were given a pre-survey in order to attain the participants basic knowledge and understanding of ADHD and the stigmas associated. The two trade areas that were randomly selected to partake in the intervention group were given a pre-survey, then administered an educational slideshow presentation on ADHD. A post-survey was given to both the control and intervention groups. There were a few limitations within the study, such as a lack of returned consent forms, minimal interest in the surveys and presentations, and the demonstration of irritation when given multiple surveys. Irritation and frustration from participants came from the fact that five other research studies were taking place during that time. Results showed an increase of understanding and tolerance of individuals with ADHD. Keywords: ADHD, Stigma, Mental Impulses, Control, Intervention, Education, Awareness, Knowledge

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CSEF Official Abstract and Certification

Word Count

239

Fair Category

LST

Project Number

3535

Title: The Effect of pH on Algae's Production of Oxygen

Student Name(s): C. Bevill, E. DeNunzio

Abstract:

Water quality across the United States is declining rapidly, and ecosystems that humans rely on are disappearing. Increase of CO₂ and ocean acidity due to climate change has altered the pH of the Long Island Sound, which is believed to have played a role in the diminishing water quality (Swanson 2016). The purpose of this study is to determine the effect of pH on dissolved oxygen. Three 10 gallon aquariums were filled with water from Holly Pond in Darien, CT, an inlet of LIS. *Volvox globator* algae was cultured for four days and equal amounts were placed in each aquarium. One tank was adjusted to a pH of 7, one was left at 8.2 and another adjusted to 9.4. Over two weeks the dissolved oxygen concentration (mg/L) and pH was recorded daily with electronic probes. It was predicted that a pH of 8.2 would have the highest levels of DO₂. The results support the null hypothesis, that a pH of 8.2 will have the largest DO₂ concentration. The p-value suggests that there is a low probability of the highest DO₂ concentration being at a pH value other than 8.2. As the Long Island Sound's natural buffering system continues to diminish due to ocean acidification, it has become more important than ever to research pH changes in the LIS in order to predict and mitigate the impact on aquatic food chains and overall structure of aquatic ecosystems.

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EV EM MI

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CSEF Official Abstract and Certification

Word Count

239

Fair Category

LST

Project
Number

3536

Title: MyMedWallet: Personalized Medical Organizer App

Student Name(s): J. Hari, D. Hari

Abstract:

There are many people who visit multiple doctors, have to balance multiple prescriptions and experience difficulty keeping all of their information organized such as blood pressure, blood sugar, etc. Literature review shows that 10-38% of seniors, ages 65-85+, have difficulties managing their medications. Around 50% of medications for chronic diseases aren't taken as prescribed and 20-30% of prescriptions are never filled. According to Medline.gov, 30.3 million people visit physician offices for diabetes and 40.3 million for hypertension. Related research on the Google Play store shows that currently there is not one application that keeps all of an individual's medical information together.

We developed the MyMedWallet app to help keep all the medical information of an individual organized in one place. The app was developed using Android App Inventor, mysql and TinyDB databases. The app provides the following features to the user: it can organize and store all medical information, including physician contact information, appointment reminders, prescription details and dosing reminders, and prescription refill reminders. In addition, it provides opportunity to track blood pressure, heart rate, and blood sugar on a daily basis with an option to generate charts that display these personal statistics in an easily-accessible way for personal use and physician review.

We conducted a survey to collect feedback from adults and senior citizens. 91% of the 32 people surveyed found MyMedWallet to be helpful to them, highlighting the top features as the Reminder and Graphing systems.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

LST

Project
Number

3537

Title: Human Brain- Testing Musical Notes

Student Name(s): T. Reyes, I. Sanchez

Abstract:

The cognitive processes in human brain tend to be more dominant on one side of the brain than the other- Lateralization of brain function. Both hemispheres of the brain appear to be identical, but the different composition of neuronal networks allows for specialized function. Human brain develops differently leading to unique lateralization in individuals. The medial longitudinal fissure separates the human brain into two cerebral hemispheres which is connected by the corpus callosum. The objective is to find out which side of the brain is more dominant at recognizing musical notes from the keyboard. The processing of sound actually begins in our ears, before sound reaches the brain. The subjects listened to the recorded musical notes using left ear and right ear separately with headphones. Thereafter the same subjects listened to the recorded musical notes with both ears. After each trial, the subjects played the notes they listened to on the keyboard. The data on the number of correct notes played by each subject versus the corresponding ear used to listen to the notes were graphed. The maximum number of correct notes were observed when subjects used their left ear alone. The left ear is connected to the right side of the brain which is more dominant in processing musical notes. The right-hemispheric lateralization in music processing was the main conclusion drawn in majority of the subjects. Music processing is one of the most complex cognitive functions that the human brain performs.

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

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

242

Fair Category

LST

Project
Number

3538

Title: Methylmercury Concentrations in Fish Tissue: A Further Analysis of Fish in the Long Island Sound vs. the Atlantic Ocean

Student Name(s): A. Delgado, R. Mulshine

Abstract:

The purpose of this experiment was to measure mercury concentrations in fish caught in the Long Island Sound and compare them to mercury averages for the same species of fish caught in the Atlantic Ocean. It was hypothesized that mercury concentrations of fish in the Long Island Sound would be higher than the baseline mercury-level averages of fish in the Atlantic Ocean, east of Long Island. Ten grams of striped bass, blackfish (tautog), porgies, and bluefish were tested for five samples of each. The fish samples included fish of similar age according to growth charts specific to each species of fish. Experimentation started with 10 grams of each fish samples being digested in a potassium permanganate solution attached to a standard condenser. The digest was then filtered and neutralized with dilute ammonia in the presence of a .01% EDTA solution, transferred to a 25 mL calibrated flask and filled to the mark with deionized water. 1-2 mL of this solution were pipetted into a 10 mL calibrated flask and mixed with 5 mL of Sodium Dodecyl Sulfate and 1 mL of hydrogen sulfate. The final mixture was pipetted into a cuvette and absorption measured at 490 nm in a spectrophotometer and compared to a standard mercury calibration graph. Initial results have supported the hypothesis, as the mercury levels for certain samples of striped bass and blackfish have been higher when compared to those same species of fish in the Atlantic Ocean.

**Technical Disciplines Selected by the Student
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EV AS 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

208

Fair Category

LST

Project
Number

3539

Title: Drug Solubility: Influence of Acid Concentration on Solubilized and Tablet Ibuprofen

Student Name(s): E. Cook, J. Rodriguez

Abstract:

Drug solubility is an essential part of developing new drugs. A benchtop study was completed to determine the optimal pH at which solubilized ibuprofen capsules dissolve faster compared to traditional hard tablets. Results can be used in drug development, increasing the potential for absorption and reduction of product waste. Solvents (0.05-M, 0.1-M, 1-M HCl-) representing acidic compounds in the human gastrointestinal tract were used. Solubilized and non-solubilized tablets were placed in separate beakers. Tablets were allowed to dissolve for three different time periods (3, 12, 48-hrs). There was no statistical difference between the liquid-gels and tablets (One-way ANOVA, $F=10.08$, $p=0.15$); however, there were differences within group and over time indicating a stronger effect of time placed in solution. Results show that solubilized capsules in 0.05-M HCl acid had the greatest change in mass (78.75%). The solubility of tablets decreased with a decrease in concentration of acid. Based on our findings, it can be determined that the solubilized capsules dissolve faster compared to hard tablets. This could be partially due to the outermost level of the solubilized pill already being semi-permeable and the pill itself being less dense, allowing the solvent to travel more freely through the pill.

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

249

Fair Category

LST

Project Number

3541

Title: Modifying Adolescents Behaviors by Educating about Bipolar Disorder to Diminish Stigmas Associated

Student Name(s): D. Garcia, C. Guzman

Abstract:

The purpose of this study was to educate individuals about bipolar disorder to increase awareness and empathy towards those who experience this mental illness. The study was conducted in a Connecticut technical high school. Students were issued a consent form that required parental consent and their assent to participate in the study. Four career technical trades (CTT) were selected randomly. Two CCT's were selected as the intervention group, and the other two groups were the control group. The intervention group was given an educational component about bipolar disorder to hopefully reduce the stigmas associated, while the control groups could only use their existing knowledge. After analyzing the data, the outcome displayed that the students in the intervention group became more aware of this illness after being educated. Limitations that affected the study included lack of interest due to five other research studies being conducted and pre surveys being distributed by all researchers that had the same control or intervention groups. Socialization, time to complete surveys, and engagement from the students due to agitation from the continuous time that was being taken from theory, was caused due to several CTT's being chosen randomly by the researchers. The outcome for the study supported the researcher's hypothesis indicating that with knowledge, individuals can become more aware and empathetic towards bipolar disorder, diminishing stigmas associated. If individuals are frequently educated about mental illness, stigmas surrounding bipolar disorder and other mental illnesses can be stomped out.

Keywords: Bipolar disorder, stigmas, awareness, education, mental illness

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

BE 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

253

Fair Category

LST

Project
Number

3543

Title: Investigation of spatial learning in apterous *Drosophila melanogaster* using a novel behavioral assay

Student Name(s): A. Zhang, M. Duan, A. Stewart

Abstract:

Drosophila melanogaster has long been used as a model for animal physiology due to the evolutionary conservation of basic physiological mechanisms (including learning and memory) and the availability of diverse mutant phenotypes. One particular mutation in the homeotic selector gene apterous (*ap*) is responsible for a complete absence of wing blades. Here, we investigate the psychological determinants of spatial learning in apterous *D. melanogaster* in an effort to clarify the links between physical and cognitive abnormalities in other organisms. Fly navigation took place in a novel 3D-printed Y-maze, with performance evaluated as the percentage of flies reaching a target area within a specific duration. Normal apterous flies did not exhibit significant evidence of learning, with or without a visual cue, although a separate experiment with a different assay did show improvement across a limited number of trials. Additionally, a small difference in performance was observed between normal and agitated flies. Our results support the possibility that spatial learning is inhibited in apterous *D. melanogaster* whereas certain other elements of higher-order information processing, described in wild-type *D. melanogaster* by previous studies, appear to be retained. This explanation would imply that *ap* is responsible for specific cognitive deficiencies along with its known physiological and morphological influences, although it is unclear whether any deficiency in spatial learning is itself congenital or acquired as a result of limited locomotion. Repeating the assay with wild-type *D. melanogaster* as well as winged flightless mutants will allow any behavioral differences to be more accurately characterized.

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

BE BI 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

227

Fair Category

LST

Project Number

3544

Title: Education's Impact on Perceptions About Borderline Personality Disorder

Student Name(s): N. Guzman, A. Varjenski, K. Stripling

Abstract:

Abstract

An experimental quantitative research study regarding borderline personality disorder (BPD) was conducted in a small New England town at a technical high school to determine if knowledge and awareness of BPD could be increased through education. The participants were given a consent form which informed their parent/guardian that they were randomly selected to anonymously take part in the research study, and must have it signed in order to participate. Students who had the form signed and handed in took a pre-survey to determine their baseline of knowledge on BPD and any stigmas they had surrounding the mental illness. Participants of the intervention groups received a post-survey after receiving an educational component (Google slideshow) by the researchers, which was later analyzed to determine if the hypothesis was supported. The control group took the post-survey a week after taking the pre-survey. Limitations of the study included a number of participants not returning signed consent forms, being absent for components of the study, and students not listening or paying attention during the educational component. Despite these limitations, the study demonstrated that increasing participants' knowledge regarding BPD increased understanding and awareness of individuals that experience this disorder. Thus education can play a vital role in decreasing the stigmas associated with BPD and thus other mental illnesses.

Keywords: Borderline personality disorder, stigmas, mental illness, knowledge, education

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

BE ME

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

173

Fair Category

LST

Project
Number

3545

Title: Doggy Doorbell

Student Name(s): P. Rodia, I. White, B. Weiss

Abstract:

The Doggy Doorbell was created to alert the owner that their dog was at the door. We did this by using plexiglass, bolts, springs, washers, nuts, glue, a doorbell and a receiver, a drill, and a doormat to make a functional system. At first, it could be set off if a mouse ran across it which could lead to possibly waking up or disturbing the owner in the middle of the night because the doorbell rang. We fixed this problem by adding more springs to increase the minimum weight needed to create the doorbell sound, while also ensuring stability. Now, a mouse, rat or even an opossum couldn't set it off. However, this also means that a small dog would not be able to set it off. Only dogs weighing 35-160 pounds could make the doorbell ring. Our invention is better than other products like this because the others involve having to train the dog to put their paw or nose up to the doorbell, and this is less convenient for the buyer.

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

AS 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

184

Fair Category

LST

Project
Number

3546

Title: Knockout of the HSP12 and Rad1 Genes in *Saccharomyces Cerevisiae* via CRISPR/Cas9 to Test Survival in Extraterrestrial Environments

Student Name(s): T. Foley, T. Kimberlin

Abstract:

The purpose of this project was to genetically knockout the Rad1 and HSP12 genes in yeast by means of the CRISPR/Cas9 system and observe the altered organism's response to extreme environments including increased and decreased pressures and temperatures, and exposure to UV radiation. These environments were intended to mimic some of the conditions found on extraterrestrial planets. The Rad1 gene is involved in yeast gene repair after it has been exposed to radiation and the HSP12 gene dictates the yeast's response to extreme heat and osmotic pressure. It was hypothesized that if the Rad1 and HSP12 genes were each knocked out in separate yeast cultures, the respective organisms would respond differently in extreme environments than the control. The bulk of this project involved conducting two CRISPR knockouts on two colonies of yeast. Results were analyzed by comparing the colony size and number of the altered organisms to the control organisms. Preliminary results indicated that the genetically altered organisms were less likely to survive in each respective testing environment. This data supports a strong correlation between the targeted genes and the specified environmental conditions.

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

CB BI 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

187

Fair Category

LST

Project
Number

3547

Title: What "Bugs" Gromphadorhina portentosa?

Student Name(s): G. Martin, S. Grott

Abstract:

We conducted an experiment on a group of male and a group of female Gromphadorhina portentosa (Madagascar Hissing Cockroaches). We introduced them to different stressful environments to see how they reacted. We have learned that madagascar hissing cockroaches have a social hierarchy within their population, and we planned to make observations to verify this. This can be shown by one cockroach that will usually be above all the others, essentially "making the decisions" and seeing a lot of fighting among the males. They are known to use elevation to display their dominance. We put them in different levels of stressful situations, for example, taking away bedding, hiding spots, places to climb, and more hours of light per day. After completing these tests, we were able to see more of a hierarchy with with the males then the females. The males displayed quite a bit of fighting during all the tests, whereas the females stayed more docile, and we actually saw them working together at times. We are hoping that the data from this experiment helps to better the general knowledge on the madagascar hissing cockroach behavior patterns.

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

BE 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

248

Fair Category

LST

Project Number

3548

Title: Comparative Analysis of the Effects of Different Dietary Supplements on Breast Cancer Cells

Student Name(s): A. Antony, J. Spafford

Abstract:

Close to 12% of women in the United States alone will be diagnosed with invasive breast cancer. The p53 gene has been recently shown to regulate cellular division and cancer. Mutations in the gene have increased risks for cancers in patients. Antioxidants, such as Vitamin C and L-Carnosine, have recently been studied to subdue some forms of cancer such as brain, renal, and ovarian, but have minimal research regarding genetic effects. In the experiment, we predict that the Vitamin C will eradicate and increase expression of the p53 gene within breast cancer cells in a greater amount than L-Carnosine due to its higher success rate in aiding in cancer treatments.

In order to conduct our experiment, we will use two lines of epithelial Mus musculus breast cells: one cancerous and one normal line. After subculturing to confluency, the antioxidants will be added to media and contained in petri dishes with sterile technique and lab safety requirements. After a month of treatment, during which observations will be collected with a microscope, western blot analysis will be used to show genetic expression of p53 proteins within cells to contrast the effectiveness of the antioxidants.

The experiment will be conducted within the next month due to a budget freeze that did not allow us to order materials. No data has been collected at the time so therefore there are no conclusions at this time as well, but successes in this experiment could lead to more viable treatments for patients.

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

CB 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

232

Fair Category

LST

Project Number

3550

Title: Knowledge will Increase Behavioral Changes and Acceptance of Individuals Experiencing Obsessive-Compulsive Disorder

Student Name(s): K. Reen, G. Tavarez

Abstract:

Abstract

This research study conducted on the mental illness OCD was carried out in order to identify if people are made aware of OCD and its many forms, will they have a clear perception of what it is like to live with OCD? The researchers conducted this study in a New England high school where the participants were seniors. The participants were given a consent form that informed their parent or guardian that they were randomly selected to take part in a research study in which they must have the consent form signed in order to participate. The students who brought back the consent forms were put into a drawing for a chance to win a twenty dollar cash award. There was a total of two students selected for the drawing. At the conclusion of the collection of the consent forms being returned the students would be given a pre-survey. The pre-survey is used to assess prior knowledge on OCD and the stigmas associated. Some of the students participated in the educational Prezi that was presented by the researchers. The limitations included the unreturned consent forms by the students, lack of time to educate the individuals, and surveys not taken seriously. No matter the setbacks the data collected proved that education had reduced the stigmas and raised the awareness of OCD and its many forms.

Keywords: OCD ~ stigmas ~ education ~ research

**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

194

Fair Category

LST

Project Number

3551

Title: Ants Under Pressure

Student Name(s): J. Tan, E. Gu, C. Tang

Abstract:

This experiment was designed to determine whether animals worked under higher, lower, or normal air pressures. This information has implications across a variety of occupations, like divers and airplane pilots. Knowing what conditions that humans work best under allow for optimizing workplace conditions for several thousand people. In this experiment, we had three containers. One container was pressurized by fitting the jar to a connection where a bike pump could be attached, another container was under a vacuum by pulling air out using an apparatus created specifically for the project, and the last container was our control under normal air pressures. We used ants as a model for humans, and since ants build tunnels like those in ant farms, we were able to measure tangible differences between each trial. We compared the amount of time it took the ants to reach the bottom of a plastic cup full of ant farm gel. In the end, the results were inconclusive. While the low-pressure trial did finish after the high-pressure trial and control, the three trials were close enough that small factors like the ants' behaviors could have caused the small discrepancies between them.

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

AS 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

189

Fair Category

PT

Project Number

4001

Title: Creating Water Using Electricity

Student Name(s): J. Burke, A. Litvak

Abstract:

Our project design was to use gravity and water to create electricity. We wanted to find alternate ways to create electricity than burning fossil fuels. This experiment was performed in my garage using various materials including pieces of wood, a small electric motor, 8 small plastic measuring cups, super glue, small lights, long metal screws, and electrical wires. Based on our results, we were successfully able to create a machine that used both water and gravity to generate electricity. We ran water onto the wheel, causing it to spin. This spinning moved the part of the motor in the hole, causing the motor to generate an electrical current, which was sent to the lights, eventually lighting them up. In conclusion, gravity and water were able to generate electricity at an efficient rate. Once enough water was applied to the wheel, the lights lit up in a matter of seconds. This proves our hypothesis right. In addition after doing this project we believe that electrical companies who normally burn fossil fuels should convert to using water because not only is it efficient, but it is much better for the environment.

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

185

Fair Category

PT

Project Number

4002

Title: magnetic top levitation

Student Name(s): M. khawaja, J. boothe, T. Holtzer

Abstract:

This project is on magnetic top levitation. Magnetic top levitation is when a top levitates over a magnet by magnetic force/strength. The purpose of this experiment is to find out if adding another magnet will increase the hovering height of the top. To make the magnetic top levitation work you are going to take a big ring magnet and place it on a flat surface. Using a plastic sheet you will place it on the magnet and after that take the top, spin it in the middle of the plastic sheet. Bring the plastic sheet up and down until the top start levitating then record the data. The results were that with one magnet the tops height was averagely 6 cm and with two magnet the average was about 6 cm. Our conclusion is that our hypothesis was incorrect even with adding another magnet the top didn't levitate higher and even with the magnetic force being doubled the top didn't hover any higher so many things could have caused the top to not levitate higher such as the speed of the top and etc.

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

EA EN 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

181

Fair Category

PT

Project
Number

4003

Title: Battery Breakdown

Student Name(s): L. Pilla, S. Glinsky

Abstract:

Our experiment tests whether Energizer or Duracell batteries are better. We tested Energizer and Duracell batteries into a flashlight, and measured how many volts were left after one hour of powering the flashlight. We then converted the voltages into percentages with a mathematical formula.

The procedure of the battery testing was surprisingly rigorous. We put one Energizer battery into the flashlight, and powered it for exactly 1 hour. We then repeated the process twice, and did the same for the Duracell batteries. In order to get how many volts were left in each battery, we used a multi-meter.

After many hours of testing, we found the data to be surprisingly close. The first Energizer battery sat at 56%, and the other two had 54% left. With only a 2 to 4 percent difference from Energizer, all three Duracell batteries had 52% left. We found that Energizer batteries work more efficiently than Duracell batteries, and that they may last longer when fully drained. This experiment had some pretty neat results, and we hope that others will use them to their advantage!

Technical Disciplines Selected by the Student
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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

247

Fair Category

PT

Project Number

4004

Title: Perpetual Motion Or Perpetual Failure

Student Name(s): T. Fanelli, D. Goetz

Abstract:

The goal of this experiment was to see if perpetual motion could be created with an overbalanced wheel. This overbalanced wheel was made by constructing 2 "A" shaped stands to hold a wheel and axle on top of a wooden platform. This wheel and axle in particular had to be as friction free as possible, which it was, but it still had some friction. Once the wheel and axle were attached, there was one more requirement.. This requirement was the bottles. In this experiment, 16.9 fl. oz. and 33.8 fl. oz. bottles were used at different times with different amounts/types of liquid inside. The first experiment was with eight 33.8 fl. oz. plastic bottles being filled with 8 ounces of fully saturated salt water. These bottles were evenly attached on the wheel. With equal energy applied towards the wheel, it was spun and timed 6 times, averaging out to 12.12 seconds. With the same process being used, eight 33.8 fl. oz. bottles filled with 15 oz. of fully saturated water and both eight 33.8 fl. oz. bottles filled with 15 ounces of fully saturated salt water and eight 16.9 fl. oz. bottles being filled with 7 ounces of water were tested out. The results ranged from 12.12 to 12.44 seconds, but what was really overall proven was that no perpetual motion was created. It is hoped that the results of this experiment will help let others know more about the laws of thermodynamics and perpetual motion.

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

AT PH ET

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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

PT

Project
Number

4005

Title: Creamalicious

Student Name(s): S. Caracciolo, M. Profili, M. Adamson

Abstract:

We created organic skin cream because most creams are not all natural and we felt that an all natural cream would be best for your skin. We created four different creams: fruit, vegetables, plants, and control. We tested the creams on a piece of leather to see if the creams would change the texture or smoothness of the leather. We found out that the vegetable cream made the leather the smoothest. Our hypothesis was incorrect, because we thought that the fruit cream would make the leather the smoothest, but it turns out that the vegetable was the best for the leather. We made the creams during lunch and recess at school, and Morgan tested the creams on the leather at home. We tested the creams on three different things: smoothness, appearance, and how easily it was to use (ie. how oily it is, how well it was applied, and how quick it is to dry). The fruit cream smelled the best, however, the vegetable cream made the leather the smoothest and when we tried it on our skin, the vegetable cream was much better and made our skin feel the best. We all enjoyed working on this project and are glad that we found something that we could use in everyday life.

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

5. 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

4006

Title: Let's Bounce

Student Name(s): A. Civale, I. Silvis

Abstract:

As people age, we realized that their knee joints, specifically the meniscus, can be affected more when exercising on certain surfaces. We created this project to find out the best surface for people to exercise on, relating to the least potential to injury. We used a tennis ball to represent the meniscus and dropped it from 100 centimeters to represent the impact the knee would face as it is landing from a jump on a certain surface. We concluded that the higher the bounce, the less energy absorbed by the ground and the more energy that goes into the knee, making it compact. When the meniscus is compact, the potential for knee injury rises. We tested nine surfaces (gym floor, basketball court, pavement, grass, tennis court, track, turf, auxiliary gym (rubber surface), and mats) and conducted each experiment with three different tennis balls and five trials for each ball. We concluded that pavement had the highest relation to knee injury, as only 42.86% of the potential energy was absorbed by the ground, and 57.14% of the energy was absorbed by the meniscus, making it the most compact. We found that the grass, turf, and mats absorbed 82.86% of the energy, making only 17.14% to be absorbed by the meniscus. Our research showed that older people with weaker joints, mat surfaces are the best to train on. While pavement surfaces are the worst to train on as they make the meniscus the most compact, leading to injury.

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

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

246

Fair Category

PT

Project
Number

4007

Title: Nexu Helmet

Student Name(s): J. Grabowski, B. Vo

Abstract:

Throughout 2007 and 2008, the death of motorcycles had been exceeded to 5000 deaths per year. We were extremely concerned about the dangers of motorcycles. Thus, our project, the Nexu Helmet, prevents accidents before they happen. The Nexu Helmet is a revolutionary invention to assist motorcyclists, as well as players of sports such as Skiing and Motocross. It ensures safety and awareness of your surroundings. This project will immensely improve safety standards by providing much needed peripheral vision which is normally blocked when wearing a helmet. With dual monitors and cameras that can be adjusted to fit your exact needs, the Nexu Helmet changes it all. It may be used to optimize your peripheral vision or provide rear view mirrors if necessary. An eventful scenario that requires the use of the Nexu Helmet takes place on the highway. If vehicles get into an accident, it would always be worse for a motorcycle. The Nexu Helmet allows motorcyclists to avoid inevitable accidents without enlisting in the dangers of risk themselves. Motorcyclists would be enabled to avoid future and present instability. An added bonus is that it is waterproof and is inclusive of a backpack for the battery. We made this helmet simple to use and effective. The Nexu Helmet is no ordinary helmet because of its many matchless features. Unlike other helmets, this single invention presents you with the ability to see what you once could not. This is a unique idea which will save countless lives.

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

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

251

Fair Category

PT

Project Number

4008

Title: The Catapult Lab

Student Name(s): D. Gibbon, N. Brown

Abstract:

Abstract

Answering the question of how far a catapult can shoot with different leverages on the shooting arm was our goal, so we made a catapult lab. The overall topic being, how leverage affects distance. Our hypothesis for this lab: If the ball is fired from the greatest height and leverage, then it will go the farthest, because it will have more time to accelerate before being fired, therefore picking up the most energy.

To put this experiment into action we took the throwing arm of our catapult, which was made out of popsicle sticks and about half a foot tall and made marks every inch to put the throwing hand. This throwing hand would fire the ball from different spots on the arm, so that we could see how different leverages affect the distance the ball goes. After three trials completed analyzed the results. We realized the distance grew steadily every time the leverage was increased resulting, as we predicted, the farthest one from the base,(7 inches), achieved the longest distance. Then we looked at the physics behind our results and realized that the throwing arm was able to build up the most energy before being released and was shot from a higher distance resulting in a higher ark.

Our literature we researched on the topic of leverage and catapults definitely affected our predictions and understandings of our results. For example on <https://www.real-world-physics-problems.com> we learned the we could store energy by creating leverage and tension.

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

PH EN

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

211

Fair Category

PT

Project
Number

4009

Title: Crystals!

Student Name(s): M. Ramos, P. Phoo

Abstract:

The purpose of this experiment was to find the best temperature for growing borax crystals and would the solubility be affected. Our procedure is pour 400ml of water in the glass beakers and boil it for about 5 minutes. Pour 25 ml of borax in the boiling water and stir until dissolved. Tie the string to a pipe cleaner and suspend in mixture . Repeat 3 more times for the ice bucket, for the refrigerator, and for the warm water, cover the top with plastic wrap and leave in the room. If wanted, add more borax and food coloring to the glass beaker everyday and repeat for the next few days. The data shows different temperatures affect crystal growth. The crystals kept at a hot temperature did not form while the other crystals did. The room temperature crystals took longer. We also saw that when we re-boiled the crystal mixture, added more borax, and then put the crystals in their places it made them bigger each time. We answered our question about what temperature crystals grow better in through our study. We showed that different temperature and conditions form crystals in different ways. If we were to do this experiment again, we would try and grow bigger crystals with different techniques.

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

247

Fair Category

PT

Project Number

4010

Title: The Egg Drop

Student Name(s): R. Grande, P. Kounavelis

Abstract:

We dropped eggs and gave them varying amounts of protection to try to make them not break. We used parachutes made of tissue paper, wrap the egg in a sponge, and wrap the eggs in layers of bubble wrap and tape to try to make the egg not break. We dropped the eggs off an elevated deck to test our designs. The purpose the project is to find out what will make an egg not break. The materials we used are eggs, sponges, a parachute (tissue paper and tape), and bubble wrap.

Our hypothesis was that if the egg is dropped without the parachute but with at least two layers of bubble wrap, then it will not break. If the egg is dropped with only the parachute, then it will break. If the egg is dropped with both the parachute and the sponge, it will not break. If the egg is wrapped in a sponge, then it will not break.

The procedure:

Drop an egg without any protection from a place that is 13 1/2 feet high.

Take pictures before and after each egg was dropped.

Drop an egg wrapped in many layers of bubble wrap from the same height.

Drop an egg with a parachute made from tissue paper and tape.

Wrap an egg in two sponges and tie them together using three rubber bands, then drop the egg.

Drop an egg using a plastic bag as a parachute and wrap the egg in two sponges.

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

EE

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- Yes No

CSEF Official Abstract and Certification

Word Count

195

Fair Category

PT

Project Number

4011

Title: Surviving the Cold!

Student Name(s): C. Dainiak, G. O'shaugnessy

Abstract:

The purpose of this project was to test if wrapping a cellular phone in different materials extended the battery life in cold conditions. It has been documented that cold wears down battery life much faster than room temperatures. We tested an iPhone 5s wrapped in materials (control, in a plastic bag, a towel in a bag, and a ski glove in a bag) and measured the battery life at different lengths of exposure to cold. In the experiments we discovered that if you insulate your phone with a glove and a plastic bag your phone will not die as fast as it normally would without any insulation. With the control (no insulation), the battery was at effective zero battery life (1% actually, but we consider it zero for this experiment) at 30 minutes into the experiment. With a simple plastic bag, battery life was doubled to 60 minutes before it hit zero (3% actually, but we consider it zero for this experiment). Increasing the amount of insulation was able to extend the battery life to 105 minutes. Thus simple insulation can extend the life of the iPhone 5s battery anywhere from 100% up to 350%.

Technical Disciplines Selected by the Student
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CSEF Official Abstract and Certification

Word Count

239

Fair Category

PT

Project Number

4012

Title: The Elasticity of Slime

Student Name(s): K. Bretan, M. Leifer, A. Murphy

Abstract:

In this experiment we investigated which activator solution created homemade slime that could stretch the most before breaking. Several “types” of slime were created by mixing white school glue (Elmer’s), shaving cream and one of three different activator solutions. An activator solution binds the ingredients together to create the slime. For this experiment three activator solutions were used: a saline solution (contact solution), sta-flo (liquid starch), and powdered borax mixed in water. For each trial, 1 cup and 2 tsp of activator solution was added to 7.825 fl oz of white Elmers glue and ½ a cup of shaving cream. The ingredients were mixed thoroughly until they took on a slime like consistency. To determine which slime was most elastic, slime was rolled out and stretched until breaking, recording how wide the slime stretched before breaking. The results showed that saline solution activator made the slime the most elastic with a width of 1,708 cm before breaking, compared to the sta-flo at 484.6 cm and borax at 434.4 cm. It is believed that the salt in the saline solution created stronger molecular bonds between the ingredients which kept the slime from breaking apart. In conclusion, saline solution activator creates the most elastic slime compared to sta-flo and borax soap. Future experiments could be done changing the amount of activator solution to determine if adding more or less solution could also change the elasticity of the slime.

Technical Disciplines Selected by the Student
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CH

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CSEF Official Abstract and Certification

Word Count

221

Fair Category

PT

Project
Number

4013

Title: How Does Temperature Affect the Growth of Crystals?

Student Name(s): A. Vasantlal, A. Vasantlal

Abstract:

Objective

In this project, we added salt to water in an open glass container. We dissolved the salt and put three containers at different temperatures. Container A was at 80 degrees, container B was at 49 degrees and C was placed at 67 degrees. We thought warmer temperatures would grow crystals more rapidly than colder temperatures.

Methods/Materials

This experiment was performed over the course of 10 days. Container A was put in a 20-gallon fish tank under a reptilian basking lamp. Container B was put in the fridge. Container C was put at Room temperature. We took a glass measuring cup full with 8 oz of purified drinking water and put it into the microwave for 2:59.4 minutes. We then put in the dissolved the salt in the hot water. There was a total amount of 11 teaspoons. We then put the containers in their respected areas.

Results

Based on data collected, the hotter temperature grew crystals more greatly than others. The water was drained completely drained from Container A. On the other hand B had almost no crystals and C had minimal growth. Heats help the crystals grow more rapidly than others.

Conclusion/Discussion

The hypothesis that crystals will grow faster was highly supported in this experiment by the results. This project is relevant the growth of minerals.

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

PH CH EV

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CSEF Official Abstract and Certification

Word Count

249

Fair Category

PT

Project Number

4014

Title: Water Desalination- A Clean Water Alternative

Student Name(s): A. Cimmino, J. Dixon

Abstract:

The purpose of our project was to build a solar powered desalination device in the most efficient way to produce the greatest output. In the first phase of the project, we focused on how to build the device. Usually, solar powered water desalination would occur outside. However, due to the snow and cold weather conditions this past January, we created a heated indoor environment using a fish tank, aluminum foil, and a 100 watt heat lamp. From our experiments in this first phase, we determined that a bowl containing 2/3 cup of salt water would produce a greater desalinated output than a bowl with 1/3 cup of salt water in a 7 hour time period. In addition, we used red food coloring and a 9 volt-battery to ensure that the desalinated water output did not contain salt. In the second phase of the project, we assembled 4 different desalinators, each one made of porcelain, stainless steel, glass, and plastic. We based our hypothesis on research that a stainless steel desalinator would trap and reflect the most heat, and thus produce the greatest output among the 4 materials being tested. We conducted 10 trials over a 30 day period, and confirmed that the stainless steel bowl produced the greatest output of water when compared to the control (plastic bowl) and other materials we tested (porcelain and glass). An average output of approximately 8mL of desalinated water was produced from 2/3 cup of water in a 7 hour time period.

Technical Disciplines Selected by the Student
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EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

PT

Project Number

4015

Title: Preventing SIDS from Suffocation

Student Name(s): E. Medovnikov, A. Marin

Abstract:

According to a 2015 Centers for Disease Control and Prevention (CDC) study, 1,600 babies in the United States in 2015 died due to sudden infant death syndrome (SIDS). 900 of these fatalities were caused by suffocation and strangulation in bed. Newborn children are very prone to move around or turn over in bed. Babies sometimes get caught face-down and cannot flip over, which can eventually smother them.

The objective of this project was to create a prototype system where parents could be alerted if their child rolled over in an unsafe position. An Arduino microcontroller, breadboard, MPU6050 accelerometer gyro rotation sensor, piezo buzzer, and a life-sized baby doll were required. The rotation sensor was attached to the baby doll's onesie as well as programmed via the Arduino microcontroller to assess the yaw, pitch, and roll angles of the child and signal the buzzer if the child's position became dangerous. To test this device, the rotation sensor was attached just above the sternum of the doll (where the sensor proved to be most sensitive). The doll was manually rolled over to a position (and certain time in that position) that was unsafe in order to trigger the buzzer. In this unsafe position, the alarm sounded, proving that the prototype was successful.

To improve this system, the buzzer would be far louder, and the prototype much smaller to prevent other hazards. The project has the potential, with further development, to save lives due to SIDS.

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

EE CS AT

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- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

PT

Project Number

4016

Title: Solving the Flood Problem: One Rock at a Time

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

Abstract:

Floods are the world's second deadliest natural disaster. They have led to billions of deaths, with recovery and clean-up costs totalling to trillions of dollars. Our experiment goal was to lessen damage caused by these disasters. Floods cause most destruction due to the masses of water with nowhere to go other than through buildings, leaving catastrophe in their wake. Making a road capable of allowing liquids to pass through would be beneficial in urban areas. So, determining which size rock lets through the greatest amount of water would help in making effective, absorbent roads. We predicted that the most water would be let through by the largest rocks and the small rocks would retain more water. Our course of action for the experiment was to take 8cm of three sizes of rocks, put them into an empty can, and pour in 300mL of water, allowing the water to pass through for 3 seconds. After that process, we measured how much water traveled through the rocks. Rock size was the independent variable, with the dependent variable being the amount of water let through. The results we gathered from the experiment were that larger rocks allowed more water through, proving our hypothesis correct. The most amount of water let through was 73% (220mL) by the large rocks, the least amount of water being 2% (5mL) which was let through by the small rocks. Hopefully this data helps to create a new kind of road which can lessen flood damage in urban areas.

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

EM EA EV

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CSEF Official Abstract and Certification

Word Count

229

Fair Category

PT

Project Number

4017

Title: Catch'em With Color

Student Name(s): E. Adam, M. Entsiwah

Abstract:

The purpose of Catch'em With Color is to let you know when your things are being messed with when you don't want them to using simple technology.

Procedure: Recipe #1

Measure 1 tbsp of cornstarch, 4 tbsp of water, 1 tsp of glycerin and 1 tsp of vinegar.

Put the ingredients in a pot & stir together with a silicone spatula. When combined, then put it on the heat.

Stir the ingredients while on the heat until it's white & clear. Finally, pour the mixture inside of a mold & wait until it's cooled to remove.

Procedure: Recipe #2

Measure 1 tbsp of cornstarch, 4 tbsp of water, 1 tsp of glycerin and 1 tsp of vinegar.

Put the ingredients in a pot & stir together with a silicone spatula. When combined, put it on the heat.

Stir the ingredients while on the heat until white & clear. Finally pour the mixture inside of a mold & wait till cooled to remove.

Conclusions

Our project was a success! After our experiments, we found that silicone was the best material to use for our project since it is strong and flexible. Since the silicone is soft to touch it gives the product a good amount of sensitivity for color to be shown. We learned that bioplastic is better used for materials like baskets & materials for eating. After trial & (multiple) error we found closure in our experiment.

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

EN

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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

151

Fair Category

PT

Project Number

4018

Title: Black Light Experiment

Student Name(s): B. Bezanson, H. Bittman

Abstract:

We first chose this experiment because we wanted to know why a black light makes things, like certain vitamins, glow. However, we soon learned that there are many household items that produce similar results and decided to use them in our research. We predicted that phosphor containing substances such as tonic water, laundry detergent, and petroleum jelly would glow under a blacklight. However, after applying a UVA-blocking sunblock, we predicted these items would no longer glow. We observed these substances under the blacklight and then again after spraying equal and increasing amounts of sunblock on each item. In the future, it would be interesting to determine if it was the length of time or the amount of sunblock sprayed that actually causes the glow to diminish. We could then make predictions about our own sunblock use and how we can get the most protection out of the sunblock we wear.

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

EA ET AT

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Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

PT

Project Number

4019

Title: Turning Sound Energy into an Electrical Current

Student Name(s): A. Mehta, C. Cutler, J. Shanks

Abstract:

Our group created a device that converts sound waves into energy, this creates more ways to harvest energy to be used at later times. The prototype works very efficiently when storing the energy created by the piezoelectric cells. As our group was trying to figure out how to make a transducer to convert sound waves to a current, we started off by researching on how we can capture sound waves as an AC current and convert that into a DC current to light a LED, our main goal. After researching, we put together a rough diagram of what we want our end result to look like. It started off with the piezoelectric disc, we attached that to a voltage meter and we saw that when you give off at least 700 hertz of sound it gives you a small AC voltage. After we took notes and made a chart on that, we moved on to converting the AC current into a DC current. It was simple, we attached the diode to the positive end of the piezoelectric wire and it makes the current DC. We realized that voltage produced by piezo was not enough so we added capacitor to store energy. This gave us enough the voltage to light the LED. Finally, we came to a conclusion that sound energy could be converted effectively to electrical energy but can not be use as a direct sole source, instead you will have to harvest the energy.

Technical Disciplines Selected by the Student
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ET EE AT

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Yes No

CSEF Official Abstract and Certification

Word Count

205

Fair Category

PT

Project
Number

4020

Title: Overpowering Radiation

Student Name(s): W. Murphy, J. Falcao

Abstract:

Our project is how the average home WiFi router effects plant growth and plant health. We got the idea of this project, by thinking about the effect the WiFi network in our house had on the environment, and if it would help or harm. After asking ourselves this question, we went to work and researched and found out that the Radio Frequency radiation from the WiFi would hurt the plants. Our initial prediction was that the WiFi router would kill the plant or cause it to have a growth defect. We proved this hypothesis, the plant next to the WiFi became weak and started to shrivel and die, after 30 days. The way we performed this experiment was we placed the same type plant next to a WiFi router and one in the kitchen. We kept both plants out of the sun and put the same UV light on them. We took pictures of the plant weekly and recorded the results. The results we got were the WiFi router didn't kill the plant but weakened and dried the plant out. The reason why these results are so important, is because it shows how the WiFi network in the average persons house is harmful to nature.

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

AT PS EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

221

Fair Category

PT

Project Number

4022

Title: Brilliant Bulbs

Student Name(s): J. Jones, M. Molina

Abstract:

Abstract Brilliant Bulbs

In this experiment we tested three different type of light bulbs to see which uses the least energy. We already knew that it was going to be a hard to do this experiment. We wanted to see which would have been the best because we really didn't know much about these light bulbs which made this more interesting for us, We predicted that LED light would be more effective. To test our hypothesis, we would need three of each of three different types of light bulb, lamp,timer, and infrared thermometer. First, measure the beginning temperature of each bulb with the infrared thermometer. Each light bulb (9 in total) were on in the same lamp for 1 hour. Once the timer was done, the lamp was turned off, the Infrared thermometer was used to measure the heat of each light bulb. Finally, we recorded our data and determined which light bulb was the most efficient to use. We found that the incandescent bulb was the one with the most energy used, and LED had the least energy use/heat. Our data show that we were correct in our hypothesis , We predicted LED would have the lowest energy usages and we were correct because our results supported our hypothesis it showed that it was actually the lowest energy usage.

Technical Disciplines Selected by the Student
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AT

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CSEF Official Abstract and Certification

Word Count

227

Fair Category

PT

Project
Number

4023

Title: Environmental monitoring robot

Student Name(s): A. Belsham, A. Belsham

Abstract:

The main objective of this science project is to be able to take environment readings because there are no existing way to monitor a room's environment conditions for temperature, gas and humidity and then send the information to an electronic device or computer. So we built a 4 wheel drive robot that can autonomously move around a room and the robot can be controlled remotely using Bluetooth and a camera to control where it goes. The sensors we added to the robot are a temperature, ammonia and humidity sensor. The ammonia sensor is to be used in a room that needs to be monitored for the environment's ammonia level such as a barn to ensure livestock are raised in the best possible conditions. The humidity sensor is also important because the more humidity there is the longer it takes for ammonia to dissipate the less humidity the faster ammonia dissipate that is one reason that the ammonia sensor and the humidity sensor goes together. The temperature sensor is used because a thermometer can take a longer time to get the reading exact in each zone but this can take seconds to get the readings. That is how we fixed the problem by building a 4 wheel drive robot that can monitor the environment of a room and give the sensor readings to an electronic device or computer.

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

EV

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- Yes No

CSEF Official Abstract and Certification

Word Count

146

Fair Category

PT

Project Number

4024

Title: Healthy or harmful

Student Name(s): T. Veltheim, C. Mims

Abstract:

For the Connecticut Science Fair, we chose to make an app prototype. The app we created was made for the purpose of making sure that people can provide healthy food for themselves and their families at a reasonable price. We chose this project because we do not want the world becoming so expensive that people cannot afford healthy food. We created our prototype by using the app prototyper Justinmind because it was easy and not confusing to use. This prototype is the beginning of an idea that our app will be able to send out coupons to people who answer a specific amount of questions in each day. We also created this prototype so people who might want to learn about what they eat, or watch what they eat, now have the chance to, with an easier, quicker interface, which also rewards you along the way.

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

AT 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

249

Fair Category

PT

Project Number

4025

Title: Wind vs Water

Student Name(s): A. Flaherty, A. Flores

Abstract:

A current area of research for scientists is climate change; caused by the accumulation of greenhouse gases in Earth's atmosphere. Due to the consumption of fossil fuels harmful gases are released, creating problems such as increasing temperature, retreating glaciers, ocean acidification, ozone layer depletion, and extreme meteorological events according to NASA. A potential solution is renewable energy: a method which harnesses energy through natural processes. The experiment was designed to find the most efficient energy source between wind power and hydropower, hence the title "Wind vs Water". If a multipurpose turbine for both wind and water was created, then the efficiency could be tested by changing the pressure of input and measuring the milli-volts produced. The results show that at the same pressures, air produced higher milli-volts than water and also showed that water flow was significantly lower than air. This difference in flow was not anticipated and led to further research. It was found that water is 784 times denser than air and is suspected this higher density combined with a constant pipe size resulted in a lower volume of water per pound of pressure being delivered to the turbine then measured for air. Using the data, the relationship between flow and milli-volts was calculated using linear equations. Other scientists can learn from this by focusing on further experimentation, testing the relationship between flow and energy produced rather than pressure and energy. Less fossil fuels will be burned and ultimately improve the Earth's current condition.

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

EA ET EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

217

Fair Category

PT

Project
Number

4026

Title: Which cup will keep the coffee hot the longest?

Student Name(s): I. Rivera, C. Gnoto, A. Johnson

Abstract:

Many adults enjoy a cup of coffee in the morning. What they don't enjoy is their coffee getting cold on their way to work. So we decided to test what type of cup would keep our coffee hot for the longest amount of time, so our hypothesis is, "if we use a thermo cup, then it will keep the coffee hot longer because it does not let heat escape easily." The hypothesis was incorrect, in fact, the styrofoam cup kept our coffee warm the longest. To test this, we began boiling water in a kettle to the boiling point. Then, we poured the water into a cup and record starting temperature. We chose using water to control the variable. Next, we recorded the temperature at each minute, for 5 minutes. After, dump the water out to let it cool. This was repeated to all cups. Lastly, test all cups again for the number of trials you are doing. Since every cup started at a different temperature, we can not use the starting temperature for our graph comparison. Instead we used the decrease in temperature from one minute to the next and averaged each difference with the other two trials. From the experiment, we concluded the styrofoam cup kept the coffee warm for the longest period of time.

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

AT EN

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

PT

Project Number

4027

Title: Project SD3: The Solar Drone

Student Name(s): A. Lessor, A. Oquendo, R. Burgos

Abstract:

What we did in our engineering project was to test different abilities of technology and to create new technology by improving the battery life of drones. That's where the Xuler C-9 Drone came into play, as we used solar panels as the main part of our drone as a recycling process of energy from the sun. We used a lipo battery and applied it to the Xuler C-9 drone 2.0. We cut a little socket into the wires of the battery to then insert the wires from the solar panel into the battery. That's how the power cycle of the Xuler C-9 was built. We also took background information about drones today, and drones from the past, and tested our drone, making charts and graphs to add to our science board. Our drone took about a month to make, including about four other months, taking research from different sources and looking at videos to see what it's like to fly a drone. Making the drone was challenging but very fun to make as a team. We bought our drone from the Parrot Store which is a store where they sell spare parts for drones that work really well. Their prices are also very decent, and is an approved website. This is what our process was of making the drone, and what we went through to make an amazing work of technological art!

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

EE ET 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

215

Fair Category

PT

Project
Number

4030

Title: CASE NO: 520910 Fingerprint Finding

Student Name(s): D. James, N. Lewin

Abstract:

In our experiment, we determined the prime approach to pick up fingerprints. There are several methods to pick up fingerprints. In this experiment, we focused on dusting. We evaluated four different substances, we believed that fingerprint powder or the baby powder would be the best options. The final procedure was: First we covered our fingers with lotion to make sure the oils of the finger transferred to our surface then transferred our prints to the surface. Second, we sprinkled a small amount of the powders on the surface. Third, to prevent smudging, we removed the excess powder. Fourth, by using lifting tape, we picked up the newly formed fingerprint. Finally, using a magnifying glass we judge the quality of the print. We repeated the same process for each of the sample powders: (chalk, baby powder, fingerprint powder and candy powder). When examined the final results and found that the baby powder had the best results. We realized that the results were dependent on the fineness of the powder. The smaller each individual grain, the better the powder would stick to the discarded oils, making the fingerprints visible. If we were to improve on our technique, we could see if the fingerprint's quality had anything to do with the chemical bonds in the powders and oils.

Technical Disciplines Selected by the Student
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AT

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CSEF Official Abstract and Certification

Word Count

214

Fair Category

P7

Project Number

5001

Title: Powered Up Potatoes

Student Name(s): J. Rosado

Abstract:

The question I was investigating was if it was possible to increase the “power” of a potato battery through the addition of water, a salt solution, and electrical energy. Potato batteries are being developed by scientists, since it is a very economical type of battery, especially in poorer countries. My hypothesis predicted if electrical power was added to a potato battery, then its voltage and amperage will increase.

To test my hypothesis, I used tap water, a salt and water solution, and a variable power supply. My control was a group of potatoes with no substances or energy added to it. For my experimental group, I measured the starting voltage and amperage using a multimeter, added salt, water, or electricity, then measured the voltage and amperage again. I completed five trials for each variable.

From researching potatoes and batteries, I learned basic battery structure and how certain variables can affect the power of potato batteries. This helped me design my experiment because it was pivotal in deciding what kind of substances to add to the battery. I also read through other potato battery experiment procedures to help me design my experiment. The implementation of these kinds of batteries will help save money and will decrease the amount of batteries thrown into dumps each year.

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

EE

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- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

P7

Project
Number

5002

Title: Pineapple Punch! An Experiment Using the Proteolytic Enzyme Bromelain To Break Down Collagen Protein

Student Name(s): T. Baldini

Abstract:

The primary purpose of the experiment was to determine whether bromelain, a proteolytic enzyme found in pineapples, packs enough of a “punch” to break down collagen, a protein found in plain gelatin. The secondary purpose was to determine whether processing the pineapple by boiling it and/or marinating it in its own juice would affect the strength of the bromelain enzyme.

Proteolytic enzymes play an important role in our overall health. These enzymes cause biological reactions in our bodies which help to break down the food we eat, regulate our hormones, boost our immune system, decrease inflammation in our muscles and reduce swelling of mucus membranes. This experiment demonstrates how an enzyme works as a catalyst to break down protein and how boiling and/or marinating a food containing an enzyme can change the effectiveness of the enzyme as a catalyst. It was predicted that the boiled and canned pineapple would not contain enough bromelain to break down the collagen. There was also suspicion that the fresh pineapple would contain enough bromelain to break down the collagen and prevent the gelatin from forming.

The results showed that the hypothesis was supported. Boiling the pineapple destroyed the effectiveness of the bromelain enzyme within it. The fresh pineapple, however, contained enough bromelain to degrade the collagen and prevent gelatin from forming. This experiment demonstrates how enzymes function and the results show that processing foods by boiling them can destroy or limit the effectiveness of the enzymes contained within them.

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

CB BI

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- Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

P7

Project Number

5003

Title: Power Walking with Piezoelectricity

Student Name(s): S. Shaw

Abstract:

For this project, I wanted to help the environment, specifically with global warming, and what better way to do that than with clean energy? So I decided to use the everyday source of walking.

When trying to come up with a way to harvest energy I remembered about piezoelectric crystals, which produce an electrical output if you apply a force to them. I used this property to harvest the energy wasted by displacing the ground as we walk. I designed a casing that holds a stack of piezoelectric crystals, using a program called Blender. When pressure is applied to the casing the crystals bend and produce electricity. I manufactured the casing with a 3d printer. I took the output to a circuit that rectifies, and converts the energy into a more suitable form for charging a battery.

In order to first test it, I pressed down the casing several times, to simulate the force of walking, and measured the energy across an empty capacitor. Once I measured, I saw the energy build up gradually, ready to be discharged into the battery. Then, after getting this data, I installed the device in my shoe by drilling a hole in which the device could be held. I drilled this hole under the outer layer of the shoe.

This could have a wide variety of applications, from saving money on batteries, to charging a device when there's no technology around. It's safe, efficient, and best of all, reliable.

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

EE

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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

P7

Project Number

5004

Title: What drink has the most electrolytes

Student Name(s): I. Purcell

Abstract:

Abstract

Ever wonder what is lost while sweating? Electrolytes: the easiest loss and gain. Electrolytes come from energy drinks, or any source of liquid containing electrolytes. Seems easy, right? But, what happens when calculating electrolytes in three of the most common drinks.

Putting this experiment to the test showed which drink contains the highest amount of electrolytes: Monster, Powerade or fruit juice. The inference conducted prior to the experiment (the hypothesis) was that the Monster, one of the most common energy drinks known to restore electrolytes, would have the highest amount.

The approach to coordinate this experiment was to follow instructions and work with diligence throughout the entire procedure. Keeping aware of the time limit, and to not overwork the expectations/criteria was the source of error. The multimeter was the main material, used as the direct informat to calculate the contained amount of electrolytes within each specified drink. Reiterating the modus operandi three times for each specified drink was a way to calculate the average, while also showing the minute changes among each tested drink.

The upshot of the research and development went against the hypothesis, also unraveling that the drink containing the highest count of electrolytes in $\frac{2}{3}$ of a cup is the Powerade; with an average of 26.5 electrolytes. The Monster had 24.4 average, and the fruit juice with an average of 12.6.

This experiment is a modified version of former experiments. While experimenting, becoming competent in background research led to overall success.

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

195

Fair Category

P7

Project
Number

5005

Title: Possible uses of magnets in transportation and construction

Student Name(s): W. Wholean

Abstract:

If I roll an object on a magnetic surface, then it should go farther than the same object on a non-magnetic surface is my base hypothesis for my science project. To explore this question I used a 15 by 21 inch plastic pan, glued a total of 33 magnets on one half to form a 4.2 x 22.5 inch track with the magnets following a 3,2,1 pattern. On top of the magnets is a very thin non-magnetic aluminum sheet for the LEGO car I made (which had small magnets inside of it) to be used as a surface to test the hypothesis without the car encountering bumps. The aluminum sheet is present on both sides for comparing purposes. I made a LEGO pusher to push the car in order for it to roll on both tracks. I rolled the LEGO car on both tracks 50 times on each side, then calculated the average distance traveled in inches, which on the non-magnetic side the LEGO car traveled 13.305 inches on average, whereas on the magnetic side the car rolled 15.6825 inches on average. With that data, I concluded that my hypothesis was correct.

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

ET

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- Yes No

CSEF Official Abstract and Certification

Word Count

93

Fair Category

P7

Project Number

5006

Title: THE IMPACT OF ANGLE ON THE AMOUNT OF ENERGY PRODUCED BY A SOLAR PANEL

Student Name(s): T. SIMMS

Abstract:

Solar energy is important because we want to reduce our carbon footprint on the earth. It is important that we find a better way to create energy from a solar panel to make a healthy earth. I wanted to find the impact of angle on the amount of energy produced by a solar panel. I did this by exposing a solar panel to a light source and timing the output. I found that a 0-45 degree angle produces the most energy. This information could help a designer create a more effective solar panel.

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

ET AT 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

239

Fair Category

P7

Project Number

5007

Title: What Materials In Homes Can Block Wi-Fi Signals?

Student Name(s): A. Doolabh

Abstract:

This experiment was created to help any person that may be suffering from weak wi-fi signals. Using the results from this experiment, people can know what to avoid when setting up and positioning their modem, how to avoid weak wi-fi signals, and further studies about materials blocking wi-fi signals can begin. This experiment was designed to test how bricks, aluminum, sheetrock, and plywood can weaken a wi-fi signal. It was hypothesized that the obstacle of bricks would weaken the signal the most, as the bricks provided a thicker obstacle to be overcome. The materials were made the same size, and placed individually in front of the modem, while the iPhone ran a wi-fi signal strength test using the "DR. Wi-Fi" app. Based on results from three trials of each, an average was reached, and the attenuation, or reduction, of the signal was found. It was found that the aluminum caused an attenuation of 5dBm, which means deciBels below 1 milliwatt, the bricks caused an attenuation of 10.7dBm, the sheetrock caused an attenuation of 11.7dBm, and the plywood caused an attenuation of 16dBm. This experiment falls under the categories of physical science and physics. The hypothesis for this experiment was disproven, as the plywood weakened the signal strength the most, and the bricks were the third most effective. This experiment was completed well, and there is a possibility for other experiments like this one.

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

EE CS 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

185

Fair Category

P7

Project Number

5008

Title: Battery Life

Student Name(s): I. Thomas

Abstract:

The purpose of this experiment was to determine how much longer a light bulb will run on different sized batteries. It was predicted that the light bulbs runtime should double for each battery size increase. The research was done on what batteries are made of, how long they last, and how to measure a voltage and lumens of an object. The experiment was done by gluing two of each battery together, positive next to negative. Both sides of each battery were scuffed. Hook up wire was cut, split, stripped and twisted then soldered on all the batteries. Light bulb end of wires was soldered on correct positive negative terminals. The voltage was tested and the light output was measured in lumens. The output of batteries and light bulbs were tested and time intervals were documented until batteries died. The results showed that every sized battery lasted twice as long except the D battery which lasted longer than double the time. In conclusion, the D battery lasted the longest and its voltage stayed on high for the longest time compared to all the other size batteries.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

P7

Project
Number

5009

Title: How do Mixtures of Chiral Substances Affect the Rotation of Plane-Polarized Light?

Student Name(s): P. Noe

Abstract:

Chiral molecules have the ability to rotate plane-polarized light. The light has a greater rotation depending on the concentration of each substance, and the path length. In this experiment, the linear dependence of rotation on concentration and path length was observed, and invertase was used to catalyze the chemical reaction of sucrose to produce fructose and glucose. This project also used mixtures of stevia, sweetener, and table sugar to test the hypothesis that mixtures of chiral substances produce an additive effect on the rotation of plane polarized light.

The optical rotation of each substance was measured by using a camera fitted with a polarized filter as the detector and a tablet with an LED screen that served as the source of polarized light. Test substances were diluted in water, and placed in an 8.5 cm tall test tube and measured using the homemade polarimeter. The rotation was measured by rotating the polarized filter until each substance reached its maximum point of darkness.

This project found that observed rotation varied linearly with the path length of the corn syrup. In the invertase experiment, the amount of rotation decreased as time passed by, and the rate of decrease depended on the amount of invertase in the tube. When the test substances were mixed together, the results were additive. Further investigation of this topic could include studying how enzyme reactions affect the rotation of plane polarized light.

Technical Disciplines Selected by the Student
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CH PH

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- Yes No

CSEF Official Abstract and Certification

Word Count

254

Fair Category

P7

Project Number

5010

Title: Battle of the Bubbles

Student Name(s): E. Cheung

Abstract:

A question I always asked was if homemade shampoo is better than store-bought? I decided to conduct experiments to figure this out. I thought that the store-bought shampoo would perform better since the creators have already done research on hair care, and that they know what consumers like. I conducted four different experiments to help me determine my conclusion. I used three different shampoos; one store-bought, two homemade. In the first experiment, I tested cleaning power, in which I used three pieces of wool and artificial sebum to assess this. In the second experiment, I tested skin and hair compatibility, in which I used a pH test strip to assess how basic or acidic the shampoos were. In the third experiment, I tested foaming behavior, in which I used a cylinder to measure how much foam a shampoo made after shaking. In the fourth experiment, I tested dirt dispersion, in which I used Indian ink in the shampoo to test how much the shampoo took it in. I noticed that the store-bought shampoo performed well in almost all of the experiments except the pH test. I also noticed that the coconut milk-based shampoo performed poorly in all tests except the pH test. However the castile-based shampoo was moderate in all the tests. After analyzing the data, I decided that store-bought shampoo would be better for your hair in most aspects, but the castile-based shampoo is better in order to avoid harmful chemicals.

Procedures from: <https://www.sciencebuddies.org/>

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CSEF Official Abstract and Certification

Word Count

246

Fair Category

P7

Project Number

5011

Title: from Biomass to Biogas

Student Name(s): M. Pethrick

Abstract:

The purpose of my project was to demonstrate how biogas can be produced from organic waste materials. This experiment involved a scaled-down version of a biomass digester, which is used to turn organic wastes into energy through a process known as anaerobic digestion, a biological process where bacteria break down biodegradable material resulting in the production of biogases such as methane. These digesters are becoming more popular on farms and other places that have a lot of organic waste which can be used to create clean, cheap energy. I was interested to see whether I could make a digester that would use organic waste from a local farm to produce biogas.

My science fair experiment last year, tested several types of biomass to find which produced the most biogas, I found it was cow manure. Using these results as a baseline, the hypothesis for my project this year is that larger amounts of biomass (cow manure) will produce more biogas.

Biogas digesters are helpful because they can turn organic wastes from our farms, factories, and cities into a valuable source of renewable energy. Although the bio-digesters that I built were far too small to produce enough biogas to really be helpful, large-scale digesters can produce clean energy that can be sold to utility companies. The anaerobic digestion process also has several other added benefits including cleaning water making it reusable, destroying harmful bacteria, reducing air pollution and odors from organic wastes and landfills.

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

EV ET

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- Yes No

CSEF Official Abstract and Certification

Word Count

213

Fair Category

P7

Project Number

5012

Title: More Water, Less Carbom

Student Name(s): J. Saucedo

Abstract:

After researching that millions of tons of CO₂ were being released into the atmosphere, causing global warming by PET water bottles, made out of petroleum, I realized that I could 3D print a disposable water bottle model out of a bioplastic, a plastic made out of plant starches. I would then compare the two water bottles based on their price, waterproofness or imperviousness, amount of energy used to make a pound of the materials, and most importantly the amount of CO₂ released making a pound of the materials. I watched tutorials and took a month-long class on Fusion 3D, a 3D printing software that I used to use my cylindrical 8-ounce water bottle design. After modifying it in MakerBot, I printed my water bottle and tested the waterproofness of the bottle, which held the 8-ounces. In my results, I found that even though the PLA, or bioplastic, filament was more expensive than the PET, it released 10 times less CO₂ than the PET water bottle, saving roughly 4,050,000,000 pounds of CO₂ from being released into the atmosphere if all water bottles in the world spontaneously became PLA. As well, the PLA also used 1.37 less times of energy to make, as well as successfully holding the 8 ounces of water.

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

EN AT EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

P7

Project Number

5013

Title: Science Behind Slime

Student Name(s): J. Urbano

Abstract:

A few months ago I started making a squishy substance called slime with two main ingredients: Glue and Tide Detergent. back then, I only thought of slime as a toy, but then I started to wonder, What is the science behind it? I Started to dig deeper to find out that boric acid is what holds the glue together and turns it into slime. Glue Contains Polyvinyl alcohol, and when it comes in contact with any product that contains boric acid, the Molecules in the glue link up with the chains in the boric acid. Boric acid can be found in products like Borax, Tide detergent, Seventh generation detergent, Sta-flo, a combination of eye drops and baking soda, and a combination of Contact lens solution and baking soda. I wanted to find out what would happen if i added more ingredients like lotion, water, shaving cream and baby oil. But i wanted to focus more on the boric acid ingredients, and wanted to see if by using DIFFERENT boric acid ingredients, Using the SAME slime recipe, If each would give me a different Texture, maybe even a different color. From One having a completely different color than the others, to one having a cloud like texture, to two methods being almost the same, This was a fun and interesting experiment to have tested out new products, Making slime, and of course researching the science behind slime.

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

CH

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CSEF Official Abstract and Certification

Word Count

234

Fair Category

P7

Project
Number

5014

Title: Sweet and Bitter Turned to Ash

Student Name(s): A. Lewczuk

Abstract:

The purpose of experiment is to investigate phenomena that illustrates chemical changes useful in everyday life. This experiment demonstrates the exothermic reaction and baking soda and sugar as they burn.

My hypothesis is that the longer the reaction is sustained the more substance will form. This process depends on the depth of the container and the moisture of the mixture.

Baking soda and sugar was tested in various containers. The reaction was started by lighting the mixture on fire and progress was observed until each chemical reaction stopped.

Afterwards measurements were taken and results recorded.

When the test material burns, carbon dioxide was released. The pressure created from the release of gas caused the newly formed material to grow. The fuel sustained the chemical reaction making the "fire snake" grow longer. The snake got its black appearance due to caramelization of sugar in the presence of heat.

My demonstration shows that longer reaction time increased fire snake length, which proves my hypothesis. I also found that the fire snake grows better when using a wet mixture in a deep container.

The "fire snake" experiment is an example of an exothermic chemical reaction because the properties of the initial ingredients are being changed to form new substance and energy is released in the form of heat. Examples of chemical changes in everyday lives are roasting marshmallows, burning a candle, making soda or baking a cake.

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

138

Fair Category

P7

Project Number

5015

Title: The importance of ammonia in the formation of salt crystals

Student Name(s): N. Barros

Abstract:

The purpose of my science fair project was to see if different amounts of ammonia affect the growth of salt crystals. My hypothesis was that the more ammonia used the more salt crystals would grow. Mix different variations of the formula in each bowl, then add the sponge to each bowl. Bowl 3 with the formula 3 tablespoons of water, 3 tablespoons of salt, 3 tablespoons of bluing, and 3 tablespoons of ammonia grew salt crystals that measured 5 mm on the sponge and 7 mm on the sides of the bowl. My science fair project falls under the category of physical science. My project is to show the physical affect of ammonia on the salt crystal growth. After completing my project I am now aware that 3 tablespoons of water, salt, bluing, and ammonia will have the best results for growing salt crystals.

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

249

Fair Category

P7

Project
Number

5016

Title: Marble Roller Coaster- How Much Height to Loop the Loop?

Student Name(s): M. Sponzo

Abstract:

This experiment caught my attention because I am a roller coaster thrill seeker. I want the roller coaster with high drops, fast turns, and loops. I have never stopped to wonder how it works. My experiment will focus on how much height is needed for marbles to go through a loop. My hypothesis is that a height of 4 feet is needed for the marbles to successfully go through the loop. I built the roller coaster with foam pipe insulation, created a 14 inch loop, and set up my first height at 3 feet. I did 10 trials for a single marble and then 10 trials for two marbles. I adjusted the height to 2 feet and repeated the process. For the final procedure, I adjusted the height to 4 feet and repeated the process. My results show that my hypothesis that a height of 4 feet was needed was correct if I was only experimenting with one marble. I discovered that a height of 3 feet had the most success for a single marble and two marbles. At a height of 2 feet, no marbles were able to go through the loop. I learned that roller coasters demonstrate several laws of physics. The marble was initially pulled by the force of gravity. The marble had potential energy which allowed the marble to speed up. The potential energy turned into kinetic energy which allowed the marble to keep moving. Momentum allowed the marble to stay firmly on the track.

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

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

248

Fair Category

P7

Project Number

5017

Title: The Buzzing Eye

Student Name(s): V. Vadhera

Abstract:

Visually impaired people have a hard time avoiding obstacles while walking. In today's world of high technology, majority of blind people are using the no-tech stick that they tap around to avoid obstacles. The purpose of my project was to make a smart stick that would make walking easier for the blind. I wanted to accomplish this while keeping the cost low. I achieved this problem by using Arduino, ultrasonic sensor, buzzer, DC battery adapter, DC 9V battery, cane, strong black tape, Arduino power module, male to female wires, cardboard, and a special Arduino USB cable. It works by sending an ultrasonic wave from the ultrasonic sensors transmitter and when it hits an object, it bounces back to the receiver. It uses the formula $\text{Length} = \frac{1}{2} \times \text{time} \times \text{sonic speed}$. After that, it moves onto the next step in my code which is the buzzer. This prototype is just a beginning and I aspire to add many more features to the smart stick that I named the Buzzing Eye! Future enhancements include adding Bluetooth technology so that the warning of an obstacle is transmitted to an ear piece verses buzzing loudly. Additionally, in the future I want to add software that will recognize what the obstacles are verses just buzzing. This future prototype will tell a blind person that they are approaching for example a tree in 25 yards. I hope to make life a little bit easier for the blind people with the Buzzing Eye!

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):

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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

P7

Project Number

5018

Title: Can Magnets Help to Clean Up Oil Spills?

Student Name(s): J. Cunningham

Abstract:

Oil spills small and large have long lasting devastating effects on our oceans. It can take months to clean up an oil spill and the effects can last for years. My project focuses on finding a more efficient method of cleaning up oil spills.

For my experiment, I studied the use of Ferrofluid and magnets to help clean up oil spills. My hypotheses was that I could magnetize the oil in the spill and use a magnet to remove the oil, leaving behind clean water.

My experiment consisted of 12 petri dishes containing water and mineral oil. Different amounts of Ferrofluid (a magnetized oil comprised of motor oil, surfactant, and thousands of tiny nano magnets) was added to the dishes. Then, a magnet was hovered over the spill to remove the magnetized oil. The amount of liquids left in each dish were measured and calculated to measure the efficiency. All of the dishes with ferrofluid produced similar and remarkable results. However, a faint murkiness of oil was left at the bottom of each dish. My thought was that the petroleum makeup of plastic petri dishes and the oil were sticking to each other. To test this, I repeated the experiment in a glass bowl, the murkiness remained.

In conclusion, my experiment showed that magnets can play a significant role in oil spill remediation despite the small amount of residual murkiness. With further development, this method can lead to more efficient methods of oil spill clean up.

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

AT EM 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

249

Fair Category

P7

Project Number

5019

Title: That's The Way The Cookie Crumbles

Student Name(s): M. McAuliffe

Abstract:

My project was to investigate if the quantity of chocolate chips in a cookie would affect the size the cookies were and how moist they were. For my investigation , I baked cookies with 0, 3, 6, 9, 12 and 15 chocolate chips in sets of three. I baked them for 16 minutes. I did this step two times. After baking, I would break them open in the middle and take pictures. I did two tests during this lab. The first test was to see if the amounts of chips would affect the diameter of the cookie. My hypothesis was the cookie with the least number of chips would be the smallest and the cookie with the most would be the biggest. The results supports my hypothesis because less chips were smaller and the most chips were the biggest. It is important to note in trial number two, all the cookies stuck together. However, the results for trial number two's test to compare the diameter of the cookies supports my hypothesis. The second test was to see if the texture of the cookies was affected by the chips. To do this, I put a toothpick in the cookie and judged how moist they were on a scale from 1 to 4. My hypothesis was the cookie with the least number of chips would be the driest and the cookie with the most would be the wettest. Mostly small was done, when big was not done. The results supports my hypothesis.

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

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

247

Fair Category

P7

Project Number

5020

Title: Rollin' Along

Student Name(s): A. Paul

Abstract:

When I'm told to take something downstairs, I never pick it up and walk down the stairs, instead, I just roll it down. However, how does the angle of a ramp affect the speed at which an object travels down it? I chose this experiment to better understand how and why the angle of the ramp affects the speed of the marble. I timed how long (dependent variable) it took a marble to roll down constructed ramps of the same length at 15, 30, 45, 60, and 75 degree angles (independent variable). First, I cut out the blocks and the board. The results supported my hypothesis by showing that the steeper the ramp, the faster the marble rolled down the ramp. When the board was at a 15 degree angle, it took an average of .61 seconds for the marble to roll down the ramp while it took an average of .26 seconds for the marble to roll down the ramp at a 75 degree angle. Another possible experiment is how the material of the ball affects the speed at which the ball travels. Understanding why a marble rolls down a ramp faster at a steeper angle helps me understand the concept of gravity, potential energy, and the transfer of potential energy to kinetic energy. If you apply it to skateboarding, you want to know when to stop and how much force to apply so that you don't roll down and get hurt with lack of control.

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

MA

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

P7

Project Number

5021

Title: Can Gravity Sort Beads?

Student Name(s): A. Rembish

Abstract:

Can a gravity powered machine sort different sized beads?

For the base, get three plastic cups and put two upright and next to each other, and another aligned with these, but upside down. Label the center on 6mm and the other upright one 12mm.

For the ramp, place seven popsicle sticks, all flat, perpendicular with a one-eighth inch gap from each other. Glue two intersecting popsicle sticks at the top and bottom. Have two upright gradually slanting inwards and another down the center.

Now, cut a cup in half and make a small hole near the center, which you place a popsicle stick in. Tape this to the upside down cup at a slight angle so that the beads will roll. Then, attach the ramp over the 6mm cup.

Last, use the machine. One at a time, place a bead in the cup that's cut in half. After all the beads have been sorted, see how many have done do correctly.

Though the goal wasn't reached, many attempts came close, and the machine worked well. The beads that didn't sort well were the 6mm. Instead of falling through the gaps in the ramp, would occasionally stay on the course of the popsicle sticks and sort into the 12mm cup. On average, though, about forty seven out of fifty beads were sorted correctly.

When using a gravity powered machine, most of the different sized beads will be sorted correctly. Gravity proved to effectively sort most beads, with few exceptions.

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

222

Fair Category

P7

Project Number

5022

Title: Dirty Composition

Student Name(s): J. Pastorok

Abstract:

My project is called Dirty Composition. In this project I wanted to find out if dirt with more organic material will absorb water better than dirt with less organic material. In this project my procedures were pretty simple. All I had to do is mix dirt's together and some dirt's not together. After I did that I had to water each plant with 90 tsp. I had them sitting from 8:30 in the morning to 1:30 in the afternoon. After that time period I had to take the water out of the pots and measure how much they did not absorb. I started to notice that some of the water was yellow. I thought that was really weird. I then found out that it turned yellow because some of the dirt's had fertilizer in it. The results came out to be that the peat moss did the best, then the topsoil, then the sand. My hypothesis was wrong because I thought that the one with the least organic material would absorb the most water. I have learned many things over doing this process that I have not known about before. Some of the things that I have learned are what soil organic matter is, what organic material is, and I learned that the dirt with more organic material absorbs the most water.

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

218

Fair Category

P7

Project Number

5023

Title: The Effects of Air Pressure On the Hieghts of Ball Bouncing

Student Name(s): J. Geloso

Abstract:

The purpose of my experiment was to see if air pressure affected the bounce of a basketball. It was predicted that air pressure would affect the ball's bounce, making it bounce higher if more air pressure was added. Some of the materials that I used to conduct my experiment included, a basketball with a circumference of 73cm, a air pump that measures psi, a 1.3m ladder, a 2m basketball hoop, a 40x40x40cm cardboard box, a 50x50 piece of plywood, and a meter stick to measure the bounce. Since I couldn't drop the ball myself, because of human error, I made a contraption that would lower the amount of human error in the experiment. I used scissors to cut open the top and bottom of the box. Then I would tape one of the sides to the backboard and slide the plywood under the box. Then I could easily place the ball into the box and pull the plywood out from under the ball to let it drop. In conclusion, my prediction was proven correct because the average of the 10psi basketball was 149.3cm. In comparison, the 4psi basketball had an average of 52.7cm. What I could have done better was to do the experiment in warmer weather so that the experiment wasn't delayed or held back while experimenting.

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

P7

Project Number

5024

Title: Cure For The Blues: A green, low cost adsorbent for removal of dye from aqueous solutions

Student Name(s): A. Ahilan

Abstract:

The textile industry is the second largest water polluter in the world, pouring brightly colored toxic waste into rivers and oceans. Many textile factories are in developing countries with limited funds to devote to water filtration. To find cost effective ways to lessen textile pollution, recent studies have focused on using locally available agricultural waste as filter adsorbents. The real question is: are properties of these bio-materials understood well enough so that they can be successfully used in filtration systems? One such material is Coir Pith (CP), a waste product of the coconut industry. This experiment explores the relationship between CP mass and its dye removal efficiency. A gravity-based, free-flow filter that requires no power was designed and built, and dye solution was dispensed through the filter at various CP mass levels. Efficiency was measured using a homemade Spectrophotometer. Each trial with a given mass of CP was repeated 3 times. The mass of the CP was increased in one gram increments until 98% efficiency was reached. The procedure was conducted at dye concentrations of 10 mg/L, 25 mg/L, and 50 mg/L. A linear relationship between the mass of CP and efficiency was hypothesized, but at all three concentrations the relationship is quadratic. Accurate data will ensure that no CP will go to waste but enough will be used. When it comes to CP, it turns out more is less! This experiment has implications for the design of cost effective filters that will restore our oceans to their natural blue.

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

EM 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

137

Fair Category

P7

Project Number

5025

Title: Reusable Hand Warmer Magic

Student Name(s): K. O'Marra

Abstract:

For my science fair project, I tested whether or not the room temperature affects the heat output of a reusable hand warmer, as well as its crystallization. I put reusable hand warmers in the freezer, fridge, and at room temperature, and then tested their heat output when they were liquid, when they were activated, and when the crystals reacted with liquid sodium acetate from other hand warmers. While the sodium acetate was still in the hand warmer bags, the one in the freezer gave off the least amount of heat, while the one at room temperature gave off the most amount of heat. However, when I tested the crystal reactions of the three, the hand warmer from the freezer gave off the most heat, and the one at room temperature gave off the least amount of heat.

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

CH

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

230

Fair Category

P7

Project Number

5026

Title: THE EFFECT OF ENERGY DRINKS ON THE EROSION OF EGGSHELLS

Student Name(s): N. Prieto

Abstract:

Today Energy and Sports drinks are everywhere. The purpose of my experiment was to determine the effect of various energy drinks on the rate of enamel decay. I used egg shells to simulate tooth enamel. I conducted three trials using 250 ml of Lemon-lime Gatorade®, Red Bull®, and Monster Energy Drink®. I also included 250 ml of Fiji Water® as my control liquid. I soaked the eggs in these selected liquids for 7 days and observed the rate of decay to the eggshell surfaces. My research concluded that the acidity in these energy drinks aggressively eroded the eggshell surfaces within a three to four day time period. While I predicted that the Red Bull® would show the most corrosive qualities, the Monster Energy Drink® was equally as corrosive. The Gatorade was a close third and eroded the eggshell and turned the shell surface green. It is concluded that Fiji® water is the least corrosive liquid to the shell and caused no outward damage to the shells surface. The experiment results could be more comprehensive if more types of energy drinks were included and tested over a longer period of time. While these drinks are marketed for better physical performance, it was interesting to see how aggressively the ingredients affected the eggshell surfaces and the molding that occurred to the liquids themselves over the span of a couple of days.

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

MI 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

254

Fair Category

P7

Project Number

5027

Title: How do Variables Affect the Amount of Energy Collected by a Wind Turbine?

Student Name(s): A. Brady

Abstract:

Wind energy is an alternative power source for homes and buildings. Using wind turbines reduces use of fossil fuels and output of environmental pollution. Size and shape of blades and other turbine characteristics could impact the environment as well as the amount of power produced. This experiment tested variables that could affect the energy collected by a wind turbine. These included different blade materials, blade shapes, blade angle, distance from fan and fan speed. Weight of blades was measured. The hypothesis predicted wide poster board blade material, greater mass, 45° blade angle, wind source on highest setting, wind turbine farther from wind source, and material with a smooth surface would produce the highest amount of collectable energy. A scale model of a wind turbine was constructed for testing using PVC pipes, DC motor, multimeter, timer and fan. Several phases were conducted as modifications were made to improve turbine design. Theoretical power was calculated for each blade type using, $P(\text{watts}) = \frac{1}{2}\rho A v^3 C_p$. [ρ , air density kg/m^3 ; A , swept area (m^2); v , velocity (m/s) and C_p , power coefficient [0.4 was selected based on Betz's limit]]. A simple circuit was created using a breadboard, LED, and resistor to measure current and voltage for comparison with calculated power. During testing, over 1,000 data points were analyzed. Results supported the hypothesis that heavier mass, smaller angle, greater distance, and higher wind speed were the variables producing the highest voltage averages for the energy collected by the model wind turbine. Blade shape had inconclusive results.

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

ET 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

249

Fair Category

P7

Project Number

5028

Title: The Effect of Fin Surface Area on Rocket Rotation at Different Locations on the X, Y and Z Axes in Relation to its Launch Point, While in Flight

Student Name(s): A. Scott

Abstract:

The purpose of this project was to contribute to aerospace engineering by finding how fast a rocket rotates while in flight. The problem being solved was how the surface area of fins affected how much the rocket rotated, and that is what I tested. This work with other model rockets in the concept of efficiency and stability. The hypothesis I created was, if the surface area of the fins is greater within the three types, then, the rocket will have less central axis rotation because there will be increased friction, but not to an excessive amount. When I did the experiment, I used a pressurized air water rocket. So how that works is after water flows into a two liter bottle acting as the rocket and reaches a certain point, the valve has to be closed and after that the air is pressurized with a pump, and then the rocket is launched. I used camera footage to analyze the rotation using the formula, $2r/t$. As a result I found my predictions to be correct with the fin design with surface area in the midrange having a rotation around a tenth of a meter per second. Other fins had somewhat greater rotations however results may have been affected by aspects of weather like temperature, wind, and air pressure. In conclusion, this project tells us that if the fin surface area on a model rocket is larger but not to an overdone amount, there will be less central axis rotation.

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

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

251

Fair Category

P7

Project Number

5029

Title: How Safe is Your Water?

Student Name(s): K. Wilkos

Abstract:

This project involved using water from a brook, my kitchen tap, a water bottle, and melted snow to test for levels of copper, iron, nitrate and nitrite nitrogen, pH, hardness, alkalinity, and total chlorine. The purpose was to determine which sources of water have the recommended EPA levels for drinking water. To complete this project, four tests were done on each type of water. Two of the tests involved placing a testing stick into the water for 1-3 seconds. I then immediately compared the color that appeared on the pad of the stick to the reference paper. The third test involved dropping an iron tablet into the water to dissolve, then comparing the final color to the reference paper. Lastly, I held a water quality meter stick into each glass of water until the ppm showed up. When I completed the testing, I recorded my results on a graph and compared the levels from the test results to the recommended EPA levels for drinking water, then noted the differences. Snow most closely matched the EPA standards, closely followed by tap water, then brook water. The water tested from a water bottle had the least correct EPA levels for drinking. The results for the electronic water quality meter stick were slightly different; the melted snow was the cleanest, then the water bottle, then tap water, and finally, the brook water. In conclusion, snow matches the recommended EPA levels the best. This means that it is the most chemical-free form of water.

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

EV EM EA

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

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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

P7

Project Number

5030

Title: Black Holes, The Insatiable Hunger

Student Name(s): A. Cooke-Politikos

Abstract:

Black Holes are interstellar objects that have such high gravity not even light can escape their grasp. Due to their relatively recent discovery, scientists do not know too much about them. Based on this information, or lack thereof, I decided to test what happens when you accelerate a mass towards a black hole at different velocities and positions relative to the black hole. I believe that there will be no significant difference in what happens to the mass in respect to different velocity and position of the mass. I was able to use a computer program called Gravitation 5.0 Ltd to simulate this. I tested a mass with different velocities and positions and recorded the results in a spreadsheet. Many times during the two body simulations, the body I was testing settled into a stable or unchanging orbit. After I tested with two bodies, I added another body. I had nine bodies by the end of the experiment. After the experiment took place, I noticed that the body was either destroyed by the black hole or ejected from the system most of the time. During the simulations with more than two bodies, there were no instances where the body settled into a stable orbit around the black hole.

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

PH 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

249

Fair Category

P7

Project Number

5031

Title: A computer can use machine learning to teach itself to be as good or better at blackjack than the experts

Student Name(s): C. Harris

Abstract:

My project is a computer program that teaches a computer to play blackjack through machine learning. The program makes the computer teach itself a winning process. There are many different types of machine learning. The type I used is reinforcement learning, which teaches the computer by rewarding it when it does something right and punishing it when it is wrong. Eventually it will learn to do only what is right. This process can help us do things that would be difficult to teach through instruction alone.

I used a simplified version of blackjack where you can't split, double down or take insurance. The procedure that I used to complete this project was: create a 2 by 2 array called a strategy table where each entry in the table represented each possible hand that the computer could have compared to every possible up-card of the dealer. Positive numbers in the table mean hit and negative numbers mean stand. When the computer trained, a good result from hitting increased the entry in the table while bad results reduced it. Over time the computer learned what to do for each situation.

I tested a range of training runs and compared the performance versus expert strategies I found online. I found that the most efficient training size was 10,000,000 hands because this generated as good a strategy as possible. It was almost identical to the expert strategies both in the plays it made and winning results over a large number of hands.

**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

226

Fair Category

P7

Project
Number

5032

Title: Rust-Acidity (How do different levels of acid rain affect some kinds of iron?)

Student Name(s): E. Long

Abstract:

My experiment was about how acids (specifically levels of acid rain) affect types of iron. My hypothesis was that if I soaked three materials containing iron in acidic fluids and compared the results, then I would find that salt water created more rust and affected the temperature the most. To do this experiment, I soaked three items containing iron in seven different acids. First, I began by soaking steel nails in my acids and then putting it in a glass tube with a thermometer to rust over time. I repeated the process using paper clips and steel wool. I recorded and compared my results over a five-day process for each material. After I completed the experiment, I discovered that my hypothesis was correct. Evidence showed that the salt water generated a considerable amount of rust and affected the temperature of the environment more than the other acids. Overall, the salt water had the greatest effect on all three types of iron. The other acids did not have the same positive result on all of the types of iron. During my observation, I noted that salt water placed in the top three ratings for rusting all iron materials. This experiment helped me to learn more about the rusting process and how acids affect it. I recommend this project to anyone who is interested observing chemical reactions.

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

CH EM

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

242

Fair Category

P7

Project Number

5033

Title: Staining Effects of Five Popular Beverages Using Eggshells to Represent Teeth

Student Name(s): J. Janezic

Abstract:

Our teeth are strong, but how much can they really take before they become that ugly stained color that everyone despises? The hypothesis of this experiment is that tea would stain eggshells, a substitute for teeth, the most out of five popular beverages.

The independent variables were the different liquids, and the dependent variable was the amount of stain on the eggshells. The materials used were large white eggs, cola, coffee, red wine, cranberry juice, tea, containers, paper towels, and Color Card, an iPhone application that measures RGB color scale.

Even amounts of each liquid were placed into five identical containers. Each of 25 eggs was photographed and recorded using the RGB color scale on the Color Card application. The eggshells were then placed into the liquid containers to sit for 24 hours. Everyday around the same time, each egg was photographed and recorded using the RGB color scale on the Color Card application. At the end of five days, the eggs were taken out of the liquids and they were photographed and recorded using the RGB color scale for the final time. The RGB data for the five eggs of each liquid was averaged, then added together to create a final sum.

The hypothesis was proven incorrect because the red wine stained the egg shell the most. Most of the eggshells stained a substantial amount and taught an important lesson about the effects of common drinks on the whiteness of teeth.

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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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

P7

Project
Number

5034

Title: The Efficiency of Different Types of Algae in Creating Self-Sustaining Microbial Fuel Cells

Student Name(s): M. Coisman

Abstract:

One of the biggest challenges facing humanity is producing enough electricity to meet the world's energy needs. The Rockefeller Foundation estimates that 16% of the world's population has little or no access to electricity. Both our current practice of burning fossil fuels and many of the green energy technologies (eg. solar, wind, and nuclear) are too expensive for this segment of the population. In this project, I tested variations of another green energy technology – fuel cells.

Many researchers have given up on fuel cells because it is too energy inefficient to produce hydrogen, the fuel that powers them. Some scientists, though, have been advancing a different type of fuel cell that is powered by microbes. These microbial fuel cells are better, but still have limitations including the need to introduce oxygen and the need to provide food for the microbes. In my project, I tested four different strains of algae used inside of the fuel cell that serve as both oxygen engines and microbial food. I built four test fuels cells and one control fuel cell and validated my hypothesis that Anabaena (a type of blue-green algae) was most effective and increased the lifespan of the fuel cell by 300%.

Microbial fuel cells may never power homes in the first world, but a farmer in the developing world could charge a cell phone or light a single LED bulb with a fuel cell the size of two five gallon buckets which costs less than \$50.

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

ET EE 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

226

Fair Category

P7

Project Number

5036

Title: Traft

Student Name(s): W. McGonagle

Abstract:

Robots that clean oceans have been an idea since global warming was discovered. This idea to clean the ocean is good, but it has major flaws. One for instance is that the trash in the ocean is mostly microscopic, this can be picked up with very fine filters. Another instance is that the trash is too big, this is a problem because then it is hard to pick up the trash that is bigger than the robot or boat. Finally, the cost of maintaining multiple oceanic robots would be absurdly expensive.

The traft is a truck like floating structure that is capable of filtering trash in the atlantic and pacific oceans. The draft was originally supposed to be autonomous, and it would get commands from the server, but there was not enough time to build. The current version of the traft is a remote controlled boat that can scoop trash into another barge. The prototype is currently only an 1/8 of the size of the final version. This final version will be capable of autonomous control, and control from servers. The problem with creating the final version is that there is not enough money for the project. This means that a larger version made out of stronger materials would lead to the Traft working, but since there is not enough money this solution is far away.

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

EE CS 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

253

Fair Category

P7

Project Number

5037

Title: Watts the Cost?

Student Name(s): C. Harris

Abstract:

Did you ever wonder which energy efficient light bulb is the best (based on lifetime cost, light output, and power usage)? Well, in this experiment, I used two devices to help determine the answer to this question. These devices were a light meter (to measure light output of the bulbs), and a watt meter (to measure the light bulb power usage, along with the voltage and frequency of the electricity measured in my house during the experiment). These meters were used to test my hypothesis, which was, "If you compare four different types of light bulbs (Incandescent, LED, CFL, and Halogen), then the LED bulb will be the most energy efficient and have the lowest overall lifetime costs". The equipment and materials I used for this experiment were a watt meter, a light meter, a stopwatch, some removable self-adhesive tape, a 60w suitable lamp, two 60w halogen bulbs, two 60w LED bulbs, two 60w CFL bulbs, and two 60w incandescent bulbs. I also needed a working table, a notepad, a pen/pencil, and a 120v-powered two prong electrical outlet to complete the tests and record data during the experiment. To increase the accuracy of my results, I ran two trials on each type of light bulb. This experiment was fun and I learned a lot, including that some light bulbs are significantly more brighter than others, even though they are all rated the same, and that the LED light bulb is indeed the most energy efficient of those that I tested.

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

ET 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

P7

Project Number

5038

Title: The Heat Is On

Student Name(s): J. Sarango

Abstract:

My experimental question was will the material placed inside a glass jar affect the temperature of the air inside the glass jar? My hypothesis is, when compared to sand, water, and dark soil, that the grass carpet jar will have the lowest temperature. I believe this will be due to the fact the grass carpet replicates plant life, which can absorb CO₂.

I obtained 4 glass jars with metal lids and labeled them water, soil, sand, and carpet grass. I then drilled an appropriately sized hole in the center of the 4 metal lids. A thermometer was inserted through the hole, in which the hole should match the diameter of the thermometer. Clay was then added to the sides of the thermometer, on both the top and bottom at the thermometer's perimeter, ensuring proper positioning. I closed the jars and positioned them so that a lamp is directly shining on the jars. I record the temperature in Celsius every 10 min for an hour. I repeated this entire procedure 3 times.

My project represents Global Warming since the material inside the jars represents a part of the Earth's surface. The incandescent lamps represent the sun, and the amount of temperature represents the heat caught in our atmosphere's greenhouse gases. We know that the more greenhouse gases that are present, the higher the temperature will be. My results show that the materials in the jar do in fact alter the temperature in the jar.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

231

Fair Category

P7

Project Number

5039

Title: The Next Climbing Helmet

Student Name(s): J. Paterson

Abstract:

The purpose of this experiment was to build an enhanced helmet. Right now there is no helmet built for the dark. If the helmet has better technology and better lights than climbing in dark spaces will be a lot safer. First the helmet was built out of cardboard for the earlier prototypes. To do this a circle was cut out of a piece of cardboard. After triangles were cut out of the circle then ridges were cut to make the helmet curve around the head. Then microbit and Leds and speakers were learned about through experimentation. After that it was all about putting it together. Then a micro controller called a micro bit board was put on the back of the helmet using tape. For actual usage, if the climber happens to fall than the microcontroller will sense this and start lighting up with the word "HELP". While this is very helpful if someone can not see the person that has fallen then the helmet will start making noise. This is noise is S.O.S in morse code. For further study it would be figured out how to put the micro bit in the helmet after the microbit the battery pack and the speaker were added to the back. The speaker would be made louder and more compact. Instead of cardboard the helmet would be built of tougher and more sustainable materials.

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

EE AT

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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

223

Fair Category

P8

Project
Number

5501

Title: Cracking M&Ms in the Microwave

Student Name(s): C. De Castro

Abstract:

Color is everywhere! Color is produced by the way our eyes interpret the energies contained within a beam of light. The energies of light contain a large spectrum of colors. When light touches an object, some of these energies are absorbed and others are reflected. The energies that are reflected and collected are then interpreted as a specific color. Different colors absorb different amounts of heat. Darker colors absorb more heat because they take in more heat energy. Brighter colors reflect heat energy, therefore little heat is absorbed. This experiment was performed to determine if the same is true to food pieces that comes in a variety of colors. Using M&M chocolate pieces as samples, yellow, red, blue, brown, orange and green of these food pieces were exposed to a source of heat energy. A microwave was used as the source of heat energy and the M&Ms were heated from one to four minutes each. A camera was used to take photographs in order to note the amount of cracking after each minute. After three trials, the results showed that dark colors like blue and brown cracked faster than lighter colors like yellow and orange. In conclusion, it is true that colors are not equally heat absorbent. The hypothesis that darker colors absorb more heat energy than lighter colors is correct.

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

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

186

Fair Category

P8

Project Number

5502

Title: What Causes Your Stains?

Student Name(s): T. Rosario

Abstract:

The purpose of conducting the experiment was to figure out what drink will stain your teeth more coffee, tea, or Pepsi. My hypothesis was that coffee will stain your teeth more because the tooth has microscopic ridges and pits (on the enamel) that hold on to the pigments of foods and drinks. Because coffee is so dark, the pigments will cling to the pits and ridges causing the enamel to get stained.

The drinks that were used were coffee, tea, and Pepsi. To begin the procedure I first had to hollow out the three white eggs, then put them into the liquid for ten minutes, take them out and wait until they dry, and compare them to the color scale.

Based on the results of the experiment coffee will stain your teeth the most, tea will stain your teeth the least, and Pepsi will discolor your teeth a little more than the tea (tea- 5 Pepsi- 5.5). My hypothesis was supported because coffee discolored the white egg the most.

Based on the data obtained the more coffee you drink the more discolored your teeth will get.

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

224

Fair Category

P8

Project Number

5503

Title: Medical boot modification for comfort

Student Name(s): P. Berganross

Abstract:

According to WebMD, 25,000 people suffer every year from ankle injuries, and most of those people are put in a medical boot. Medical boots are treatment for an assortment of injuries, but many complain about them being uncomfortable.

The objective of this project was to design and create different components to make an already existing medical boot more comfortable. To accomplish this objective, a medical boot, memory foam, sorbothane, one way air vent, an empty glue container, and tubes were used. To improve comfort, the student researcher layered sorbothane between two sheets of memory foam to allow the boot's current padding to compress but stay firm. A pump mechanism was also designed and made which included an empty glue bottle, tubes, and a vent. This pump mechanism would provide more comfort by increasing pressure around the foot to make it tighter. The boot was tested by the student researcher who deemed it comfortable. With additional time more modifications would be made. A few of the extra modifications would be a functioning pump mechanism, and a different latch system, focusing more on latches like ski straps than Velcro straps. Also, the traction on the bottom of the boot would be improved to make it less slippery.

This new medical boot will make the healing process safer and more enjoyable by modifying the comfort and design.

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

5. 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

5504

Title: Building an app

Student Name(s): S. Reese

Abstract:

Steven Reese
St. Mary School

1/25/18
Grade 8

Science Fair Abstract

The purpose of my science fair project was to see if I could make a Periodic Table app using the platform provided by apple called Xcode. I thought that I would be able to create the app and make everything work. My procedure was to create a periodic table in Xcode then to put in all the facts and program it so if you tapped the elements the fact would show up. For my results I got everything to work and I tested multiple times but when I went to test it for a final time to see if everything worked I got two unknown errors that I believe showed up in the code that makes the app run. I am continuing to work on the app to see if I can get it to work consistently every time.

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

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

P8

Project Number

5506

Title: The Effect of Barometric Pressure on the Speed of Wifi

Student Name(s): S. Walker

Abstract:

Everywhere around the world, companies and individuals face slowing wifi daily. One factor known to impact wifi response speed is weather. Extreme wind, precipitation, temperature, and humidity can get in the way of signals. Barometric pressure readings are almost always identical between indoors and outdoors so pressure may also impact wifi speed. It was hypothesized that if the barometric pressure measures higher, then the wifi speed will slow because signals are sensitive enough to be impacted by humidity. To determine if a differing barometric pressure impacts wifi, two types of data were taken. To collect outdoor data, measurements of barometric pressure were taken in inches of mercury twice a day in two locations. At this exact time and location, download and upload speed was taken in mbps and the ping was taken in ms. This process was repeated for 15 days. To collect data that would not be affected by other weather patterns, a pressure chamber was created. A phone was sealed airtight inside of the chamber and different levels of pressure were pumped into it while running data from the phone inside. In the experiment, there was not a difference between the data for 20, 40, and 60 psi. Results differed within trials but, the data ended up staying in the same range every time. 60 psi had the fastest and slowest results, proving there is no correlation. This experiment proves there is not a relationship between pressure and wifi. Many weather patterns impact wifi, however, pressure does not.

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

EV ET 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

172

Fair Category

P8

Project Number

5507

Title: Green Step

Student Name(s): J. Fiestas

Abstract:

The purpose for my project was to see if you could create energy from a footstep and, harness it. Why create energy from a footstep? Well I want to advocate this new type of renewable energy that can be used in future inventions. So, people can use this as at least a small leverage to replace harmful fossil fuels, harm caused by non-environmental friendly energy sources. Maybe even one day reverse the effects of global warming. For my actual investigation I created a circuit using piezo electric plates which was my key point to create this energy. Of course, this circuit was concealed under a doormat, but that circuit is the actual science of my product. When I was finished constructing the circuit, I then put it through multiple tests that I had asked, when I was planning this project. One example question was; How many footsteps does it take to light, a light bulb? Through my extensive tests I concluded that in fact you can generate electricity from a footstep.

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

245

Fair Category

P8

Project Number

5508

Title: The Effect of Brand Selection on the UV Blocking Ability of Sunscreen

Student Name(s): S. Montalto

Abstract:

Americans spend up to one billion dollars yearly on sunscreen. If I compare the UV protection from generic and brand name sunscreen, they will protect you equally. Many people will purchase a generic brand to save a dollar or two. The purpose of this experiment was to see if there is any difference in UV protection between name brand sunscreen and their generic equivalents. Three trials were conducted for each sunscreen. For every trial there were three categories- Direct UV measurement, UV measurement with a clear plastic slide, and UV measurement with sunscreen on a plastic slide. For this experiment the UV meter was held in front of the UV lamp once with no cover, once with only the plastic slide for its cover, and once with the plastic slide covered in sunscreen. The process was repeated for each sunscreen and the control, Cera Ve. The average for each of the trials was calculated. When comparing Banana Boat (SPF 30) and Equate (SPF 30), Banana Boat blocked 92.5% of UV radiation while Equate blocked 93%. There is only a .5% difference between these two sunscreens. However, CVS Sport (SPF 50) blocked 99.25% while Coppertone Sport (SPF 50) only blocked 92.91%. There is a much bigger difference in these two in 6.34%. The last comparison, Neutrogena (SPF 30) and CVS (SPF 30) both blocked 96% of UV radiation. I concluded my hypothesis was true. The generic sunscreens protect just as well as the brand name sunscreens.

Technical Disciplines Selected by the Student
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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

215

Fair Category

P8

Project Number

5509

Title: Invisible Forces: Creating Magnetic Fields

Student Name(s): J. Galvin

Abstract:

This year I decided to do my project on electromagnetic induction. I wanted to see how current can create a magnetic field, which in turn could be used to do work. I thought it was amazing that you can create a new source of power(A magnetic field) by using just a nail, a wire, and a battery. Believe it or not, magnetic fields are used to power trains! Today's world is focused on creating new sources of energy so we can reduce the amount of fossil fuels used. If we can harness the power of a magnetic field on a small scale, imagine what we can do on a larger scale!

In my experiment I created a magnetic field using current produced from a 9 and 12 volt battery. The current ran through a copper wire which was then wrapped around a metal nail 60 times creating a solenoid. The magnetic field generated was able to pick up paper clips. I compared the how many paper clips were picked up using a 9V, 12V, and two 12V batteries in series. I documented my results on a chart to see how the amount of current used affected the strength of the magnetic field generated. The more paper clips picked up, the stronger the magnetic field.

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

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

249

Fair Category

P8

Project Number

5511

Title: Don't Rock The Boat

Student Name(s): B. Barry

Abstract:

When aircraft carriers rock back and forth due to waves or wind, it is especially difficult to land military aircrafts on the aircraft carriers. It is important for engineers to design effective bilge keels to keep boats from rocking back and forth. If the rocking of aircraft carriers can be minimized using bilge keels, then military aircraft planes can safely land in rough seas. If two straight bilge keels are attached to the bottom of the boat, they will create the greatest drag on the moving water and will decrease both the number of oscillations and total time the boat is rocking. This investigation was conducted by testing three designs of bilge keels - straight, curved inward, and curved outward. First, five tests were performed with no bilge keels. These results are compared to the results of the three bilge keel designs to show how effective the keels were at keeping the boat stable. Next, the three bilge keel designs were tested using the same procedure as the initial test. The total time and number of oscillations was measured for the initial test and each design. The data shows the bilge keel design with straight bilge keels provided the least amount of oscillations and smallest total time. Possible extensions to this investigation are testing how the length of each bilge keel or the number of bilge keels attached affects the results. This experiment can be used to ensure the safety of our armed forces landing military aircrafts on aircraft carriers.

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

ET PH 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

248

Fair Category

P8

Project Number

5512

Title: Slip Hazard Alarm Robot H2OhNobot 2.0

Student Name(s): T. Zhang

Abstract:

Many people are injured when they slip on the floor because of water. According to the 2014 Liberty Mutual Annual Workplace Safety Index, falls on the same level were the second most costly injury and accounted for 15.4 percent of the nation's total injury burden. Additionally, the National Floor Safety Institute said falls are the sixth leading cause of death among people aged 70 years or older. This also happened to a teacher at school.

The project objective was to prevent injury from slipping on wet floors. First, research was done on the sensors which can detect water on the floor. Experiments were conducted to test the ultrasonic sensor. A thermal camera (FLIR ONE) was selected to detect the water because it could show the different temperature of objects. After water is left on a surface it will have a lower temperature than the environment due to evaporation. The data was collected indoors and outdoors. The thermal image data was analyzed to process the images and find the difference between the dry floor and wet floor. The H2OhNobot (H2O Oh No Robot) was built. A smart phone (android) app was programmed to take thermal images, detect water area on the floor in the thermal image (colder area), make a warning sound, and communicate with the robot. The non-contact FLIR temperature sensor would be attached to the person's body. Finally, ice can be also detected using thermal cameras. Potentially, this device could save many people from getting injured.

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

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

247

Fair Category

P8

Project Number

5513

Title: Lights, Camera, Refraction

Student Name(s): J. Sciallo

Abstract:

My topic for this years Science Fair is Snell's Law, the Refraction of Light. I chose this topic because I am interested in why light refracts and why when you stick a pencil in a cup of water it looks like the pencil is broken. My hypothesis was that of the three mediums, the gelatin would have the fastest speed of light and the least amount of refraction because out of all the mediums that I tested the gelatin had the lowest density. I predicted that the light will travel the slowest or have the greatest amount of refraction through the glass because the glass is the most dense of the three mediums. For my experiment I tested the refraction of light in gelatin, glass and ice by shining a class 2 laser through each medium to calculate the refraction of light by using Snell's Law. After conducting my experiment I found that the index of refraction of light through gelatin is 1.405, through ice is 1.335 and through glass is 1.403. I found that the ice has the fastest speed of light and the least amount of refraction. The gelatin had the slowest speed of light and the greatest amount of refraction. The speed of light through the glass was faster than the gelatin, but slower than the ice. I learned so much from my project. I learned from this experiment that light refracts when it moves from one transparent medium to another of different density.

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

PH MA

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

238

Fair Category

P8

Project Number

5514

Title: Copper Water

Student Name(s): Y. Rosa

Abstract:

Recently, water from some sinks in our school have been found to contain high levels of copper. Some copper levels exceed EPA standards of 1.3ppm. We don't know where the copper is coming from, but I wanted to find out how long you need to flush the water to get low, safe, copper levels. In my study, I measured how much copper was in the water before and after flushing the tap. The contaminated water that I tested from was from 2 sinks at my school. One sink had been shut off for a while. The other sink had not. I turned both the sinks on and took a sample right away. The sink that been turned off had a lot of copper in it when I first tested the water coming out of it. The other sink didn't have as much copper for the first test, but they both exceeded the EPA standard. I tested a water sample for every 500mL that flushed from each tap to see if the copper levels changed over time/volume run. I found that the copper levels did decrease with the flushing of water. It took longer for the concentration of copper to reach safe levels from the sink that had been turned off and had a higher initial concentration. Overall, this project helped determine that we needed to run the sinks for a few minutes before we could use them.

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

251

Fair Category

P8

Project Number

5515

Title: Temperature's Effect on the Brightness of LED Light Bulbs

Student Name(s): C. Stanton

Abstract:

The intent of this study was to test if various brands of LED light bulbs emit the same amount of light (lumens) in warm and cold temperatures. It was hypothesized that if LED light bulbs are exposed to different temperatures, then they will emit different amounts of lumens. My online research supported what my hypothesis expressed. Last year, I tested five different brands of LED light bulbs, one Incandescent light bulb, and one Compact Fluorescent light bulb (CFL) to see if they perform as advertised. This year, I only used LED light bulbs (the same brands used previously). For my experiment, I used two bulbs of each brand of LED light bulbs, for a total of ten light bulbs. First, I put one of each brand of light bulb inside a freezer set to zero degrees Fahrenheit for thirty minutes. Then in a dark room, I screwed each light bulb into a lamp and turned the lamp on. While the lamp was on, I used a lumen-meter on my mother's iPhone and measured the brightness of each light bulb. Then, I put the remaining light bulbs near a heat source of seventy-five degrees Fahrenheit for thirty minutes. According to my research, I found that light bulbs would emit more light in colder temperatures, so I was surprised to notice that most of my results showed the opposite. Except for the Sylvania Ultra light bulb, the light bulbs had given off more light after they were in the warmer temperature.

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

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

249

Fair Category

P8

Project Number

5516

Title: The effect of salt on the power output of a microbial fuel cell

Student Name(s): N. Muriel

Abstract:

Microbial fuel cells are devices that can turn microbes into electrical energy. I tested the effect of salt on a microbial fuel cell. It is hypothesized that adding salt to the soil of a microbial fuel cell will increase the power output. To begin, I prepared the soil and assembled the microbial fuel cells and put the wires, resistors, and LEDs in the hacker board. I waited seven days for the LED to blink but it did not so I continued testing. I took current measurements of the soil using a simple conductivity sensor and a nine volt battery. To convert current to conductivity (Siemens) I used the formula conductivity (Siemens) = current (amps)/ voltage (volts). Then I used resistors and the multimeter to check the voltage of the soil for eight days. To convert voltage to power I used the formula power = voltage²/resistance. When it stabilized, I mixed in salt with the soil in the fuel cells. I put one gram in MFC #2 and five grams in MFC #1. I took samples of soil for more conductivity tests and closed the cells. I tested conductivity the same way as before. Then I tested voltage and power the same way as before. The readings with the salt were higher than without. With the addition of one gram of salt, the peak power increased by 46%. With five grams, it increased by 400%. I came to the conclusion that salt increases the power output and conductivity of MFCs.

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

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

P8

Project Number

5517

Title: Sensors and Robotics

Student Name(s): L. Duarte

Abstract:

Robotics are being used by many industries to automate processes, to improve quality, safety, and efficiency. I wanted to create a robot using the Lego Ev3 robotics set to try to mimic how a modern-day warehouse robot, like amazon, using sensors. I wanted to have my robot follow a black line. I did this to show how the amazon robots follow directions by reading chips implanted to the warehouse grounds. I was able to allow the robot to follow a black line by using the Ev3's light sensor. Since the sensor measured ambient light and reflected light intensity I thought that the ambient lights at the science fair would be different from the ones I have at home, the robot would act differently. So I conducted an experiment to test my theory. I taped six different colored papers of the same size to a box. I then created a program to stop the robot when it sensed a preset value of reflected light intensity coming off the colors and measured the distance read by an ultrasonic sensory the robot. I ran the experiment three times for each color keeping the distance from the colors consistent. I did this in very low ambient light and bright ambient light. The results showed that the ambient light of the room did not affect the robots reading as greatly as I assumed. This proved that my hypothesis was wrong, and that the light sensor is not affected by different ambient light conditions.

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

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

250

Fair Category

P8

Project Number

5518

Title: Sneaker Feature 2

Student Name(s): S. Gasbarro

Abstract:

My experiment focused on the change in the rebound of sneaker foam during exposure to a repetitive weight. I manually dropped a ten pound weight on a roughly one square inch piece of sneaker foam from about 13 inches high to mimic the running pattern of an average 140 pound person. I used a force plate to record, gather, and analyze the data during the trials. I performed 6 trials overall, each using the same weight, same force plate, same height of drop of the weight, but a different piece of sneaker foam, as to get individual results each time without influence of previous trials. My data showed that in two of the trials, the rebound in the foam was positive, in one trial, the rebound of the foam was constant, and in three of the trials, the rebound of the foam was negative, meaning that over time, the sneaker foam would eventually wear down, causing the sneakers to flatten out. My hypothesis was that if a sneaker is exposed to repetitive pressure, the rebound will gradually decrease because of the weight gradually wearing down the foam and causing it to flatten out, increasing the density of the foam, and decreasing the bounce of the rebound. My conclusion was that over time, the rebound of a sneaker under pressure decreases because the repetitive weight will wear the sneaker down and increase the density of the foam. Therefore, my hypothesis was supported by the data that I collected during this experiment.

Technical Disciplines Selected by the Student
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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

249

Fair Category

P8

Project Number

5519

Title: Capillary Action

Student Name(s): T. Paradise

Abstract:

The focus of this experiment is capillary action, a natural force that lets liquids rise vertically in between two solid surfaces. The driving force of capillary action is the surface tension of liquids. The purpose of this project is to see in what circumstances the water will rise the most, using three variables; gap size, temperature, and chemical composition. The experiment used two sheets of glass spaced by shims to create a gap held together by clamps. The structure was held vertically by a custom made wooden stand with a baking pan filled with water. First, gap size was measured by putting water in the baking pan and waiting 5 minutes. Starting with no gap, then increasing the increments by 0.001 in. using shims. The next procedure was temperature. This was collected by using the same setup but with the 0.001 in. shim. Water was used as it was before, but with different temperatures changing with increments of 30°F, starting at 40°F. The last experiment was chemical composition. The chemicals used were water, isopropanol, and glycol. The same setup was used, but the 0.001 in. shim at room temperature. The results of first experiment was that there being no gap was most effective, rising 17 cm. The second experiments results were that the 40° water rose the most, rising to 21 cm. The third experiment showed that isopropyl was the most effective liquid to use, rising to 13.5 cm. In conclusion the experiment supports the stated hypothesis.

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

PH

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

P8

Project
Number

5520

Title: Cosmetic Science: Which Products Best Protect Lips

Student Name(s): I. Morse

Abstract:

I tested three cosmetic products to determine which makes the most protective lip balm. I tested beeswax, shea butter, and almond oil, and created four different recipes with them to test their performance in four experiments.

First, I checked which created the best water seal because a good seal will prevent moisture evaporation. I coated papers with the balms, put drops of water on each sample, and analyzed which balms resisted water.

Next, I checked which balm's consistency had the best heat tolerance. I placed each recipe in a 170-degree oven, and timed when they melted.

I also checked the stickiness of the recipes, because products need to adhere to skin to protect lips. I used samples at room, freezer, and refrigerator temperature. I pressed a penny on each sample, turned them over, and pressed my finger into the lip balm so it stuck. I lifted my finger up and timed how long each sample stuck.

Finally, to test lip balm yield, or how much of the product comes off onto lips in a swipe, I made four test sheets with 12 two-inch lines each. Then I moved the balm along each line. I increased the number of swipes to match the number on each line to see which sample had complete coverage first.

Results showed shea butter is the best ingredient to protect lips from water, heat, and dryness. The shea butter recipe performed best in most tests, while the recipe that had no shea butter performed worst.

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

103

Fair Category

P8

Project Number

5521

Title: Money Laundry

Student Name(s): A. Cawley

Abstract:

Money Laundry is a project describing which solution, from baking soda paste, coca-cola, water, and vinegar, will clean coins the best. According to my research, vinegar will clean the coins the best because it is an acid. Coins, often thought of as dirty, are covered in cupric oxide, the dirt found on the coins. There are only a few ways to clean off the cupric oxide and that is through acetic, nitric, and sulfuric acids. My hypothesis was correct because after letting the coins soak in the vinegar for enough time, they were nice and shiny, almost as if they were new!

Technical Disciplines Selected by the Student
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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

109

Fair Category

P8

Project Number

5522

Title: Quiet as a mouse

Student Name(s): A. Fields

Abstract:

I have a really huge family, were very loud. I often look for a quite space in the house. Often during my search for a quiet space, I wonder which room would be the most sound proof. That lead to the question "what materials are the most sound proof?". What I found out was that the card board was the best at blocking out the most sound. What I learned was because sound waves vibrate so much slowing them down can be a little challenging. This experiment can show people that you can take household items and use them to acquire a little more peace and quite for yourself.

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

EN EN 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

170

Fair Category

P8

Project Number

5523

Title: Effect of Spiral Spacing on Conversion Efficiency of Horizontal Axis Spiral Wind Turbine

Student Name(s): T. Chen

Abstract:

Wind power is being exploited as a renewable energy source. Conventional turbines are designed to be used in open areas. Horizontal Axis Spiral Wind Turbines have been in development to operate at comparatively low wind speed, making them viable for urban deployment. In this study, the spacing between spiral rotations is varied, and several turbine responses are observed and analyzed. Three turbines with difference spacing arrangements - constant, increasing, and decreasing - are built and tested to assess the rotation speeds at several wind speeds. The break-in point for each arrangement is also determined. It is found that the turbine with increasing spacing exhibits lower rotation speeds at all wind speeds; the break-in speed of the turbine also follows this trend. Upon close inspection of the turbines, it is observed that at the smallest spacing chosen, the spiral blade bends toward rather than away from the incoming wind direction. In hindsight, the direction of the spiral curvature - as opposed to increasing/decreasing spacing - may have more impact on turbine performance.

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

ET 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

212

Fair Category

P8

Project Number

5524

Title: 3D Printed Orthotics

Student Name(s): P. Paragas

Abstract:

Babies are often born with flat feet, which is when one's foot arch collapses when one stands. Only an estimated two out of ten people keep flat feet when they grow into an adult. This is a relatively large number, at 64,891,892.6 people in the U.S. alone.

The objective of this project was to design and print a 3D printed orthotic, which would be printed with the shape of one's foot inside of it. This would, therefore, not allow the arch of one's foot to collapse. The orthotic was designed using a 3D designing program, Tinkercad. The original goal for the prototype was to collect the customer's foot shape, which can be collected with a 3D imaging software, which could then be used to custom print the orthotic. 3D scanners were unavailable, so the prototype was demoted to the simple shape of the orthotic. The prototype was successful, however, because the shape of the prototype was able to be comfortable to nearly all of the feet that were measured to it.

This research project will contribute to reducing foot pain, and improve physical performance for flat-footed runners by keeping one's arch from collapsing whilst they run. Moreover, 3D printing orthotics will make the process faster and more cost and energy efficient.

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

223

Fair Category

P8

Project Number

5525

Title: Temperature and Magnets

Student Name(s): A. Gage

Abstract:

Abstract

The purpose of this this experiment is to see what effect temperature has on the strength of magnets. The hypothesis is that if the magnet is subjected to heat then the magnet will get stronger. If the magnet is subjected to the cold then it will get weaker.

To test this hypothesis I had to expose a magnet to different temperatures. First I exposed it to boiling water, then the freezer, and then an ice bath. I performed three trials for each temperature to make sure my results were accurate. After exposing the magnet to these different temperatures I had the magnet pick up as many paper clips as it could. I weighed the amount of paper clips it picked up in grams and compared it to the magnet at room temperature.

I observed that the room temperature magnet had the most strength. The boiling water was next with only 11 less average paper clips. The ice water was 14 grams less and the freezer magnet was 30 less paper clips than the room temperature.

From this data I have concluded that the magnet is at is strongest when at room temperature. When a magnet is subjected to heat it is weakened but not as bad as if in cold temperatures. An interesting extension to this experiment would be to use electromagnets.

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

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

242

Fair Category

P8

Project Number

5526

Title: Wifi? Why not?

Student Name(s): J. Hanley

Abstract:

Have you ever wondered why the Wi-Fi never works in your basement, but always works elsewhere? Are you tired of changing rooms every time you want to send a text message or watch a YouTube video? Well, did you know that certain materials can block Wi-Fi signals? If the signal has to go over a long distance to your basement and through multiple walls to get to your iPad, it won't be as strong. In this experiment, I tested the affect of different materials you would find in your home like wood or metals, and then recorded the signal strength. I placed the router so that it had a clear line of sight and nothing would interfere with the signal strength. I then tested the signal strength every 50 feet, going progressively further down the road until the signal got very weak. I then blocked the router with wood and repeated the experiment then with sheetrock and finally aluminum. The experiment proved that when the router was blocked with materials the signal was weaker and dropped off faster than when it wasn't blocked. Aluminum which accounts for metals in your house dropped off much faster than the other materials. This experiment may help you to improve your own Wi-Fi and allow you to watch cat videos in your basement. Maybe you'll discover how to get your Wi-Fi strong enough to work while you lounge on the back porch.

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

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

248

Fair Category

P8

Project Number

5527

Title: Stormwater Pollution: The Effectiveness of Zeolites in Decreasing Nitrate Levels of Runoff

Student Name(s): P. Lenz

Abstract:

Aquatic environments are the victims of pollution resulting from excessive levels of nitrate present in urban and agricultural runoff due to fertilizers, animal, and human waste, as well as other organic and non-organic contaminants. A potentially effective method of reducing this contamination is the use of microporous minerals, zeolites, as a filtration media in stormwater drains. This study aims to test the effectiveness of the development of a potential filtration system for stormwater street drains. Electrical conductivity, total dissolved solids, and nitrate concentration were measured with a nitrate test kit and spectrophotometer for water samples containing common stormwater contaminants, animal manure, plant fertilizer, and an insecticide. To observe if filtration time improved contaminant reduction, water samples were filtered twice with measurements taken prior to and after each filtration. Average nitrate levels were reduced as much as 22 ppm (mg/L), a significant reduction since concentrations of 40-50 mg/L are extremely high. The ability of zeolites to reduce nitrate concentrations decreased between the first and second filtrations, suggesting that their absorption capacity is reduced over time. However, zeolites can become dehydrated and later rehydrated, allowing them to be reused multiple times. To further support this research, studies should be conducted on the fabrication and placement of this filtration system and its ability to reduce other stormwater contaminants. The results of this experiment demonstrate the potential of a stormwater nitrate reduction method capable of decreasing harmful algal growth that negatively impacts aquatic ecosystems and ultimately endangers human health.

Technical Disciplines Selected by the Student
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EM BI 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

230

Fair Category

P8

Project Number

5528

Title: Mini Generator

Student Name(s): H. Wyndorf

Abstract:

Americans emit more than 9 tons of greenhouse gases per year from power plants alone. This can lead to global warming which will affect our environment in the future. The need to develop clean sources of energy is therefore critical to our future.

The objective of this project was to create a mini generator that uses green, sustainable energy to charge a mobile device. The materials needed for this project were two computer cooling fans, a mini USB step-up converter, a phone charger and materials to design an enclosure for this system. The generator was installed in a stationary position with a fan in front of it, and the positive and negative wires were soldered to a mini usb step up converter. The mini electric motor generated electricity when turned and that electricity traveled to the step-up converter which converted 3 volts to 5 volts. The converter has a female USB port which accommodated standard USB wires like phone chargers. This unit was tested by positioning the generator in front a fan, which blew the blades of the generator therefore generating electricity. When a particular wind speed is achieved, the voltage from the generator is able to charge a device.

This project was successful because the mini generator system was created and generated voltage.

This type of unit can help with the evolution of small green energy solutions.

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

ET 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

133

Fair Category

P8

Project Number

5529

Title: Rust Never Sleeps

Student Name(s): N. Wadsworth

Abstract:

My project tests which of four different coatings best protect steel against rust. I measured the mass of bare pieces of steel, coated them, and then accelerated the rusting process with salt, vinegar and hydrogen peroxide. I measured the mass again after scraping the rust off. From the data, I discovered that the petroleum jelly and red lithium grease (coats of thicker consistency) lost the least amount of metal in grams. I found that thicker consistencies create a better barrier than slick materials like oil or soft ones like paint (the other coats I tested). Thick consistencies block the oxygen and corrosive materials from interacting with the steel and creating rust. My projects informs an audience from big companies that use steel to the everyday person, about what materials could protect from rust.

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

CH

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

122

Fair Category

P8

Project Number

5530

Title: A Simple Electric Motor

Student Name(s): S. Hammond

Abstract:

Electric motors make a difference in our everyday lives. Rotating coils of wire, which are driven by magnets, creates electric motors. Motors transform electrical energy into mechanical energy. Magnets help make motors run. Magnets produce a magnetic field with a north pole and a south pole. Like poles (north-north, south-south) repel each other. Opposite poles (north-south) attract each other. My hypothesis statement is that the placement of the magnets will affect the rotation speed of the motor, therefore the more magnets the faster the motor will spin. My hypothesis was proven to be correct. The placement of the magnets did affect the rotation speed of the motor, therefore the more magnets that were placed the faster the motor spun.

Technical Disciplines Selected by the Student
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EE

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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

253

Fair Category

P8

Project Number

5531

Title: D.I.Y. Hovercraft: Lift and Propulsion

Student Name(s): M. Barbagallo

Abstract:

I have always wondered how hovercrafts operate, so I decided to build one to learn more about them. The goal of this experiment was to build a working hovercraft that can support my weight, lift me off the ground, and propel me. I built the base of the hovercraft which included the skirt, disk, and leaf blower. I added a rotating chair platform, so I could change direction. I tested the hovercraft to verify its lifting capabilities and ensure there were no leaks. I chose to add lights, so I made a battery pack that could power them. I rewired them so instead of using 120 volts alternating current from an outlet, they would run from 12 volts direct current from the batteries. Once the hovercraft was complete, I wanted to add things for esthetics, so I included diamond plate adhesive vinyl to the base. To determine the pressure, I built a manometer to measure it. I measured the pressure coming from under the craft to find out how much it took to lift. I repeated this four times and it came to approximately 2.5 “inches of water”. To double-check my calculations (to find the amount of pressure needed to propel it), I measured how much Pound-force it took to pull the craft using an electric scale. It required about 0.11 psi to accelerate the hovercraft to 1 m/s². In conclusion, I successfully built a working, rideable hovercraft and calculated the amount of pressure needed to lift and propel it.

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

164

Fair Category

P8

Project Number

5532

Title: Life+

Student Name(s): S. Li

Abstract:

The objective of the Life+ is to supply 5 additional minutes of power to a computer that has been disconnected from a power source. These 5 minutes of power allow the user to save all of their unsaved work. This is done by using capacitors to store the power. The objective of the Life+ Project is to test which set of capacitors can best store enough energy for a computer to last 5 minutes. I tested 5 sets of capacitors, each set holding 3 capacitors with the same amount of farads and the sets holding different farad amounts. A farad is the unit of measurement for how much electricity a capacitor can hold. Each single capacitor in each set has: .01 microfarads, 1 microfarad, 100 microfarad, 1000 microfarads, 10000 microfarads. The results are used to approximate the right capacitor set to achieve 5 minutes of power. This system could also be used on any device that has a precarious connection to a power supply.

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

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

153

Fair Category

P8

Project Number

5533

Title: Optical Illusions: Infinity Mirror

Student Name(s): M. Vossler

Abstract:

The Project I did is an Infinity Mirror. An Infinity Mirror is an Optical Illusion that tricks your eyes and makes you think you are seeing a long tunnel of lights when you really are not. To make the Infinity Mirror, I had to make it from scratch. I had to have help on this project from my dad because there were dangerous tools being used like saws. While doing this project I observed that the light in the middle is bouncing back and forth on the mirror and the two-way mirror film on the glass. While this is happening, what you see on the outside is the Optical Illusion of a long tunnel of lights. My conclusion is that the Optical Illusion is possible because of the Recursive Infinity Effect. This means that the image is repeated infinitely many times until it is so small it can not be seen anymore.

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

AT EE PH

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

248

Fair Category

P8

Project Number

5534

Title: The Walking Cane

Student Name(s): M. Coyne

Abstract:

For a person with impaired vision there are limited options to help them walk around. One of the most common options is a white cane. The problem with the white cane is that the user frequently hits objects and people, because the user navigates his/her environment by sweeping the cane from side to side to detect objects.

The objective of this research project was to improve the white cane by making it a sensing cane with an omni wheel. This was accomplished when a small Arduino microcontroller was attached to the bottom of a white cane, and an ultrasonic sensor was wired to the Arduino in order to alert the person using it when an object is approaching. An omni wheel (multi directional) system was also designed, created, and attached to the bottom of the white cane in order to let it glide easily in any given direction along the ground. The sensor on the bottom of the white cane was programmed to alert the user when an object was within .5 meters making the cane shake via a vibration motor wired to the Arduino and connected to the cane when the object was a foot away. To test this prototype, the student researcher had to navigate through a safely staged classroom using under adult supervision.

The Walking Cane was successful because the student researcher was alerted when his white cane came within .5 meters of the object via vibrations and the omni wheel provided easier navigation.

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

258

Fair Category

P8

Project Number

5535

Title: Using Robotics for Investigating Underwater Habitats

Student Name(s): M. Tainter

Abstract:

The engineering goal of this project was to build a remotely operated robot with sensors, to collect data and investigate an underwater habitat that is too difficult for humans to observe without this technology. Possible designs for a robot frame and propulsion were researched, built and tested. The robot frame was built from PVC pipe with pool noodle foam for floatation. Multiple motors were tested to determine best power and fit for robot frame. Different methods of waterproofing motors were explored. Putty tape with a wax ring was selected. A battery operated 3-motor control box (up/down/forward/backwards/turns) with toggle switches was built in a plastic container, including storage for an Arduino board and additional components.

Sensors for collecting data underwater were selected and tested. A waterproof HD WiFi inspection camera was added to the robot. It sent images and recordings to a smartphone app. Arduino sketches were prepared to collect data including temperature, water level and ultrasonic sensors to locate objects. Sensors were waterproofed (hot glue/shrink wrap/electrical tape) and retested. The water level sensor was not a depth sensor as expected, but was intended to measure rainfall. This sensor was modified by enclosing it in a PVC pipe open at one end (based on Boyle's Law) for use as a depth sensor in this project. This modification increased its measurement range from 40mm to 1m.

Sensors were added gradually, modified as needed, reattached and retested. The robot was successfully integrated with sensors and used underwater to collect data (temperature, depth, distance, video/images).

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

P8

Project Number

5536

Title: How Do Airplanes Fly?: Bernoulli's Principle

Student Name(s): S. Wood

Abstract:

My project is a demonstration of Bernoulli's Principle. Bernoulli's Principle is the law, discovered by Daniel Bernoulli an eighteenth-century Swiss scientist, that the as velocity of a fluid (including air) increases, its pressure decreases. How an airplane flies can be explained by this principal. An airplane can achieve lift because of the shape of its wing. The airplane's wings are shaped so that the air will flow faster over the top of the wing and slower underneath the wing. The fast moving air results in low air pressure while the slow moving air results in high air pressure. The high air pressure underneath the wing overcomes the low air pressure and pushes the wing upward. My project demonstrates this in a similar way on a smaller scale.

I predicted that if Bernoulli's Principle is correct than the piece of styrofoam will stick to the top of the box even though the air is blowing out. I constructed my experiment by attaching an air pump to a piece of poster board and pushing a styrofoam disk into the air current and seeing if it would stay. I observed that the disk was pulled into the air when it was .5 inches away from the air flow. My experiment proved that lift works due to differences in air pressure. In conclusion, airplanes have lift because there is low pressure under the wing which pushes it up.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

175

Fair Category

P8

Project Number

5537

Title: Using a wind tunnel to aid in the creation of an airfoil with higher lift.

Student Name(s): A. Sauer

Abstract:

According to the United States Environmental Protection Agency, transportation accounts for 27% of greenhouse gas emissions in the US. A large portion of these emissions originate from the incredible quantity of petroleum used daily in airports.

In 2012 the US used an average of 5,381 barrels of fuel a day on airplanes alone as reported by the United States Energy Information Administration. The objective of this engineering project was to reduce the amount of fuel consumed in the aeronautical industry by creating an airfoil with greater fuel efficiency. Four airfoil designs (three experimental airfoils and one control) were tested in a wind tunnel especially created for this experiment as a test bed.

The results were as follows: Of the airfoils tested the ideal airfoil had a raised lower camber as well as a longer chord than the standard airfoil. A possible extension of this study could be to create a full wing instead of a portion of a wing. That way it would ensure that the airfoil design would work on a full scale airplane.

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

ET 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

234

Fair Category

P8

Project Number

5538

Title: MediTrack

Student Name(s): A. Starr

Abstract:

My invention, MediTrack, is a device that is able to view the location of a patient affected with Dementia by using an Arduino Library, a GPS Module, and an Arduino UNO. My invention uses a GPS module and the TinyGPS++ Arduino Library to pinpoint the GPS Module's exact location in terms of latitude, longitude, altitude, and speed. Most current devices on the market do not feature an exact latitude, longitude, altitude, and speed. This is replaced with a blue dot signifying the location of their module. The device first uses RX and TX pins to transmit data to and from satellites at a rate of 9600 baud. The TinyGPS++ Library translates incoming NMEA data into numbers. The code instructs the module to print the speed, latitude, longitude, and altitude. After a two second delay, the altitude, speed, longitude and latitude is printed. This device can be used to help stop the problem of people with Dementia wandering away and getting lost. I came up with this idea when I heard stories about elderly people in Japan who were affected by dementia wandered away and could not be found. If they were, they forget who they are and where they live, so the authorities have no idea where they should be. This device could also have other applications such as a way to make sure your kid is safe and to know where they are.

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

AT EE CS

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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

146

Fair Category

P8

Project Number

5539

Title: A Homemade Hovercraft is More Accessible Than a Store Bought Hovercraft

Student Name(s): K. Fitzgerald

Abstract:

A store bought hovercraft can cost thousands of dollars. They are inaccessible to the average person. An entry level commercial hovercraft, Model UH-11F can carry up to 350 lbs. I found the homemade hovercraft can carry at least 590 lbs. After researching the basic concepts of how a hovercraft works, a list of supplies was purchased and assembled. Once assembled, weights were placed on top of the hovercraft to test its lift capabilities. Weights included a 220 lb male, 134 lb female and a 107 lb female. Additional free weights were added to equal 590 lbs. Each weight was added consecutively and the hovercraft was able to sustain the weight. The hovercraft moved steadily and swiftly with the full load it was carrying. The cost of the supplies was under \$100.00. Finally a hovercraft can cost considerably less and can carry more than 350 lbs.

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

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

P8

Project Number

5540

Title: Are you a 'fan' of wind turbines?

Student Name(s): K. Szczepanski

Abstract:

This year for my Science Fair experiment I compared Horizontal-Axis Wind Turbines (HAWT) and Vertical-Axis Wind Turbines (VAWT). I picked this topic because I am very interested in renewable energy sources. Last year I conducted an experiment comparing the energy generated by solar cells based on their angle in relation to the sun. Since I wanted to do another project on renewable energy I thought wind energy would be a good type to study and one that in the future I might be able to combine with what I learned about solar cells. In my experiment, I built both a HAWT and a VAWT and tested which turbine produced the most energy at three different wind speeds (low, medium and high), three different numbers of blade configurations (2, 3, and 4), and three sizes of blades (from a plastic cup - 1/2, 1/3, and 1/4 cup). I had a fan generate a wind directly in front of the turbines, then used a multimeter to measure the Voltage and Amps generated at each wind speed and blade configurations (I ran each test 3 times). I calculated the power (in Watts) created by each wind setting and blade configuration for both turbines. My results found that the HAWT generated far more power than the VAWT in all test conditions, which I didn't expect because I thought they would have similar results. However, I was correct that the most energy would be generated at the highest wind speed and with four blades.

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

EE ET 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

P8

Project Number

5541

Title: Water Temperature and Hurricane Prevention

Student Name(s): E. Ramthun

Abstract:

This project focuses on energy exchange between different temperatures of water and how that might affect the movement and path of hurricanes. Background research revealed the Bill Gates and Stephen Salter design of a device called the Salter Sink that tried to control hurricane development by cooling ocean surface temperatures. Testing began with Phase 1 which measured the temperature rate of change in different volumes of water, to examine small scale cool down rates at 5, 20, 200 and 1000ml. This became the control and documented the impact that water volume had on the temperature cool down rate. Mathematical analysis included calculating slopes for temperature intervals and calculating specific heat capacity. As a result, volumes smaller than 1,000 ml were eliminated from subsequent testing. Phase 2 tested the changes of temperatures that resulted from the mixing of two water masses. In theory, the Salter Sink brings cooler deeper ocean water to the surface to try and delay or decrease storm formation. Phase 3 of this experiment was the building and testing of a working Salter Sink model. Various designs were tested and optimized to investigate the operation and practicality of this type of storm control. Some of the design and material changes included the metal and plastic flapper valves tested to balance water pressure. Check valves were built and tested as an alternative. Ten gallon and 55 gallon versions were tested. Small scale modeling of the Salter Sink has shown promising results for the future of this technology.

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

AT MA 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

210

Fair Category

P8

Project Number

5542

Title: Acoustic Anomaly Detector

Student Name(s): B. Glastris

Abstract:

The Acoustic Anomaly Detector (AAD) is a small and compact sound detector. It can detect any sound from any appliance. If that sound or constant frequency gets changed in any way then the AAD will show an alert and tell you that something is wrong with your appliance. The detector is comprised of multiple components, all mounted on a wooden base. The AAD works by using a microphone to detect the sound coming from an appliance. The analog sound picked up by the microphone is converted to a digital signal which is then sent to the Fast Fourier Transform (FFT) function where it is broken down into its component frequencies. The results of the FFT code is that each sound frequency that the detector picks up is placed into separate bins. These bins get displayed on the screen as lines. Once you know what the "normal" frequencies are for the operating appliance, the application can be tailored to display an alert if the frequencies being picked up are outside of that normal range. That will alert the user and may indicate the appliance is not working properly. Not only does this have residential application but it can also be used in industrially to detect small problems before they become bigger.

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

CS 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

238

Fair Category

P8

Project Number

5546

Title: The Portable Linux Terminal

Student Name(s): S. Correya

Abstract:

Many people don't know how a Linux laptop works compared to Windows. Although Linux is much less expensive (mostly free), more secure, and used to power machines and servers at all kinds of organizations (Google, Facebook, NASA, etc.), it is still less popular and known than Windows and most of its functions are not well known.

The objective of this project was to create a handheld Linux Terminal (a mini laptop) and evaluate how well it does basic tasks (i.e., searching the web, playing music, etc). To accomplish this goal, a Raspberry Pi 2, a mini prototype microprocessor, was used in the making of the terminal. The Raspberry Pi 2 was programmed to have Librelec (an operating system) that acts as open-source media center. The open-source media center lets you could store and play different music or videos. Many problems arose during the making of the Terminal, some of which could not be solved, so the terminal itself couldn't be created. However, the Raspberry Pi itself can be taken anywhere and it will work if it is plugged into any computer or television. The finished product is able play videos, music, and different television shows.

The prototype was successful because it was able to plug into a computer and play videos and music. This device can conveniently carry your open source media center anywhere you want and lets you see and hear your preferences at anytime.

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

250

Fair Category

P8

Project Number

5547

Title: Image Recognition to Diagnose Lyme Disease

Student Name(s): K. Parikh

Abstract:

The application of convolutional neural networks to detect the bullseye rash present after contraction of lyme pathogen *B. Burgdorferi*, is inspired by the 200% increase in reported Lyme Disease cases from the year 2015 to 2017. Using fine tuning procedures, vgg16, a deep learning network, was fine tuned through replacement of its fully connected layers and retraining of terminal neurons. The convolutional neural network was construed and overwritten in the language Python to achieve image recognition. Five variations of fine-tuned models were fabricated, each trained using a batch size differing by two units, to explore the effects of batch size on progressional validation accuracy. It was accurately postulated that a specific range of batch sizes would best distribute weights when faced with a linear regression problem. Batch sizes exceeding and preceding this range would be subject to variation surpassing boundaries of an optimization algorithm, in case of the former, or overfitting of weights in the case of the latter. Using 35 images per category for training, the number of backpropagation initializations range from 175 to 35 iterations. Batch sizes 2, 4, 6, or 175-59 weight updates, yield the greatest accuracy, 93.75%, 96.66% and 90.00% respectively. The effects of batch size on accuracy will vary depending on method of transfer learning, epoch size, and derivative of the loss curve. This model's interactions with images of clear skin and lyme rashes is a large epidemiologic and public health advancement; furthermore, promising potential translation to a software application distinctly accessible via phones.

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

CS AT 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

239

Fair Category

P8

Project Number

5548

Title: The LightOff

Student Name(s): A. Florkiewicz

Abstract:

South Korean researchers discovered sleeping with lights on leads to shallow (Stage 2) sleep which makes it easier to wake up during sleep. Furthermore, Harvard Health Publishing found having inadequate sleep can be detrimental to your health. Also, having lights on during sleep contributes to wasted energy and money. Moreover, replacing lights frequently is also an additional cost; so it's best to have the light off during sleep since it's not being utilized.

The objective of this project was to create an apparatus that turns off a LED when its user falls asleep. To accomplish this objective, a LED, pulse sensor, laptop, and an Arduino Uno microcontroller were used. To attain this goal, a code from the Pulse Sensor GitHub was modified. The original code works by processing the BPM (beats per minute) and displaying that information on the Pulse Sensor Visualizer. The code was changed turn on and off to a LED at a threshold BPM. To test this device, the student first determined his resting heart rate. Then, the student researcher wore the pulse sensor on his ring finger during sleep and the modified code turned the LED off for approximately three minutes when the threshold was reached. The prototype was successful.

This prototype has the potential to save electricity and help nightlight users avoid some of the harmful effects of sleeping with the lights on such as the increased risk of cancer, heart disease, diabetes, etc.

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

EE CS AT

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

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

4. Is this project a continuation? Yes No

5. 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

5549

Title: The Effect of Temperature on Lift Decay in Helium Balloons

Student Name(s): N. Nagel

Abstract:

I conducted this experiment to find out how temperature affects the lift decay of latex helium balloons. My hypothesis was the lower the temperature is, the slower the lift would decay. First, I modified my scale, so it could take measurements while it was right-side-up. Using six balloons filled with helium, I worked with my dad and labeled them based on which condition they would go into. I measured the lift of each balloon. Then I put two balloons in the freezer, left two at room temperature, and put two in the oven, set for 100 degrees Fahrenheit. After 2 $\frac{3}{4}$ hours I took the balloons out of their conditions to let them adjust to room temperature. One-quarter hour later I measured them again. After measuring them, I put them back in their conditions. I repeated this process five times. I did this on two different days, with six balloons being tested on each day.

My hypothesis was proved correct. No matter the lift of the balloons in the beginning, the balloons that had been in the freezer had the most lift at the end. Three-quarters of the balloons that were in the oven ended up having 0 percent of their original lift by the end of the experimentation. The room temperature balloons' lifts were below the freezer but above the oven's, which had the lowest lift.

This data supports my conclusion that the lower the temperature is, the slower the lift decays.

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

241

Fair Category

P8

Project Number

5550

Title: Manual Tightening Prosthetic Hand

Student Name(s): S. Paglia

Abstract:

According to the CDC, about 1,600 babies in the U.S. are born with upper limb reductions each year. People born with upper limb reductions face daily problems that include: difficulties with motor skills, limitations with certain activities, emotional issues because of appearance, and many often need assistance with self care.

The objective of this project was to innovate and improve an open source 3D printed prosthetic hand for people with upper forearm deformities beyond the elbow by adding a prototype manual tightening system to the prosthetic. A manual 3D printed prosthetic hand that could tighten its grip using the designed prototype tightening system was created to accomplish the objective using an open source prosthetic hand design, a 3D printed screw with a box-like handle, holes for the cords, and a dowel on the bottom to hold it in place. The prototype works by holding the cords and twisting them so the hand tightens beyond its normal grip, making it much easier to grasp and pick up an object. To test the device, the research student used the prosthetic to attempt to lift and maintain a grasp on several objects of different sizes and shapes, such as a soda can, a plastic ball, and an iPhone. The innovated design successfully picked up more of the objects than the original design. This improvement to the design would make day to day life easier for a person using these open source 3D printed prosthetics.

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

EE EN 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

229

Fair Category

P8

Project
Number

5551

Title: The Thermodynamics of Chemiluminescence

Student Name(s): K. Power

Abstract:

Thermodynamics is the science of the relation between heat and other forms of energy. Chemiluminescence is chemical reaction that causes a release of energy in the form of light. The purpose of this project was to find out if temperature affects the brightness a glow stick. My hypothesis was if I change the temperature of a glow stick, then it will affect the brightness of the glow stick. First, I filled four cups with different temperatures of water, one freezing, one cold, on room temperature, and one warm. Then, I recorded each temperature. I activated the glowsticks, and then put the cold water cup in the refrigerator and the freezing water cup in the freezer. I left the other two cups on the table in the dark. I left them and came back thirty minutes later to record the data and observations I made. I did the same thing for two hours.

The data showed that temperature does affect the brightness of glow sticks. The glow stick that was in the warm water was brightest at the end of the experiment. The room temperature was a control to see how long it took for a normal glow stick to fade. It was the second brightest at the end. The glow stick in the cold water was almost faded and the one in the freezing water was almost completely faded.

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

150

Fair Category

P8

Project Number

5552

Title: Wat(H)er Spin if Off

Student Name(s): T. Do

Abstract:

This experiment represents how hydropower works and focuses on the problem of, "Will the shape of a water turbine affects its revolution per minute (RPM)." In the process of forming my question, I'd hypothesized that "The cube-shaped water turbine will have the least revolutions per minute (RPM)." I'd researched on how a hydropower plant works, its expense, its structures, and the importance of it to society. I recorded down the results and indicated which shape has the least revolutions per minute. Through the 3 trials I've tested for the shapes, such as a cube, rectangle, triangle, and circle, the triangle has the least RPM average. My hypothesis was proven to be incorrect and the data surprised me by how far off the average of the cube's RPM to the triangle's RPM was; 65:0. I now know that the triangle shaped water turbine will provide NO electricity for many homes.

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

EE 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

239

Fair Category

P8

Project Number

5553

Title: Burning Calories: What's in Your Breakfast?

Student Name(s): K. Van Tassel

Abstract:

Throughout history, food has been a very beloved and critical part of the international community. However, despite its importance, many people do not fully understand what is in the items they are constantly consuming. In order to better understand the contents of the foods we eat, I decided to conduct an experiment investigating the relationship between the heat content of a food and its metabolic caloric value (as indicated on the nutritional labels). My hypothesis stated if the metabolic caloric content of the food being burned increased, then the food's heat of combustion would increase to be higher. In this experiment, a homemade calorimeter was used to burn small portions of various cereals (the independent variable) to find how the energy released by the food sample affected the temperature of an above can of water. This change in temperature was then used to determine the amount of energy transferred to the water from 1 gram of burned food (the dependent variable). The results of the experiment did not follow my hypothesis, for they showed that the heat of combustion of the tested foods was lower than their metabolic caloric content. This is most likely due to the flaws of the calorimeter used in the experimentation, for it was incapable of channeling all of the energy released by the food's flame to the water. The energy lost to the surrounding materials was not counted in calculations, making the values inaccurate.

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

CH 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

257

Fair Category

P8

Project Number

5554

Title: ANTIBACTERIAL AND ANTI-INFLAMMATORY "VITAGUMMIE"

Student Name(s): M. Marino

Abstract:

A vitamin that helps to boost your immune system, provides the essential nutrients, and is antibacterial and anti-inflammatory.

Many toxic metals like aluminum, mercury relates with fluoride compounds. These toxicants send disruptive messages to the body affecting the immune system. Glyphosate and phosphate in the fertilizers tend up in the food and water supply. The harmful interactions of such chemicals are associated with rising infant mortality in the U.S., and creating substantial problems in the human body.

I engineered a vegetable-based vitamin that boost the immune system, provide vital nutrients and vitamins, is anti-inflammatory, and help fight bacteria and disease. VitaGummie creates an environment for the body to react as an anti-inflammatory and antibacterial compound by making the internal organs to stop the swelling and allow the body to absorb efficiently the nutrients. Many diseases and illness start in the digestive system and is processed in the duodenum, distributed all around the 11-important systems in body.

My mentors: Dr. Stephanie Seneff, Ph.D., Senior Research Scientist Director at MIT, Artificial Intelligence researches the damaging effects of Fluoride and Glyphosate. Dr. Keith Scott-Mumby, a highly recognized nutritionist from England.

VitaGummie affects the form of a chemical substance, but not its chemical composition. Therefore, the benefits of the ingredients don't change. Some elements depend on others for the vitamin to be active, i.e., turmeric (anti-inflammatory) needs the components of the Piperine. Dr. Mumby believes that the ingredients of VitaGummies and the preparation process will accomplish its purpose and will be safe for consumption.

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

192

Fair Category

P8

Project Number

5555

Title: Maglev Magnetics

Student Name(s): A. Buchkowski

Abstract:

My project is about electromagnets and how they work.

I did my project to learn more about how electromagnets work in our daily lives.

An electromagnet is a magnet that is run on electricity. Unlike a permanent magnet, an electromagnet's strength can be determined by the number of wire loops around the piece of metal or by the amount of current flowing through the wires. An electromagnet is created by wrapping metal wire, usually copper, around a piece of metal and running electricity through the wire, creating a magnetic field. The current of the electricity and the thickness of the wire determines the strength of the electromagnet. In a normal lump of iron the atoms are pointing in all directions but if you force all those atoms to point in a certain direction with electricity it will create an electromagnet.

The experiment in my project was able to test different electromagnet strengths by increasing the voltage and testing the different numbers of wire turns on the bolt.

Through performing my experiments, I was able to learn that electromagnets' strength increases with the amount of wire turns and the number of volts used.

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

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

203

Fair Category

P8

Project Number

5556

Title: 3D Printed Dog Prosthetic

Student Name(s): K. Scianna

Abstract:

Sometimes a Canine's leg needs to be amputated. In this situation, most dog owners would like to give their dog a prosthetic leg; however, there are many different problems that come with the current design of prosthetics designed for dogs, such as the high cost of the prosthetic. Moreover, the prosthetic is often the wrong size which makes the dog uncomfortable.

The objective of this project was to design and create a canine prosthetic that is comfortable and adjustable. Specifically, a plate on the inside of the prosthetic that can comfortably adjust to accommodate any location of amputation. To achieve this, the prosthetic was first designed and modeled in Tinkercad. This helped visualize where each piece should be made to accommodate the pan. Then, it was test printed multiple times to make sure that the design worked and it didn't fall apart or collapse when it was being printed. After several different designs, one finally worked so it was printed at its full size. To test the prosthetic, two stuffed animal dogs legs were amputated at different locations to see how it adjusts.

This prosthetic has the potential to save owners hundreds of dollars and it won't compromise the comfort of their Canine.

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

EN 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

219

Fair Category

P8

Project Number

5557

Title: The Novel Method Of Oi-Spill Clean-up Using Biomass

Student Name(s): A. Hall

Abstract:

Which biomass will absorb the most oil during an oil spill? In this project, The Novel Method Of Oil Spill Clean-Up I will be answering this question.

I choose this project because i believed it could help the Coastal Guard and Environmental Agency clean-up efficiently. To take part in the experiment, you will need 5 mason jars labeled 1-5 and as you add 200mL of water weigh each jar then add 50 mL of motor oil to each jar then weigh again. Then you weigh all of your chosen biomass seperately, I choose wood chips, pomegranate peel, tangerine peel, and microfibre cloth. Then, add it to each jar except the constant, Jar #5. You then let it sit for a week. After the week is over, you seperate the biomass from the mock oil spill and weigh it. The results demonstrated that my hypothesis was disproven. My hypothesis stated that the tangerine peel would absorb the most oil. I was lead to this conclusion because when the peel of a tangerine is dried out it will absorb some water. In the end, the wood chips absorbed the most oil because of its structure. The pomegranate was runner up, and the tangerine peel won bronze. The microfiber cloth was invalid because it absorbed both the water and the oil.

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

EM EV EA

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

P8

Project Number

5558

Title: Mirror-cle Solar Panels

Student Name(s): J. Wu

Abstract:

Many houses lack south-facing roofs, limiting electricity output from solar panels. I investigated if mirrors could increase electricity produced. My hypothesis was, "If light reflected onto solar panels increases, then electricity production will increase." I used a solar cell to represent solar panels. The light was controlled by placing a mirror at 60°, 75°, and 90°. I drew a ray diagram to calculate the amount of light reflected onto the solar cell. The diagram showed the light coverage was 60%, 100%, and 75%, respectively.

I conducted 45 test sets in 3 groups of different external lighting (15 sunlight, 15 roomlight, and 15 darkness), using a flashlight as a constant light source. Each group simulated a different weather condition (sunny, partially sunny, and cloudy). My experiment proved my hypothesis correct and showed three conclusions. First, all trials using a mirror produced more electricity than the control (no mirror), with an average increase of 27% for all mirror angles. Secondly, the electricity production is linked to the amount of light reflected. The mirror at 75° reflected the most amount of light and produced the most electricity (31% increase), followed by 90° (28% increase) and 60° (21% increase). Lastly, the test group with no external light produced the highest increase at 47% for the mirror at 75°, while only 7% in sunlight. This shows cities like Seattle, WA, with frequent cloudy days, would benefit significantly from mirrors.

My goal next year is to explore materials similar to mirrors but produce less heat.

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

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

75

Fair Category

P8

Project Number

5559

Title: Can You Blame the Burnt Cookies on the Pan?

Student Name(s): E. Topalis

Abstract:

In this experiment, I asked the question ‘will different types of baking sheets bake cookies differently?’. I chose this experiment because I like baking and food. I predicted that there would only be a slight difference between each batch of cookies. I observed that the cookies turned out slightly different on each sheet they were cooked on. In the future it would be interesting to see what other types of pans will do to cookies.

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

CH

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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

243

Fair Category

P8

Project Number

5560

Title: Does temperature effect Helium loss from a balloon?

Student Name(s): J. Ferris

Abstract:

In 8th grade science we learned about the different states of matter and I thought it would be interesting to test what we've learned. In this project I tested Helium loss from latex balloons in locations with different temperatures. My hypothesis was that if I place Helium balloons in warm, cold and mild environments, then the balloons kept cold will not lose Helium as fast as the balloons kept warmer. To complete the experiment I filled 12 balloons, all the same size (67cm circumference) and placed 4 in each location for 14hrs. I brought all balloons back to the room where they were filled and measured the new circumference at the marked line on each balloon every 20min until the circumference no longer changed. The balloons kept cold (27F) decreased an average of 4.75cm, the balloons kept warm (76.5F) decreased an average of 13.86cm and the balloons kept in the mild area (65.5F) decreased by an average of 10.13cm. The results show that my hypothesis is correct and I have proven when Helium balloons are kept cold they can last longer than they normally would. I waited 24hrs just to see what would happen next. I did not take measurements but the only balloons still floating were the ones that had been kept cold during the experiment! Science class helped me to understand why latex balloons don't float well for more than a few hours during a party, especially outside during the summer.

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

CH

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

253

Fair Category

P8

Project Number

5561

Title: Stealthy Shapes

Student Name(s): M. LaMonica IV

Abstract:

Do the angles and texture of 3-dimensional shapes affect the scattering of visible light? Possibly!

?

First, I needed a box lined with black paper, an LED flashlight, a Lux / light meter, and white paper. I taped the flashlight and Lux meter on the inside of the box, and made my four test shapes out of white paper. Next, I placed a shape in the center of the box directly in line with the flashlight, closed the box, and turned on the flashlight and the Lux meter. Finally, I recorded the readings on my Lux meter display noting the amount of light being scattered back from the shape. I repeated this three times for all four of my test shapes. I predict the w-shaped figure will scatter the most light back toward the light sensor.

?

In conclusion, I guessed incorrectly. The v-shaped figure, not the w-shaped figure, scattered the most light because of the single angle. I observed that the only part of the v-shaped figure that reflected light back to the light sensor was the thin angle facing it. My background research showed that light refraction bends light rays as they pass from a fast medium to a slow medium. Depending on the shape, the light reflected outward in different directions reducing the amount of visible light. This is why the Lux meter picked up different readings for each of the four different shapes even though they were the same distance away from the light source.

Technical Disciplines Selected by the Student
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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

255

Fair Category

PS

Project Number

6001

Title: Diagnosing abnormalities in Chest X-Rays using Convolutional Neural Networks

Student Name(s): M. Pillari

Abstract:

The objective of this project was to apply machine learning to detect abnormalities in chest X-Rays. The dataset was constructed from over 112,000 X-ray images. To use this data in an effective manner, it needed to be preprocessed. The data was resized from 3000x3000 to 256x256 pixels and histogram equalization adjusted each image to have greater contrast to accentuate the abnormalities. Various Convolutional Neural Network (CNN) structures were tested in the investigation for the most effective neural network structure. Four categories of networks were tested. Random initialization networks were constructed with three, four, or five convolution and pooling layers, and a binary dense output layer. These random initialization CNNs took longer to gain accuracy and would overfit to the training data quickly. None ever reached beyond 70% validation accuracy when tested with different batch size, learning rate, and dropout. The pre-trained CNNs—"VGG16", "GoogLeNet", and "InceptionV3"—were used to extract features from the images, these features were then output to a dense layer then a binary output layer. These CNNs saw benefit in their training speed, but they also overfit much sooner, causing them to have validation loss not significantly lower than the random initialization networks. Finally, Residual and Capsule Networks—"CapsNet", "ResNet50", "InceptionResNetV2"—saw the greatest success. They learn quickly while avoiding overfitting for longer. The final model was successful and able to diagnose abnormalities with a high level of accuracy. In the future, region-based CNNs might see greater success in identifying small abnormalities that the current models sometimes miss.

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

AT CS 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

236

Fair Category

PS

Project Number

6002

Title: Unforeseen Impacts of Cosmic Radiation

Student Name(s): S. ManurSreekantaMurthyGari

Abstract:

Last year, two neutron stars merged with each other and let out gravitational waves and gamma rays. The general consensus is that nothing could have been done anything to prevent loss of life or any other negative impact of it. This project was designed to address and model the unforeseen impacts that cosmic radiation from colliding neutron stars or supernovae could have on Earth if the stars were close enough and the gamma rays were directed towards Earth, providing three different scenarios related to the collapse of the ozone layer. It was predicted that no impact on the ozone layer would lead to no threat to the organisms of Earth, a slight break in the ozone layer would lead to a temporary ice age and a mass extinction, and the complete collapse of the ozone layer would lead to rampant starvation for all species and an even larger extinction.

The data previously collected from NASA and other scientific organizations' websites was assessed to answer specific questions on the impact of gamma rays on the species of Earth, and was used to forecast the unforeseen impacts of a collapse in the ozone layer. A computer simulation was created through Scratch, a programming software, to display the results of the three scenarios. The hypotheses were proven true by the data. The results of this project will help governments around the world in planning for predicted yet unexpected atmospheric events.

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

CS 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

154

Fair Category

PS

Project
Number

6003

Title: Multiple And Binary Star Systems Effect On Orbital Periods And Life Cycles Of Stars

Student Name(s): B. O'Hara

Abstract:

Multiple star and binary systems are a collection of stars that are close enough to each other to gravitationally interact with each other. The data compiled is that of multiple and binary star systems that were collected at Western Connecticut State University's observatory. The data that is collected is the observation of many stars in multiple and binary star systems and the path that they follow with their partners as well as the luminosity that each separate star gives off over the course of the observation. Using this data from many different systems things are determine such as the luminosity of the stars, what type of star they are, where they are in there life cycle (what element are they fusing at the moment), how they interact with the other stars around them, and their orbital periods around one another. With this information we can categorize the stars and learn even more about them.

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

PH

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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

PS

Project
Number

6004

Title: Investigation of Recycled Concrete Aggregates as a low-cost CO₂ Sequestration Vehicle through Indirect Mineral Carbonation

Student Name(s): J. Hong

Abstract:

Carbon dioxide (CO₂) is the largest source of greenhouse gas on Earth. In past few decades, the concentration of CO₂ is increasing at an exponential rate due to anthropogenic activities. The increasing rate of CO₂ concentration is causing global warming and climate change, specifically ocean acidification. This work includes CO₂ sequestration through indirect mineral carbonation, indirect mineral carbonation includes acetic acid treatment as a recyclable extracting agent of alkaline earth metals such as calcium from the waste concrete to react with CO₂ in an aqueous solution forming stable carbonate minerals. Recycled concrete aggregates (RCA) is the coarse aggregate portion from the crushed waste concrete, using RCA gives a secondary use after the demolition from its original use. Previous studies showed RCA properties can significantly increase the reactivity potential of concrete using acetic acid treatment. The study is presented by varying the particle sizes of RCA: .4cm, .2cm and .05cm. The maximum carbonation can be achieved with smaller the particle sizes because it has greater surface area. The increase of pH indicates fewer hydrogen ions are present, the percentage increase demonstrates the difference between the initial pH value of CO₂ sequestration and the pH value after the carbonation. The .4cm RCA increased by 135.6%; .2cm RCA increased by 139.6%; .05cm RCA increased by 144.2%. This experiment concluded that the indirect mineral carbonation of RCA is economical, environmentally friendly and effective approach to future carbon dioxide sequestration strategy and smaller the particle sizes of RCA, higher the carbonation efficiency.

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

EM EN 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

205

Fair Category

PS

Project Number

6005

Title: Effect Of Ambient Gases on the Stability of Perovskite Solar Cells

Student Name(s): K. Hossain

Abstract:

According to the Institute of Energy Research, fossil fuels meet 82% of the United States' energy demands. This is a significant issue because not only are fossil fuels a nonrenewable resource but they also cause a lot of damage to the environment. For these reasons, efficient solar energy is in high demand today. Recent developments have resulted in more efficient solar panels through the application of perovskite films, but these films have been proven to rapidly degrade under UV exposure.

The goal of the study is to place perovskite solar panels in environments filled with various gases in order to observe if there is an effect on the degradation of perovskites. The idea here is that the ambient gases will absorb some energy from incoming sunlight and dull the UV rays' harmful effects on the perovskite film. The proposed methodology is to create various groups of perovskite cells sealed within mason jars filled with either H₂, CO₂, He, or regular atmospheric gases (which will serve as the control). Recording the voltage output of these different cells over the course of 2 months will allow trends to be observed from the collected data, making it clear which of the tested gases best protects against UV degradation.

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

ET 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

246

Fair Category

PS

Project Number

6006

Title: Optimal Baseball Swing Attack Angle

Student Name(s): A. Chandy

Abstract:

The objective of this project was to determine the optimal swing path or attack angle, concerning the chance of contact with the ball, the possible hit distance, and possible hit velocity. It was hypothesized that the optimal attack angle would be approximately 20 degrees. This was because it was a balance between the attack angle to produce the greatest distance and velocity, but also remained as a viable swing to have a greater chance of contact. In order to do this, we had to set many constants such as pitch speed and frictional constants between the bat and ball. It was also assumed that there was air resistance, and lift due to backspin, but no wind resistance. To find the possible hit distance and hit velocity, collision physics was used to find the speed of the ball off the bat based on angle and the distance between the center of the bat and center of the ball. To find the chance of contact, the intersecting volume between the pitch path and the bat path, a cylinder and rectangular prism. The bat path's orientation was changed based on angle. The optimal swing path was ultimately determined by seeing how the angles from -20 to 40 with 10 degree increments, ranked in the three categories. It was concluded that the 20 degree angle was optimal. This finding is very relevant in the baseball world as there has been a revolution in changing swing path to hit more efficiently.

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

MA 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

246

Fair Category

PS

Project Number

6007

Title: Adsorption of Antimony Using Mesoporous Alumina: A Comparison to Adsorption of Arsenic

Student Name(s): D. Allam, J. Macharia, D. Pintavalle

Abstract:

Antimony, a toxic element found in manufacturing products and treatments for specific diseases such as HIV, is carcinogenic if ingested in high dosages. This research intended to identify the level of efficiency of activated alumina with a mesoporous structure as a potential adsorbent for the removal of antimony from aqueous solutions. Adsorption of arsenic by mesoporous alumina (MA) is effective as it has an adsorption capacity 5.6 times greater than commercially activated alumina. Antimony and arsenic share similar characteristics including a range of oxidation states, which impacts the efficiency of adsorption. Since adsorption of arsenic using MA has been proven to be effective, I chose to use the same technique.

I synthesized and characterized the MA to determine the mechanism and kinetics. I analyzed the adsorption modes of the material using several analytical techniques. Nitrogen sorption was done through the BET method to determine the surface area, the pore size and pore volume of the MA. Acid sites on the oxide surfaces were characterized using the TPD method, which determined the quantity and strength of the material. The TEM provided clear magnified images that allowed me to determine the morphology of the MA. I used the PXRD method to ascertain the structure and crystallinity of the material. These adsorption parameters will enable me to determine the mechanism of adsorption including: effect of pH, antimony concentration, adsorption time, and solution temperature. Results are pending on the analysis of adsorption of antimony, but are expected by March 9th.

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

CH EM

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

262

Fair Category

PS

Project Number

6008

Title: Effective Catalytic Conversion of Plastic Waste into Fuel

Student Name(s): E. Haddad

Abstract:

Plastic has become an indispensable part of every aspect of our society. Highly inert polyethylene (PE) produced annually on 100 million metric tons. It constitutes 60% of the total plastic of municipal solid waste. Thermal and catalytic pyrolysis requires $>400^{\circ}\text{C}$. Recently, a dual catalytic hydrogenation-dehydrogenation and cross alkane metathesis (CAM) processes was developed to allow degradation of polyethylene to fuel at 150°C over 3 days. The objective of this project is to study the CAM by replacing the heterogeneous $\text{Re}_2\text{O}_7/\text{Al}_2\text{O}_3$ catalyst with effective homogeneous Ru-carbene catalyst (Grubbs catalyst) to reduce reaction time and temperature. 5-decene and stilbene were selected to evaluate CAM reaction time at 120°C . Gas chromatography and mass spectrometry (GC-MS) used for analysis. The first experiments heated for 1h and 2h, GC-MS analysis resulted in similar two sets of multiple peaks that differ in 14 mass units, which is consistent with $-\text{CH}_2-$ fragments. One set consistent with stilbene/alkene CAM products and the other consistent with only 5-decene related alkenes ranging from C(6) to C(16). The structures confirmed by best match to MS database. These results not only proved effective fast CAM but also evident equally fast alkene isomerization in a dual synergistic mechanism, beneficial in catalytic degradation of long chain alkenes. The CAM/Isomerization reaction with 5-decene in absence of stilbene reproduced effective formation of alkene mixture. Highly effective CAM reduced reaction time from 3 days to 1 hour. Furthermore, effective alkene isomerization was discovered during the CAM, helps degrading long polymers into short hydrocarbon fuel.

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

ET CH 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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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

PS

Project Number

6009

Title: Modeling Permafrost Degradation to Estimate the Irreversibility of Runaway Climate Change

Student Name(s): A. Price

Abstract:

The goal of my research was to develop a model that foresees the change in the warming climate using permafrost thaw and transportation emissions. These projections include amounts of carbon emissions, and how this could change the increase in temperature. With the current trend, I expect to see an exponential increase in the degradation, and therefore, the carbon emissions. This will vary as new studies come about with new information. The information my model contains could be a great help for researchers in this field. The unique timeline with unique data can be key in the fight against climate change. It does this by showing how much the emissions are increasing, and what that is doing to the global climate. I have studied past models and information that has to do with wetland sources of carbon, as well as transportation trends. To start, I created a conceptual model of a basic permafrost process. Then I created one regarding permafrost degradation. Finally, with help from my mentor, Dr. Quinton of Wilfrid Laurier University, I created a predictive model in Excel. It used data from a Permafrost data bank my mentor gave me access to, and a data bank on U.S. transportation emissions I received access to. I then needed to manipulate the timeline prediction so it would equate to a global scale. With that number and knowledge of global carbon limits, I was able to draw a global habitability timeline from this model.

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

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

PS

Project
Number

6010

Title: Janus Bottlebrush Copolymers: A Universal Strategy Enabling Access to Ultra-Small Phase Separation

Student Name(s): V. Li

Abstract:

Self-assembly is an important property of block copolymers (BCPs), one which enables full access to their unique photonic, chemical, and physical properties. One specific area of application of self-assembly is lithography, where BCPs can be used to create nanoscale templates for the circuitry of electronics – enabling higher transistor density, more precise wiring, or other technological advances. However, the precise nanostructure necessary to fulfill these requirements can only be regulated through the molecular properties of the BCPs. In situations such as lithography for the purpose of circuitry, the inability to independently regulate the two can prevent successful utilization, as one would need a specific shape in addition to specific molecular properties. However, with complex architectures, more variables are available, and thus, important molecular properties and nanostructure can be modified independently of each other. In this project, I used Janus bottlebrush graft block copolymers (GBCPs), a polymer with altering polymeric sidechains which introduced an additional parameter, the backbone length, which enables control over the thermomechanical properties independently of its nanostructure. We found that, with the complex architecture, we were able to maintain our structural control while altering molecular properties of PDMS and PLA demonstrating independence. The simple synthetic route to GBCPs and the possibility of using a variety of polymer combinations contribute to the universality of this technique as well making it a viable commercial path.

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

EN 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

256

Fair Category

PS

Project Number

6011

Title: Reusable Paper with Light-based Writing

Student Name(s): Z. Hao

Abstract:

With paper consumption attributing to over 35% of our world's deforestation and paper production resulting in harmful phosphorus emissions, the development of "reusable" paper is highly desirable, especially in businesses, where paper is typically wasted after a one-time reading. This engineering project develops "reusable" paper polymer-film that can be written on, erased, and re-written multiple (~15) times to help address the issue of wasteful paper consumption.

The initial color of the paper polymer-film is a deep blue. Text and images can be printed with UVA (365 nm) light, which energizes TiO₂ photocatalysts to change the color of the UVA-exposed regions to white. These printed patterns have exceptionally high resolutions and can retain their contrast and legibility for a day (~18 hrs), before slowly being reverted to a deep blue by ambient oxygen oxidation, allowing it to be re-printed for other purposes.

The color of the paper is provided by methylene blue (MB) dye, which turns white when photocatalytically reduced by energized TiO₂. The paper film's structure is provided by a 0.5 cm thick layer of polydimethylsiloxane (PDMS). TiO₂ is synthesized via hydrothermal reactions, with glycerol as the capping agent to prevent crystal agglomeration, allowing for more efficient color-changing reactions. TiO₂ is also synthesized in the presence of montmorillonite (MMT) clay, whose lamellar structure absorbs the hydrophilic MB to prevent water-based decomposition.

The ~18 hrs of legibility and the ~15 "life cycles" of this reusable paper design provides a promising, eco-friendly solution to wasteful, one-time paper use.

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

EN CH AT

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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

178

Fair Category

PS

Project Number

6012

Title: Correlations Between Insulator Composition and Potential to Retain Temperature

Student Name(s): J. Callender

Abstract:

Fossil fuel reserves have decreased over the past century causing an increased need for research into alternative sources of energy and improved insulation materials. Demand for improved thermal insulation materials is increasing due to the growing costs and depletion of energy sources. This study is focussed on identifying materials that enhance insulation, and thereby, reduce energy waste. Common, everyday materials, including newspaper, aluminum foil, dish foam roll, and wax paper were used. These materials were placed in a box with an ice cube. We measured the amount of time it took to melt the ice cube as a proxy for insulatory value. Foam provided the greatest insulation value compared to other materials. The results for the foam retained the temperature the best. The results for the foam was 19,964 seconds before the temperature could not be retain any longer. This may be due to the thickness and heat retention ability of the material. Air flow was reduced as result of the density of this material. Our findings can be used to reduce heat loss and improve fuel efficiency.

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

EM 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

229

Fair Category

PS

Project Number

6013

Title: Fire Hydrant Alert System

Student Name(s): K. Young

Abstract:

Our High School and Intermediate School share one large school campus, parking is at a premium and has become a serious issue within our school community. With only 400 parking spaces for faculty, students, staff, and guest, visitors park wherever they can for sporting and other community events. The lack of adequate parking has led to a major safety concern as drivers have been parking in the fire lanes and blocking access to fire hydrants. These parking violations pose a major safety concern should emergency vehicles need to be called in. Without an active police presence at events, we do not have a suitable means to address the issue and keep first responder lanes open. Using computer technology, we can manufacture a device that can detect parked cars in fire lanes, in front of a fire hydrants or in other no parking zones. In order to accomplish this, a microcontroller will be used to collect data from an ultrasonic distance sensor to detect an object obstructing the area. The microcontroller will interpret the data and will respond with a flashing neopixel LED strip. If the obstruction is not removed within two minutes a signal will be sent to the monitoring system indicating that a tow truck must be sent to remove the obstruction. The technology implemented will be self-sufficient and will be charged using a small solar panel.

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

233

Fair Category

PS

Project Number

6014

Title: Point Cloud Ray Tracing Using Bounding Sphere Hierarchies

Student Name(s): D. Pfrommer

Abstract:

Quickly rendering three dimensional scenes has been a longstanding challenge in computer graphics research. Whereas current approaches for ray tracing scenes involve polygon-based ray tracing or voxel-based rendering, relatively little research has been done into ray tracing point cloud data, where a 3D model is represented by thousands of tiny spheres as opposed to polygons. The ray tracing algorithm proposed and used in this research address the challenges of quickly rendering three dimensional scenes from high volume point cloud data. Current methods for point cloud ray tracing approximate a point cloud with a series of elliptical discs called “splats” and then performing ray-splat intersections. Conversely, the method proposed in this research builds on Bounding Volume Hierarchy (BVH) techniques, where the desired scene is recursively split into sub-volumes, allowing large parts of the scene to be excluded when calculating ray-scene intersections. While popular partitioning schemes for BVHs include octrees and axis-aligned bounding boxes, this research utilizes a sphere-based bounding hierarchy where the entire rendered scene is represented as a tree of nested spheres, with the leaf nodes in the tree representing individual points in the point cloud. Through traversal of the node tree which maximizes reuse of intersection information, it is possible to accelerate ray-scene intersections in a way which, because of the spherical nature of the hierarchy, would lend itself well to point-cloud rendering.

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

CS

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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

PS

Project Number

6015

Title: USE OF DRIVING ROBOTS IN A LANDSCAPING SETTING TO CONVERT FIELDS INTO A CANVAS FOR LARGE-SCALE ART AND DESIGN

Student Name(s): W. King

Abstract:

This project seeks to enable artists to translate virtual images into real images on a large scale. This will do away with the limitations on the scale of artworks caused by time, access, and ability, with the possibility to create any uploaded digital image. The project was constructed using basic robotics parts. Experimentation surrounding robot performance was completed with a focus on software, as the entire robot was programmed for this project. Over the course of this project, many different techniques of image generation were researched, but a style similar to G-code, code mainly used to control automated machines, was found to be most appropriate for the desired scale and accuracy. To attain these goals, small steps were taken, each one important to the final goal. The robot began with very basic code that gave simple movement instructions. Next, a mechanism to raise and lower a pen or marker was developed. Gradually, various functions were added to the software, making user instruction more intuitive once a rotary encoder was introduced, giving the robot a sense of its relative position. Then, a chip was used to enable the main board to connect to devices remotely, giving the robot the capability to receive instructions without a wired connection. Although this project has not yet reached the final goals, the research that has been done and progress that has been made show great promise towards developing a robot with the capability to translate digital images into real images on any flat surface.

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

EE 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

254

Fair Category

PS

Project Number

6016

Title: Harvesting Wind From Urban Street Canyons Using a Double Helix Wind Turbine

Student Name(s): J. Osborne

Abstract:

My project is an engineering project that relates to and is built around real data that I acquired using the Scientific Method in past projects. This product that I have constructed is a double helix wind turbine that is optimized for urban use where wind is scientifically proven to accelerate through “street canyons,” or certain streets and alleys that funnel wind through small spaces.

Street canyons are typically formed by strips of tightly packed, tall buildings that impede the natural flow of the wind through the region. Some wind will blow straight into these buildings but since there is a stream of wind all around them, there is no freedom to deflect upwards or backwards and instead the wind will often pour off of the buildings in a sideways matter, into the streets. As dictated by the Venturi Effect, the increased volume of wind through a small space will cause acceleration.

After studying this phenomenon, I had constructed a unique vertical axis wind turbine to best harvest this abundant wind. Some obvious obstacles I had to account for were the harsh wind behavior inside the canyons, inconsistent wind patterns (direction), as well as safety hazards amongst city goers and even birds. The features that I included to address these issues were the double-helix-all direction-collecting airfoils, an all encompassing cage that includes two base layers to allow convenient wiring, a high power, bi-rotational DC Motor, and a compact, lightweight turbine design that allows for mass placement among tight urban street canyons.

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

EE 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

240

Fair Category

PS

Project Number

6017

Title: Deep neural network based subspace learning of robotic manipulator workspace mapping

Student Name(s): P. Liao

Abstract:

The manipulator workspace mapping is an essential problem in robotics and has attracted significant attention in the community. Most of the pre-existing algorithms have expensive time complexity due to the reliance on sophisticated kinematic equations, which also demands specific software platforms. This paper introduces subspace learning (SL), a variant of subspace embedding, where a set of robot and scope parameters is mapped to the corresponding workspace by a deep neural network (DNN). All subspace models share the same hidden layer architecture with only differences in input and output layer. The network will take on different sets of parameters depending on information about the current input distribution $p(x)$, so altruistic optimization methods can be applied to converge to a specific subspace. A classical approach is re-implemented in MATLAB to generate the training/validation/test sets, and the Neural Network Toolbox is used to train deep learning models. With a large dataset of around $6 \cdot 10^4$ samples, the experiments on a variety of subspaces/optimization methods/model architectures demonstrate that the embedding significantly reduces run time and time complexity (from $O(n^{36})$ of traditional discretization method to $O(n^3)$), with high accuracies (average F-measure is 0.9665 with batch gradient descent and resilient backpropagation). Subspace learning explores the possibility of solving robotics problem from an artificial-intelligence perspective, and it has the prospect of being extended to accommodate a broader spectrum of needs in the industry.

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

CS 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

245

Fair Category

PS

Project Number

6018

Title: Quantifying the Consonance of Equal Divisions of the Octave

Student Name(s): A. Pourkavoos

Abstract:

This experiment aimed to find equal divisions of the octave (EDOs) which sound more consonant than 12-EDO, predominantly used in Western music. Generally, n-EDO is the scale created when n notes are equally placed within an octave, making the ratio between frequencies of consecutive notes equal to the n-th root of 2, because pitch and frequency are logarithmically related. The ear perceives an interval as more consonant if the frequency ratio of the notes separated by that interval closely approximates a rational number with a small denominator. In 12-EDO, for example, an A has a frequency of 440 Hz and an E has a frequency of 659 Hz, so the ratio between them is very close to 3:2, and thus the two notes, played together, sound consonant. 12-EDO also approximates the 5:4 and 6:5 ratios, albeit less accurately. This experiment used a Python program to test all n-EDO scales for values of n between 1 and 100 for the accuracy of their approximations of the intervals whose ratios equal the first four odd primes, so chosen because many consonant intervals can be derived from these and the octave. This computation revealed that 22-, 31-, and 41-EDO score higher than 12-EDO and therefore approximate consonant intervals with greater accuracy. These results are comparable to those calculated by other researchers using the Riemann zeta function. Applications could include composing more consonant music than that currently written using 12-EDO.

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

MA 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

201

Fair Category

PS

Project
Number

6019

Title: Object Location Technology for the Visually Impaired Using a Tactile Interface

Student Name(s): K. Roche

Abstract:

Technology is constantly advancing, but it does not always adapt to the needs of the differently abled. I created a device that uses a tactile and auditory interface to help the visually impaired find objects that are lost frequently in their homes. To use my product, my client presses a button that describes the lost object with tactile shapes. That button will set off a unique sound that emanates on a small speaker that is attached to the lost object. To build my device, I followed various tutorials that allowed me to control an IO (Input/Output system) website from a microprocessor feather Huzzah over a wifi signal, which allows the speakers to act on information received from the buttons wirelessly. In the future, I could integrate my prototype into a home technology like Alexa or Google Home. In order to have a better understanding of the problems my product addresses, I spoke to a visually impaired client about his experience with searching for lost items. I discovered that each person with a visual impairment has their own Orientation and Mobility (O&M) system that helps them maneuver the world and locate lost objects. My technology makes this process more efficient.

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

AT EE 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

199

Fair Category

PS

Project Number

6020

Title: The Design of a Self Funding Heating System

Student Name(s): M. Meade

Abstract:

To some, getting paid to heat your own room or house seems like an offer that is too good to be true. With recent applications for hardware and use of software, a self-funding heating system is made. It works by using processors of a computer. Since computer processors make heat when trying to run a huge amount of processes, the heat from that processor can be dispersed with a metal heatsink and blown on with air. This cools the processor with the atmosphere, and is how most computers cool their processors today. By using a program on computers with a range of different price-point processors, the effectiveness of a system that is able to fund itself can be analyzed. The program rents your computer's processing power to solve complex problems, and in return, you receive a fraction of cryptocurrency. This is how the idea functions. This experiment shows the different combinations of hardware that people may use to put this idea to work. This is not only applicable to people who need to heat rooms in the winter, or generate heat, but it is also becoming a new way to make money without any effort after setup.

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

AT 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

190

Fair Category

PS

Project Number

6021

Title: Synthesizing a Flexible, Conductive, and Biodegradable Polymer Matrix, Containing Graphene and Chitin

Student Name(s): W. Mergenthaler

Abstract:

Current conductive polymer matrix technologies are inefficient and remove the distinct characteristic of a flexible polymer. It is proposed that using graphite powder as a highly conductive material, coupled with a soft polymer matrix, will allow the product to remain flexible and will pass an efficient electrical current while a long chain polymer of N-acetylglucosamine, is added to to establish the biodegradability quality. A compost test was conducted over 21 days, and the chitin based polymer had a 1.62% degradation compared to the control polymer which showed a nonmeasurable mass loss. Multivariate tests were done in order to find the best ratio for conductivity, flexibility and biodegradability. After producing multiple products, it was concluded that the ideal ratio consisted of .5 grams graphite powder, mixed into 25 ml of polymer and 1 gram of chitin, which passed 6 volts with a 12 volt input. Without the chitin, the product only passed .0078 volts, showing the chitin had a major impact on offsetting the dielectric insulation of the polymer. In future research, replicas of each matrix will be made in order to test consistency and error, and the products biodegradability.

**Technical Disciplines Selected by the Student
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EE AT 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

252

Fair Category

PS

Project
Number

6022

Title: Engineering an Enzyme-responsive Genetic Delivery Vehicle

Student Name(s): T. Sondhi

Abstract:

We are engineering a enzyme-degradable reverse micelle (RM) nanocapsule with the goal of encapsulating long strands of DNA (>100 bp) and delivering it to cells. RMs are nanoparticles composed of surfactants with a positive nitrogen head and a neutral hydrocarbon tail, and are synthesized through a spontaneous response when exposed to organic solvents such as dichloromethane. The surface of the RM will also be functionalized through the bonding of short thiolated DNA to its surface via thiol-yne click chemistry. This also facilitates the entry of the RM into the cell, through a mechanism to be investigated using a gold nanoparticle immobilized liposome system as a proxy for a lipid bilayer. We can determine the composition of short thiolated DNA to maximize the efficiency of the cellular uptake of RMs. The RM is hypothesized to condense long DNA through electrostatic forces from the net positive charge of the polyarginine crosslinker, similar to how histones condense DNA in chromatin. We will use Zeta Potential measurements to determine the surface charge of the RM, and polymerase chain reaction (PCR) to determine whether the RM has successfully encapsulated DNA. If the encapsulation is successful, we can conduct further tests to determine the mechanism of DNA encapsulation by changing the crosslinking molecule to have different properties, such as a negative or neutral charge. The ability to encapsulate long DNA within these RMs is extremely important, as this will provide a reliable method to deliver long DNA, such as genes, to specific cells within the body.

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

BI 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

211

Fair Category

PS

Project Number

6023

Title: The Development of a Portable, Kinetic Driven, Ozone Based Water Purification System for Application in Disaster Relief

Student Name(s): J. Iquina

Abstract:

According to the World Health Organization, two billion people drink from a water source contaminated with biological contaminants. Modern technology and innovation have attempted to solve this water crisis through water purification products, improving access to clean water for water-scarce communities. However a majority of these products require a filter or material that must be replaced after multiple uses. This project aims to eliminate that issue by developing a portable, kinetic driven, ozone based water purification system that operates using a 12 volt manual generator as opposed to the standard 110 volts required with an electrical outlet. The three main components of the purification system involve an ozone generator, air pump, and the 12 volt manual generator. After construction of the water purification system, a simulated wastewater with a concentration of 126,000 CFUs/ml was prepared using Escherichia coli, (E. coli) and was run in the water purification system for 20 minutes with an ozone production rate of approximately 200 mg/hour. The post treatment cell count exhibited a 99.9% mortality, thus proving the system is highly effective at removing biological contaminants. The widespread application of this novelty water purification system can be utilized in disaster stricken areas, communities without access to clean water, or off the grid operations.

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

EE AT 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

254

Fair Category

PS

Project Number

6025

Title: Electronic Stethoscope System for Monitoring and Analyzing Bowel Sounds in Real-Time

Student Name(s): A. Mohnani

Abstract:

Necrotizing Enterocolitis (NEC) is a horrific disease that affects many premature infants and has a 30% fatality rate. Consequently, the bowel sounds of infants are monitored periodically to assist in the diagnosis of NEC. Unfortunately, the current method of evaluating bowel sounds has limitations. Medical professionals listen to bowel sounds with a stethoscope, which is subjective, inconsistent, intermittent, and time-consuming. I aim to rectify this by creating a self-contained computerized system that analyzes bowel sounds in real-time, allowing for more rapid and informed diagnosis of NEC and many other gastrointestinal diseases. I used a microphone to record sound and an adapter to transmit directly to a computer. Once the sound was transmitted, I used Wavelet Bayesian Denoising to remove static and noise interference. Then, I designed a Lowpass Equiripple Filter, which removed nearly all sound above a certain frequency. Since bowel sounds have an abnormally low frequency, the filtered recording consisted of almost exclusively bowel sounds. I constructed an algorithm that found the number of “gurges” or “clicks” that occurred, compared it to the medically accepted range, and outputted a value between 0-9, where 0 signified no bowel sounds, 1-4 represented hypoactive sounds of varying degrees, 5 represented average, and 6-9 represented hyperactive. All of these processes occur simultaneously with the recording of the sound, which allows analysis to be performed in real-time. Overall, my system has the potential to consistently, objectively, and continuously monitor and diagnose the gastrointestinal activity of patients, from premature infants to adults recovering from surgery.

Technical Disciplines Selected by the Student
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CS EN 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

222

Fair Category

PS

Project Number

6027

Title: Radical Design for a Home in an Earthquake Zone With Embedded Safety Pods and Emergency Resources

Student Name(s): A. Chen

Abstract:

I'm designing a home for people who live on fault lines, and I'm using the threat of an earthquake as my guiding design problem. My design is a dynamic geodesic dome embedded loosely in a substrate. The dome is not joined to the substrate, so it will bob and tilt when the dome is exposed to seismic waves. The substrate will allow the dome to move more than it would otherwise. Its subtle movement will prevent its internal structures from being destroyed and collapsing on its occupants. A pod located in the bottom portion of the dome will allow users to slide to safety using a fireman's pole. The pod contains supplies that will keep its occupants alive if they are trapped. Water, first aid kits, oxygen masks, and food are restored at the bottom layer of the inside dome, where its occupants can access them. I chose to build a geodesic dome because it is made out of equilateral triangles. As Grashof's law describes, the links of the triangular chain are best at withstanding the pressure of external forces. To choose the substrate, I embedded a cross section of the dome in different sizes of gravel particles and sand mixed with different concentrations of water. I used an earthquake simulator to test the structure's movement in different scales of seismic waves.

**Technical Disciplines Selected by the Student
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EN EE AT

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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

217

Fair Category

PS

Project
Number

6029

Title: New Abundant and Sodium-Free Metakaolin Solid Electrolyte Ceramic for Power Grid Na-Ion Batteries

Student Name(s): A. Kosyakov

Abstract:

Many concerns have arisen in recent years regarding lithium-ion batteries (LIBs), mostly due to the rapid depletion of lithium reserves, and the safety issues arising from the volatile liquid electrolytes used to make them. These limit their ability to be incorporated into the energy storage systems (ESSs) of smart power grids that rely on renewable energy. Sodium, however, is 1000 times more abundant than lithium, and can be used in the construction of sodium-ion batteries (NIBs). However, NIBs have less capacity than LIBs, and adhere to the same issues regarding use of liquid electrolytes. In this research, a new metakaolin ceramic NIB solid electrolyte was developed, and derived from the highly abundant clay aluminosilicate kaolinite via a simple one-step calcination process. Full CR2032 cells were built with 1mm thick metakaolin pellets and standard NaNiO₂ cathodes and hard carbon anodes. These cells exhibited a maximum voltage of 1.2V and indicated no loss of capacity after 100 cycles, pointing to metakaolin-based NIBs as an attractive potential alternative to LIBs in ESS applications. The metastability and unique structure of metakaolin was found to form exceptional solid electrolyte interfaces (SEIs) with the electrode materials, while conducting Na⁺ by a newly discovered induced vacancy process that does not require the presence of elemental Na in the actual ceramic.

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

ET 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

235

Fair Category

PS

Project Number

6030

Title: The Analysis of a Biochar Containment Boom as a Mitigation Technique for Relic Pollutants after Marine Dredging

Student Name(s): E. Skuches

Abstract:

Biochar has the potential to act as a mitigator for relic metals due to its ability to sequester elements such as carbon. Using biochar for mitigation can aid in the protection of marine environments from the liberation of relic metals such as iron and copper, and nitrogen that occurs during harbor dredging. Biochar was produced through the process of pyrolysis. The absorbent boom design consisted of 0.558g of biochar contained in 200 micron mesh. An Iron (III) Nitrate solution, Copper (II) Nitrate solution, and an Ammonia solution were made to measure the absorption of the boom on the concentration of the solutions prior to and after the biochar. One boom was placed in each solution respectively, and allowed to sit for 48 hours. After the 48 hour period, the booms were removed and concentration calculations using a colorimetry test was conducted. The concentration of each solution prior to the biochar was: Iron (III) Nitrate solution: 26.24 ppm; Copper (II) Nitrate solution: 5.82 ppm; Ammonia solution: 168.32 ppm. Following the biochar, the concentrations were as follows: Iron (III) Nitrate solution: 25.76 ppm; Copper (II) Nitrate solution: 4.76 ppm; Ammonia solution: 87.68 ppm. The biochar was able to successfully sequester Iron (1.8%), Copper (18.2%), and Ammonia (47.8%) in the solutions. In the future, research will be conducted to strengthen the results supporting this data and to cement biochar as a sufficient mitigator for nitrogen and heavy metals.

**Technical Disciplines Selected by the Student
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EM EN EV

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

268

Fair Category

PS

Project Number

6033

Title: Open-source, In-field Smartphone Detection and Mapping of Waterborne Diseases via Time-Based Spectroscopic Sensing with a New 3D Printable Optical Interface

Student Name(s): N. Liu

Abstract:

Recent studies point to an increase in smartphone usage across the world, even in underdeveloped nations. While many have limited access to clean water, they do possess smartphones. The need to measure and remediate water-borne pathogens is immediate; smartphone technology may offer an opportunity for rapid point-shoot detection of bacteria in drinking water, so location-specific water quality data may be shared for improved remediation. Herein, a smartphone-based spectrometer was developed, for rapid, in-field detection of pathogenic E.coli (O157-H7) in water. Using inexpensive optical parts, basic household materials, and open-source 3D-models, a smartphone accessory and accompanying app were developed to transform a smartphone to a bacteria-in-water detector. In the accessory, the phone's flashlight transmits light through an optical fiber to the front of the phone, where it is filtered to 598nm, passed through two plano-convex lenses, a glass diffuser, and through the measured water sample, where it is measured by the phone's ambient light sensor. As the bacteria grow in the suspect water sample over time, the solution's turbidity increases; the app (developed in Android Studio) correlates absorbance increase, and uses logarithmic regression to determine the presence of bacteria. This approach eliminates false-positives caused by particulate, which will otherwise settle. Bacteria CFU/ml is determined using pre-integrated calibrations. While the bacteria positive/negative detection feature is unique to this smartphone accessory/app, its count prediction was found to be accurate within 5% of lab-based spectrometer measurement, with comparable detection limits. The resulting data can be uploaded for crowd-sourcing detection of infected bodies of water.

**Technical Disciplines Selected by the Student
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EV 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

6034

Title: Measuring Stellar Parallax of 61 Cygni

Student Name(s): J. Bove

Abstract:

In this project, an attempt was made to measure the stellar parallax of the binary system 61 Cygni through image analysis. On August 5, 2017, a first imaging session captured 61 Cygni, then a second captured 61 Cygni six months later on February 6, 2018. By comparing the two image sets, 61 Cygni was seen moving across the sky relative to fixed background stars. To quantitatively determine the value of the shift, an arcsecond/pixel ratio was determined to be .290 by dividing the number of pixels between the approximate centers of each star by a professionally confirmed value of the separation of the stars of the 61 Cygni system. Then the exact pixel displacement of 61 Cygni was determined in components of Right Ascension and Declination before accounting for a professionally confirmed value of 61 Cygni's proper motion via subtraction. The remaining motion is theoretically accounted for only by parallax; this is the project's observed parallax shift. The experimental values for the distances of 61 Cygni A and B were 4.24 lightyears and 4.66 lightyears respectively, each close to a 60% error from the professionally confirmed value of 61 Cygni's 11.4 lightyear distance. Sources of error include atmospheric dispersion, human error in image analysis, questionable assumptions taken out of necessity, and lack of a larger sample size due to the project's timeframe. Despite the relative inaccuracy of the results, it recorded motion in a single attempt and shows the power of amateur astronomy to study humanity's place in the universe.

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

PH MA

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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

195

Fair Category

PS

Project Number

6035

Title: Effects of Hydrophobic Coatings on Simulated Ocean Thermal Energy Conversion Heat Exchange

Student Name(s): K. Maldonado

Abstract:

Closed Cycle Ocean Thermal Energy Conversion (OTEC) utilizes temperature differences between deep sea cold water and warm surface water in order to evaporate and condense a working fluid that drives a turbine. The issues of low efficiency and relatively low power output in OTEC power plants prompted this investigation of hydrophobic coated pipes and its effects on power output and heat exchange. A simulated heat exchanger mesh was programmed and analyzed using OpenFOAM's chtMultirRegionSimpleFoam solver, where air was set as water and porous was set as the working fluid tetrafluoroethane (R-134a). By decreasing the diameter of the mesh in order to simulate a hydrophobic coating, as well as adjusting the slip condition, a power output of 8.585 J was achieved. A lab model of hydrophobic piping was constructed for future experimentation. It is designed in looped fashion, pumping water through hydrophobic and untreated pipes. Pressure gauges and flow meters will be used to determine observe the flow rate of water, which could prompt further simulations in OpenFOAM. A super-hydrophobic coating could be analyzed in future simulations and experiments, with the intention of contributing to the growth of clean energy production by OTEC power plants.

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

ET EN 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

249

Fair Category

PS

Project
Number

6037

Title: The Effect of Ski-Boot Tightness on Ankle Movement and Injury Potential

Student Name(s): H. Molot

Abstract:

The tightness of a ski boot is a key factor in creating pressure between the boot and the ski, which is vital for maximizing acceleration and turn efficiency. However, the rigid make of a ski boot has been a leading cause of ankle injuries in skiers of all levels. The purpose of this experiment is to identify the level of tightness in a ski boot that will be least susceptible to ankle injury while skiing. Data was collected on how varying the boot-tightness impacts forward flexion of the ankle within the boot. The tightness of the boot was varied, and tested under a constant poundage of 30 lbs. This force was produced by a novel apparatus that replicates the natural forward tug created by the body angle and the force of gravity while skiing. It is hypothesized that the tightest boot-level will produce the least amount of movement, with the lower tightness levels allowing large amounts of (perhaps unsafe) movement. Data was collected under these parameters: the bottom two buckles of the boot are kept constant at a medium tightness, while the top two buckles are varied. The results indicate that a steady increase of tightness from toe to ankle is the optimal level of forward flexion. Additionally, the top buckle at its highest setting resulted in the lowest level of ankle flexion. The 3rd buckle, when set to high tightness, was effective at allowing more high ankle movement and sliding, which has a high injury potential.

Technical Disciplines Selected by the Student
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EE AT 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

238

Fair Category

PS

Project
Number

6038

Title: Amount of Chlorine in Water, Compared to the Resulting Chloramine

Student Name(s): M. Kabre

Abstract:

The purpose of this lab was to see how the amount of chlorine in water affects the amount of chloramine is produced. This experiment was made to help swimmers who are getting sick due to the constant exposure to chloramine. In this lab the procedure was to fill 8 Erlenmeyer Flasks with 1 liter of tap water. Then, in groups of 2, put 0 mL, 1 mL, 2 mL, and 3 mL of chlorine in each of the flasks. Next, measure the amount of chloramine that has been produced due to the experiment. The outcome of this experiment showed that for 0 mL of chlorine there was 0 ppm of chloramine, for 1 mL there was 2 ppm, for 2 mL there was 7 ppm, and for 3 mL of chlorine there was 6 ppm of chloramine. This showed how, to an extent, the amount of chloramine has a direct correlation to the amount of chlorine that was put in the water. However the last set of data, that required for 3 mL of chlorine to be put in the water, had a decrease in chloramine, breaking the pattern that appeared in the three sets before. This experiment and study has the potential to help kids who are suffering from the intake of chloramine while swimming. It is a harmful chemical that irritates the eyes and lungs, and reducing it around pools will be beneficial to those swimmers.

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

CH

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

PS

Project Number

6039

Title: Natural Vs. Synthetic Drinks Compared By Electrolyte Concentration

Student Name(s): O. George

Abstract:

Athletes need preparation for high-intensity sports by building a supply of electrolytes to carry them through the physical demands of exertion. This project compares orange juice, a natural product, against various types of formulated sports drinks on the market with one goal in mind: which one has the most electrolytes and provides the best hydration? A conductance sensor was used to determine the concentration of electrolytes in various sports beverages. Amperage was used as an indicator of the elements present in each drink and compared to each other. The hypothesis was that if the sports drink with the highest advertised concentration (Body Armor) of sodium (Na⁺) and potassium (K⁺) will produce the greatest amperage tested compared to orange juice. The results supported my hypothesis. Sports drinks with the highest advertised concentration, Armor, of electrolytes produced the greatest amount of conductivity. However, the third best drink sodium and potassium levels were not as high as a few of the other drinks tested, showing that the concentration of sodium and potassium aren't all that matters when it comes to electrolyte content. In my experiment, I also discovered drinks that were advertised with high electrolyte content that tested poorly compared to expectations and in comparison with their counterparts. Since most athletes will not test the electrolyte content using a multimeter, it is important to read the drink label to ensure it is satisfactory for hydration. This information can be used to formulate the ratio and concentrations of different electrolytes in developing optimal replacement.

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

CH 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

PS

Project Number

6040

Title: Relationship between different designs of water turbines and the level of hydroelectric power produced

Student Name(s): M. Lee

Abstract:

Most energy today are produced by the burning of nonrenewable resources, such as coal and oil. Unfortunately, these fuels release pollutants into the atmosphere and contribute to climate change. One of the solutions to this global crisis is hydroelectric power which is a safe, renewable source of power that generates electricity with minimum impact to the environment.

Many different designs of water turbine are used in producing wave and tidal energy. The purpose of this experiment was to perform a water turbine simulation with variation on the axis, turbine blade number, and blade tilt angle to produce the maximum electrical power. Two types of water turbines, Horizontal and Vertical Axis, were tested with 4, 6, and 8 blades. For each different blade number turbine, blades were designed with 40, 50, and 60 tilt angles. Maximum voltage and current were measured per turbine, and power was calculated in mW.

Between the two different axis turbines, the Horizontal Axis Water Turbine produced more power than the Vertical Axis Water Turbine significantly in all blade variations. Power produced by the Vertical Axis Water Turbine had a direct relationship to the number of blades and the blade tilt angles; As the number of blades and the blade tilt angles increased, power generated increased. The best turbine design was 8 blades, 40o blade tilt angle Horizontal Axis turbine which produced an average power of 231 mW.

This information can be used to design the most efficient water turbine which can generate the maximum hydroelectricity.

Technical Disciplines Selected by the Student
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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

191

Fair Category

PS

Project Number

6041

Title: Ocular Alkali Burn Preventative: Innovative Eye Wash Station

Student Name(s): D. Lebron

Abstract:

More than 25,000 chemical products such as oxidizers, petrochemicals, corrosives, and even common household cleaning supplies have the potential to cause serious damage to the cornea, which means dependable eye washers should be present and ultimately work. More than half of the injuries presented by children with ocular alkali burns have not been able to clean the chemical out from their eyes in time. This project tests the dependability and durability of the innovations made.

The hypothesis that was being tested compared an eye wash station with the ability to adjust with height and distance to the standard stations. If the hypothesis were to be proven true, the innovated eye wash would allow efficiency rates to go up. A piece of cardboard was placed in a fixed position above the eye washers to represent the “eyes” in need of clearing.

The standard station proved to have a 40% accuracy rate, reaching the “eyes” a measured 2 of 5 times. The innovated and adjustable station proved to have a 80% accuracy rate, reaching the “eyes” a measured 4 of 5 times, proving the adjustable feature allowed for an overall higher efficiency rate.

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

EN ME 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

245

Fair Category

PS

Project Number

6042

Title: Comparison of 14-Day Survival and Development of *Lymantria dispar asiatica* and *Lymantria dispar dispar* on Out-of-Season Foliage

Student Name(s): J. Liu

Abstract:

European and Asian gypsy moths are non-native to North America consuming over 300 host species. Larvae hatch in the spring. During the larval stage, gypsy moths can completely defoliate trees, causing vulnerability to disease and pest infestations. Tree species' susceptibility to gypsy moth defoliation splits into three categories: preferred, less preferred, and avoided. The goal of this project was to determine whether gypsy moths can grow and survive on out-of-season (summer) foliage. To accomplish this gypsy moths from two populations (one European and one Asian) were grown for 14-days on two out-of-season foliage types. One host was preferred-*Quercus velutina* and one less preferred-*Pinus strobus*. Weight gain, survival rate, and current instar were recorded. It's hypothesized that Asian gypsy moths would survive and develop better than European ones, because of their broader host range. Also, both strains would survive better on *Quercus velutina*, the preferred host. SAS, PROC UNIVARIATE was used to access distributional fits for data. Strain, host, and their interactions were examined for effects on survival rate and weight gain over 14-days. For survival rate PROC GLIMMIX was fitted using a beta distribution with logit link function. For weight gain PROC GLIMMIX was fitted using a gamma distribution with a log link function. Only host significantly affected survival rate and weight gain. This research demonstrates there is a risk of gypsy moth establishment during the summer and can provide critical information to improve eradication efforts.

**Technical Disciplines Selected by the Student
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EV EA 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

220

Fair Category

PS

Project Number

6043

Title: The Effect Cellulase and Pectinase Have on the Extraction Methods Used to Isolate the Oil Algae Produces Which Can Be Converted into Biodiesel More Efficiently

Student Name(s): J. McConnell

Abstract:

The purpose of this experiment, is to determine the best method that produces the most extracted oil from algae to be used as biodiesel. The methods that were examined are: hexane method, ultrasonic method, and supercritical fluid extraction. In the supercritical fluid extraction method, ethanol as used instead of the liquid CO₂. Each of these three methods were performed in triplicate using the enzymes; cellulase, pectinase, and finally with cellulase and pectinase. The goal here was to find an efficient way to extract oil from algae that could replace expression because expression uses very expensive equipment that not every lab can do. If I found a method that can be more efficient than expression, it can help small scale oil extraction because more people would be able to afford it. I performed each test three times after the control, except for the hexane test because the algae was becoming more limited and there wasn't enough to do the rest of the tests, so due to no oil being extracted from the algae into the hexane, I stopped using the algae on the hexane tests. The ethanol test with both enzymes seemed to be the one that extracted the most oil. TLC tests showed that the ultrasonic tests didn't have any oil and that was most likely because of human error.

**Technical Disciplines Selected by the Student
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EN BI 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

245

Fair Category

PS

Project Number

6044

Title: Assessment of Cation Competition on the Effectiveness of Paramagnetic Lanthanides as Shift Agents for Sodium-23 Magnetic Resonance Spectroscopy

Student Name(s): K. Tenerowicz

Abstract:

One of the characteristics of a healthy, viable cell is the ability for it to maintain a small intracellular sodium concentration ($[Na]_i$) and a large extracellular sodium concentration ($[Na]_e$). This forms a strong sodium gradient ($[Na]_e - [Na]_i$). Often in diseases, this gradient is not maintained as well, and detecting this can be beneficial to catching a disease early. However, calcium may also interfere with the sodium gradient. Thus, through in-vitro experiments, the competition of calcium versus sodium to form bonds with the paramagnetic shift agent TmDOTP⁵⁻ was determined. This study used Nuclear Magnetic Resonance (NMR) Spectroscopy as a non-invasive method of discriminating between intracellular and extracellular sodium compartments. The independent variable was the cations, and the dependent variable was how the cations competed. The controls were the samples without calcium. It was hypothesized that calcium would be more competitive due to its higher electronegativity. Samples were created to simulate conditions inside the body. The procedure of making the samples and gathering data was kept the same apart from the necessary differences in the variables. Measurements of the samples showed sodium at its resonance frequencies, and the peaks on the graphs created represented any significant resonance frequencies of sodium ions. These peaks were analyzed and from this data, the more competitive ion was found to be calcium. These results are useful in predicting the effects of calcium in the body and in diagnosing diseases early through a non-invasive method.

**Technical Disciplines Selected by the Student
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BI 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

123

Fair Category

PS

Project Number

6045

Title: Perovskite v. Silicon Solar Cells: a Comparison of Overall Efficiency

Student Name(s): E. Meindl

Abstract:

The purpose of this experiment was to compare and test the efficiency of perovskite solar cells to traditional silicon solar cells. It was hypothesized that perovskite solar cells would be more efficient than the traditional silicon panels because the average efficiency of the perovskite panels have surpassed those of silicon in the recent years as shown by research at Caltech. The first part of this investigation included the construction of the perovskite cells. Three solutions were made: a titania solution, Perovskite solution, and a CuSCN solution each layered between FTO glass which is conductive. The silicon solar cells and the perovskite cells were tested using a light source and a multimeter in a closed environment. Results were collected and analyzed for statistical relevance.

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

EE AT ET

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

207

Fair Category

PS

Project Number

6046

Title: Using the Comparison of Announcement Day Stock Market Data and Trading Signals to Create a Predictive Machine Learning Based Trading Model

Student Name(s): A. Park

Abstract:

Currently, there are countless ways to predict the fluctuations in the stock market. Not only are there a variety of ways, but there are also many types of variables that can be used as input to create the predictive model. This project specifically uses announcement day earnings, a data type that has not been used before and provides crucial information concerning different stocks. Every company is required to announce their earnings somewhat annually, and during those times, knowing how the stock will fluctuate can provide critical information. This project utilizes both proprietary trading signals and announcement day earning returns to create a machine learning based predictive model. In addition, this research strives to find the best predictive algorithm or model with this particular data set by experimenting with several different statistically predictive models. These types of algorithms include multivariate linear regression, neural networks, and finally Random Forest, which ultimately created the best model prediction of stock performance over time. When compared to a hypothetical hedge fund algorithm, although more volatile, as can be seen by its ir value of .108, it does produce results that hypothetically could beat the hedge fund model solely relative to the amount of gross one could expect off of their original investment.

**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

252

Fair Category

PS

Project
Number

6047

Title: The Impacts of pH on Ethene Degradation and Growth of Ethenotrophs

Student Name(s): J. Feuerstein

Abstract:

Chlorinated solvents are carcinogenic chemicals used as industrial degreasers and dry cleaning fluids respectively that often spill into groundwater. Reductive dechlorination (RD) can be employed to break down these chemicals. However, a compound known as Vinyl Chloride (VC) forms during RD. VC, a dangerous carcinogen, is highly soluble, and cannot be quickly metabolized. Ethenotrophs in the soil can degrade VC to safe compounds through monitored natural attenuation (MNA). To determine applicability of MNA, specific bacterial processes must be known. One important factor that has never been studied on ethenotrophs is pH. pH is important, as groundwater pH ranges from 3-10, and initial RD can impact groundwater acidity. Therefore, the goal of this experiment was to determine how well ethenotrophs consume substrate at different pHs, in order to learn about the applicability of MNA. It was hypothesized that pH has an impact on growth, which would be maximized at pH7. Media was created in bottles with pHs set via titration. Isolated ethenotrophic cultures and ethene were introduced to each bottle. Data was collected as growth and substrate depletion over time, measured with an OD-600 and gas chromatograph (GC) respectively. q_{max} values, which demonstrate maximum substrate depletion rate, were then determined using the monod equation. It was found that bacteria depleted substrate fastest and similarly at pHs 6-7.5, with slower rates at pH8 and nonexistent rates below a pH5. This data matched patterns seen with the OD-600 and GC. These results demonstrate important implications towards the applicability of MNA in various environments.

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

EV MI CB

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

203

Fair Category

PS

Project
Number

6048

Title: Quantitative Analysis of the Susceptibility of Bacillus Subtilis, Chemical and Physical Protectants and the Denaturing of the Protectants from Harmful UVB Wavelengths of 320-290nm

Student Name(s): B. Redo

Abstract:

The purpose of my experiment was to test SPF levels 30, 50, and 70 and chemical barriers Coppertone Sport, Banana Boat, and Neutrogena versus a physical barrier, Aveeno, for the effectiveness of filtering out cancer causing UVB with wavelengths of 290-320nm. Coppertone Sport with a reading of 0.13 and SPF 70 were tested to be the most effective. I also tested the effect of heat on the denaturing of the chemicals in the sunscreen. The sunscreen was placed in water that was 40 degrees Celsius for ten minutes. After the sunscreens were exposed to the heat, they were tested again with the UV rays 290-320nm. After one heat exposure Coppertone Sport SPF 30 went from an average UV index reading of 0.4 to 0.5 which was significant enough to show a change. An additional test to determine the effectiveness of each brand was using a UV sensitive bacteria, Bacillus subtilis. The control was a petri-dish with no sunscreen protection. Unfortunately, the control dish had bacteria growth. The results show that it is UV resistant. There are different conclusions that can be drawn. There could have been a mutation or a lack of duration of time the bacteria was under the ultraviolet light.

**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

255

Fair Category

PS

Project Number

6049

Title: Lowering SLS Costs with Preexisting Solid Rocket Boosters

Student Name(s): R. Lemone

Abstract:

The purpose of this experiment was to determine if NASA's Space Launch System (SLS) costs could be lowered with the use of a combination of one shuttle solid rocket booster (srb) with one new SLS one or two shuttle srb's in comparison to using two new SLS boosters. This is a concern as research and development and building costs for rockets surpass billions of dollars, any cost reduction while still being able to accomplish missions would be beneficial. The space shuttle srb's were used due to their success in the space shuttle missions, and their high thrust-to-weight ratio and having an almost perfectly synchronous burn time with the SLS srb's. To test the experiment, information on the mass, dimensions, thrust, burn times, and specific impulse of the SLS, SLS boosters, and space shuttle boosters were researched to complete the calculations of the experiment. These included: finding the thrust-to-weight ratio of the different booster combination first stages to see if the SLS could launch, calculating the potential change in velocity of the stages to ensure they could make it to lunar orbit (one proposed future destination for NASA), and ensuring that the gimbal of the engines could counteract the the torque created by an offset center of thrust to mass with the SLS/shuttle combination. Early testing has shown while possible for a combination of shuttle boosters to be used, the save of money would not outweigh the lower payload sizes and potential safety hazards, making the SLS boosters a better choice.

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

PH MA

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

234

Fair Category

PS

Project Number

6050

Title: Comparing Dissolved Oxygen (%) between Mamaroneck Bay and Darien Harbor

Student Name(s): K. Arevalo

Abstract:

The Long Island Sound (LIS) is an estuary, meaning it contains a mix of saltwater and freshwater, located between Connecticut and New York. LIS is home to over 1,200 invertebrate species, 170 fish species, and dozens of bird species. These numbers have slowly decreased as a result of human development along the coastline, which has increased pollution. The water quality of LIS needs to be monitored in order to protect it from further damage. A research project which measured water parameters in LIS was conducted by Save the Sound in order to better understand the water quality. This research was conducted in over 120 different embayment areas located in LIS and at each embayment, seven different water parameters were measured and recorded. At each location, temperature (degrees celsius), salinity (ppt), dissolved oxygen (%) and (mg/L), fluorescence (RFU), chlorophyll a (ug/L), and turbidity (NTU) were measured. The parameters between the two embayments, Darien Harbor and Mamaroneck Bay, will differ because of their location in LIS and lack of water circulation at embayments located in the narrows, the westernmost section of LIS. Dissolved oxygen (D.O) was measured in this research to better understand the aquatic life in LIS. The dissolved oxygen levels tended to be lower in Mamaroneck Bay and higher in Darien Harbor. However, t-tests were conducted in order to analyze the data and to prove if this observation is in fact true.

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

273

Fair Category

PS

Project Number

6051

Title: Magnetically Induced, Visual Detection of Trace Arsenic Contaminants in Water Using Fe₃O₄ Photonic Crystal Structures

Student Name(s): R. Jain

Abstract:

Arsenic, a highly toxic metal contaminant commonly found in our drinking water, is responsible for many accidental deaths. Currently, the only visual arsenic-in-water detection system is tedious, and can detect arsenic concentrations of 250ppb or more, well above the EPA 10ppb water-action-level. To combat arsenic drinking water contamination, a sensitive, inexpensive, portable, and easily-visualized detection system is needed, and has been developed in this research. To begin, superparamagnetic, SiO₂-coated, polyacrylic acid-capped Fe₃O₄ colloidal nanocrystals (CNC's) were synthesized, and their photonic and physical properties characterized via SEM and UV-Visible spectroscopy. Application of 80-140G magnetic field from a portable, 3" magnet altered the refractive indices of the photonic structures, so that long-to-short wavelength, red-to-blue color change is easily visualized from the native brown CNC solution color. Addition of 1ml of 10ppb Arsenic, however, to 2ml of 8mg/ml CNCs causes alteration of the photonic characteristics, so that long-wavelength shift occurs with applied magnetic field (native brown to orange). This new color changing behavior is specific to arsenic contaminant, and attributed to As-O interactions at the surface of the SiO₂-coated CNCs. Other typical metal contaminants did not share this same metal-oxide CNC-coating affinity. For the consumer friendly, rapid Arsenic-in-water assay, a color code was developed to detect/indicate as little as 10ppb As-contaminant, with color change at 10ppb increments. In the field, drops of suspect water are added to the CNC solution at 1:2 (v/v) in a small vial; Arsenic contamination is determined in seconds via color change through the application of a small magnet.

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

EM 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

249

Fair Category

PS

Project
Number

6053

Title: Sterilization of Bacteria-Infected Water Through the Electricity Generated by the Rotary Motion of a Hippo Roller

Student Name(s): C. Calzone

Abstract:

The Hippo Roller is a water barrel attached to a handle that rolls on the ground to help people in the developing world transport heavy quantities of water. As much as 80% of illnesses in developing countries are related to contaminated drinking water. The number of people without access to clean water rises a rate of about 2.3 percent every year. My project aims to prevent waterborne diseases through sterilization. I have created an add-on for the Hippo Roller that will harvest the kinetic energy generated by its rolling to power an ultraviolet light. This light takes 45-90 seconds to sterilize one liter of water. I will section off a part of the Hippo Roller where the water will be sterilized. The energy harvester uses a makeshift dynamo with a DC generator and a wheel that is placed on a point tangent to a spot on the circumference of the Hippo Roller. When the wheel spins, the rotor of the generator spins and the rotary motion of the hippo roller is transformed into mechanical energy. The generator is connected through wires to a voltage regulator, which supplies power to the ultraviolet light. I am using a Steripen(a UV light) to rid the water of bacteria and protists. The generator generates a max of 11 Volts at any speed above a walking speed, where the Steripen can charge with a charge of at least 5 Volts so the Steripen sterilizes the water as the hippo roller is pushed.

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

ET EE

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

199

Fair Category

PS

Project Number

6054

Title: Carbon Emission-Free Power Generation Using Wave Energy and a Robust Generator

Student Name(s): R. Muriel

Abstract:

In this project, I built a carbon-free power generator which uses wave energy. My design goal was to build a raft which would produce power with very little environmental impact. My design consisted of two vertical parallel poles holding copper coils with a swinging magnet in between them. This system was secured to a raft. After the raft and power generator system was assembled, I tested whether my generator actually worked. The amount of voltage produced was recorded for a period of 5 seconds while the waves were produced at a frequency of 1 wave per second, 2 waves per second, or 3 waves per second. Then, the voltage recorded was averaged. By testing the amount of voltage produced based on the frequency, I was able to determine that my generator showed a greater amount of voltage as the frequency increased. When waves were produced at one wave per second, an average of 0.99 millivolts were produced. When waves were produced at two waves per second, an average of 3.33 millivolts were produced. When waves were produced at three waves per second, an average of 4.15 millivolts were produced. This data proved that my generator was working successfully.

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

ET EE

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

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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

213

Fair Category

PS

Project Number

6055

Title: Inhibiting the Formation of Methane Hydrates using Zeolite Minerals and Hydrophilic Polymers in Natural Gas Pipelines

Student Name(s): D. Jagoe

Abstract:

Methane hydrates pose a direct threat to the integrity of natural gas pipelines. Methane hydrates are formed within the high pressure and low temperature environments of the pipelines when water is present. Accumulation of hydrates within these pipelines can cause damage, and may lead to methane leaks into the environment. Removing the presence of water will generate a pure methane stream, eliminating the risk of hydrate formation. It is proposed that zeolites and hydrophilic polymers will reduce the risk of hydrate formation, through the absorption and thus removal of water from the methane stream. To establish the efficacy of this proposal, zeolites and hydrophilic polymer cartridges were constructed and tested with an inline gasification system. The gas flow in the gasification system passed through at a rate of 1.01 CFM, containing a concentration of water at .92 ppm. The gaseous flow would then travel through the cartridges of zeolites and polymers, absorbing the water, and producing a pure methane stream. The zeolites and hydrophilic polymers absorbed 42.57% and 4.88% of the water contained within the gas flow, respectively. This indicates that the zeolites and hydrophilic polymer based in-line filters have the capability to remove water from the gas flow, and produce a pure methane stream, thus reducing the risk of hydrate formation.

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

ET CH 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

224

Fair Category

PS

Project Number

6056

Title: Stopping an allergic reaction before it starts: A small mass spectrometer to detect peanuts within foods for those with a peanut allergy.

Student Name(s): Z. Service

Abstract:

All over the world, people struggle with allergies within foods that they do not know are there. The project plan attempted to create a device that is able to detect peanut allergens within food without having to come into contact with the potentially dangerous allergens. Before making the spectrometer, research needed to be done on the what would be the best way to heat the food to vaporize any samples to send it through the spectrometer. It was determined that a mass spectrometer - which was going to be used - is not feasible to detect peanut allergens within food based on limitations of size. The constraint is due to the fact that the proteins for peanut allergens, specifically those of the Ara h1, Ara h2, and Ara h3 type, begin to denature at 190.9°F (or 88.3°C). This is imperative to the effectiveness of the device because by vaporizing a food to be able to test it, it destroys the allergen that was being searched for in the first place. The next stage of the project design is to locate university mentors to help design and prototype a device that can be utilized to test for this. Additionally, research will be done for other options to detect allergens within food samples. These detection methods include but are not limited to immunoassays, ELISA tests, dipstick tests, etc.

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

EN

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

230

Fair Category

PS

Project Number

6057

Title: The Effectiveness of Ceramic Membranes with a Manganese Oxide Coating in Filtering Dyes from Industrial Waste Water

Student Name(s): E. Marin

Abstract:

Polymeric membranes are the most common means of textile wastewater filtration. Polymeric membranes experience membrane fouling where their performance is reduced. Ozone, commonly used to decrease membrane fouling, degrades the polymeric membranes. Ceramic membranes are resistant to ozone, and when ceramic membranes are coated with catalytic materials, their performance is enhanced. The purpose of this study was to find the optimal conditions for a MnO₂ coated ceramic membrane. Different calcination, or baking, temperatures of 250 and 550 were used to apply the coating. It was hypothesized that the highest calcination temperature would produce a membrane with the most effective filtration qualities. Membranes were coated, calcined, and tested in a filtration system. Permeate and flux were recorded to determine membrane effectiveness. Powder X-Ray Diffraction (PXRD), Transmission Electron Microscopy (TEM), and Scanning Electron Microscopy (SEM) were used to determine the mesoporosity, crystal structure, and morphology of the coatings. All images were analyzed. Results determined that calcination temperature had little effect on porosity. Results confirmed coated ceramic membranes filtration abilities, confirmed that element phase change is significant in expanding the diversity and gradual increase of pore sizes, and that gradual increase of pore sizes produce higher filtration effectiveness. Additionally, increased hydrophilicity has led to increased effectiveness. The implications of this project could help further advances in the water filtration industry and lead to a more effective and efficient mode of purifying water.

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

EN CH 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

257

Fair Category

PS

Project Number

6058

Title: Remediation of Heavy Metal and Fertilizer-Runoff Contaminants using High Throughput, Silk Nanofiber Biomimetic Multilayer Membranes

Student Name(s): N. Woo

Abstract:

As the world's population continues to grow, so does the usage of certain pollutants, like fertilizers, metals, waste, etc. As such, the world's water sources have become increasingly polluted, resulting in less clean water for an otherwise growing population. This is especially true for developing countries, where ~70% of industrial waste is dumped into untreated waters. In the U.S., 22 million tons of fertilizer is used, creating a huge problem with fertilizer runoff. Increased heavy metal and fertilizer content in water has triggered the need for a simple, inexpensive, rapid, and efficient water purification method, particularly one that can be applied in remote regions. In this research, such a device was created, fabricated from biomineralization of silk nanofibers into HAP (hydroxyapatite) nanocrystals, which were easily assembled into a multilayer membrane within a low-cost filter cartridge. To measure heavy metal remediation, 500ml of 1000ppb arsenic and lead solutions were separately filtered through the completed assembly. Two passes were required to reduce the Pb-content to 8.8ppb, well below the EPA water-action-level for potable water. Likewise, for arsenic, three passes were required to reduce the As-content to 12.86ppb, for safe drinking. For nitrate contaminant reduction, 500ml of 100ppm-NO₃⁻ was reduced to a potable 2.9 ppm concentration with 3 filtration cycles. With four passes through the filter, the HAP-multilayer membrane removed 96-99.7% of lead, arsenic, and nitrate contaminants, while producing potable water that is free of filter constituents. The HAP-filter is easily constructed for <\$5, and is consumer-ready for simple, immediate use.

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

EN EM AT

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

226

Fair Category

PS

Project Number

6059

Title: Enhancing Latent Prints Visualized through Iodine Fuming with Magnetic Powders

Student Name(s): S. Gloria

Abstract:

Fingerprints are a valuable type of physical evidence in identification. To date, no two people have been found to have the same fingerprints, including identical twins.(NFSTC 2013) Forensic scientists often need to develop latent fingerprints on ransom notes, checks, counterfeit bills or other porous surfaces. Although, visualization of latent prints on non-porous surfaces such as glass and metal works well with fingerprint powders, surfaces such as paper and wood prove more difficult. The purpose of this experiment was to test a new technique for enhancing latent prints visualized through iodine fuming on porous surfaces. Iodine fuming is a technique used to visualize invisible fingerprints left behind on porous surfaces such as paper. In this experiment, magnetic powders were used as a second development step in the visualizing process. The use of magnetic powders after an initial iodine development led to a much clearer defined print and in addition created a permanent fixing of the developed print. Iodine developed prints will fade within hours without a fixing process. After the latent prints were developed, a rating scale was used to quantify the print quality. The technique was shown to work well on bond paper and cardboard and to a lesser extent on unfinished wood. There does not appear to be record of these two techniques used together to develop latent prints in the scientific community.

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

CH 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

254

Fair Category

PS

Project Number

6060

Title: Health Monitoring System

Student Name(s): A. Jindal

Abstract:

I propose that continuous physiological parameter monitoring is essential for ill patients and elderly who don't have facilities to receive 24-hour surveillance by a nurse/doctor. When the patient isn't in the hospital, there's a strong need for a web-based patient health monitoring system. This system will allow doctors to monitor the physiological parameters online and take any safety precautions or actions during an emergency. I've used various sensors known as the pulse sensor, humidity sensor, and temperature sensor. They are measured and sent to the Arduino microcontroller for further processing. I have used an LCD display, 2 LEDs, resistors, connectors, Arduino Uno, breadboard, switch, and battery. For the purpose of this project, the results are displayed on the display board and updated every few seconds. When the result of any sensor exceeds a certain number, the LED turns red, and when pulse is detected green LED turns on. However, in the future, I hope to continue this project and have the results be texted to a doctor when it crosses a particular doctor determined threshold. I may add a few sensors and I'll try to find a lab/institution from which to continue testing. I was only allowed to take multiple readings upon myself under varying conditions that might simulate those of a patient. The device, programs, and sensors all work as you will see from the photos and data on the display board and project notebook; further I will bring all equipment to demonstrate, should I be selected for interviewing.

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

AT 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

254

Fair Category

PS

Project
Number

6061

Title: Synthesis and Separation Of a Chiral Compound In Preparation Of a Positron Emission Tomography (PET) Radiotracer

Student Name(s): M. Geradi

Abstract:

Positron emission tomography (PET) is a promising technology that utilizes radiotracers for producing detailed, 3D images of the body. The radiotracer studied in this project targets the SV2A receptor in the brain, which is a marker of synaptic density and hence can be used to study Alzheimer's disease and epilepsy.

This project aims to synthesize an enantiopure compound in preparation of a chiral PET radiotracer. The racemic compound was synthesized at -20C and purified using a silica gel column. Reaction progress was monitored by TLC and structure was confirmed utilizing NMR. Conditions required for separation using the HPLC system were optimized by testing varying combinations of organic solvents (0–100%), in conjunction with different chiral columns and flow rates (0.1 –2mL/min). Three chiral catalysts were tested under varying reaction conditions for synthesizing an enantiopure compound. The racemic compound was successfully synthesized and separated using the HPLC system. Full separation was achieved by using ethanol and hexane in a 25%/75% combination, 0.1% TEA, 1.0mL/min flow rate and the CHIRALCEL OJ-H column.

The quinidine catalyst successfully yielded a 90/10 enantiomeric ratio. The other 2 catalysts still produced a racemic compound. Currently, the quinidine catalyst is being tested under new conditions to further improve the enantiomeric ratio.

Optimizing synthesis of the enantiopure compound using chiral catalysts could increase yield of the PET radiotracer and lower the cost and reaction time of the synthesis. This increases the viability of this PET radiotracer for diagnostics and research of Alzheimer's disease, epilepsy and other neurodegenerative diseases.

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

CH 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

217

Fair Category

PS

Project
Number

6062

Title: Pumping Iron

Student Name(s): S. Hatfield

Abstract:

The purpose of this research was to determine if hardened steel that has been thermal cycled will be the strongest and least fragile. Bladesmithing and blacksmithing are both lost arts, however they are making a come back in today's world and include the added benefits of more modern inventions such as as the power hammer and gas forge. A debated topic among bladesmiths is whether or not to thermal cycle (the process of heating and cooling) a blade before the quench, and if so, how many times would be ideal. That is what this experiment sought to answer through the use of a charcoal forge and 9 pieces of steel, which were divided into 3 groups. The first group did not get thermal cycled, the second group was thermal cycled 3 times and the 3rd group was thermal cycled 5 times. Each of these groups were then exposed to forces of weight until they broke or bent severely. The hypothesis was supported, as the steel that was thermal cycled the longest was the strongest and hardest to break or bend. The steel that was not thermal cycled broke the easiest or bent the most. It took a force of over 8000 grams (16 pounds) to break the final piece, and 760 grams to break many other pieces.

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

EN CH

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

226

Fair Category

PS

Project
Number

6063

Title: Effect of Modifying the Structure of a Known Conformationally Rigid Cyclic Tungsten Bis-Alkyne Complex on Behavior and Flexibility

Student Name(s): R. Lee

Abstract:

The study of transition organometallic chemistry dates back to the early 19th century, when Zeise discovered the first transition organometallic compound in 1827. Later, in the 1960s, scientists began to experiment with transition organometallic compounds involving alkyne bonds. Since then, ongoing research has shown that the alkyne ligands around the metal center could rotate between two different orientations, called syn, where the ligands face the same direction, and anti, where they face in opposite directions. Dr. Curran and his group explored whether any of these molecules could be held to either the syn or anti orientation. In 2017, they did discover such a molecule. Consisting of two alkynes, appended to the cyclopentadienyl rings of a ferrocene unit on one end and tungsten metal on the other, the cyclic molecule was held to only the syn orientation. In this project, we seek to rearrange the atoms linking the ferrocene to the alkynes in the cyclic tungsten bis-alkyne complex created by Dr. Curran et al in order to discover whether this change will keep the molecule in the syn orientation. We are currently in the process of creating the target molecule, which has never been made before. Mass spectroscopy and NMR spectrometry will be used to confirm the molecular identity of the final product. In the poster, details about how to prepare the molecule will be given.

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

245

Fair Category

PS

Project Number

6064

Title: Determining How Concentration and Solution Type Govern Multi-Walled Carbon Nanotube (MWCNT) Aggregation Behavior

Student Name(s): R. Du

Abstract:

Over the past few decades, Multi-Walled Carbon Nanotubes (MWCNTs) have been increasingly used for water treatment applications. However, the concerns with MWCNTs are their safety and effectiveness, which aggregation, behavior of substances grouping together, could control. The purpose was to determine what factors govern MWCNT aggregation behavior, so material scientists can better design materials released into the environment. The research question was: How do changes to MWCNT particle charge impact aggregation in different solution types and concentrations? It was hypothesized that MWCNTs would aggregate less in monovalent solutions and lower salt concentrations. To understand these relationships, particle charges of MWCNTs, solution types, and solution salt concentrations were varied. These variables were chosen based on relevance to the environment. The MWCNT aggregation was measured using Time-Resolved Dynamic Light Scattering (TR-DLS). 3 groups of MWCNTs were used and 2 were acid treated and annealed at temperatures of 400 and 600 degrees Celsius. One set of MWCNTs was not annealed at any temperature. The solution types tested in each group were NaCl and CaCl₂. The salt solutions were tested in 3 different concentrations each. NaCl concentrations were 50, 100, and 200 mM. CaCl₂ concentrations were 0.5, 1, and 2 mM. Results supported the hypothesis that increased salt concentration and MWCNTs with a less negative surface charge, or annealed at higher temperatures, aggregated faster. Researchers can redesign MWCNTs in the future to be as (un) stable as needed to a controlled level of safety and functionality.

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

EN 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

250

Fair Category

PS

Project Number

6065

Title: The Effect of MN250 on the Removal of Sulfonamide Antibiotics in Wastewater

Student Name(s): J. Zhang

Abstract:

Sulfonamides are antibiotics with multiple uses. Their excess use leads to them being in runoff into bodies of water, which has caused concern to arise concerning human and ecological health, antibiotic resistant bacteria, and the introduction of antibiotics into the food chain. Hypercrosslinked resins exhibit high adsorption capacity for polar and nonpolar compounds, easy regeneration, and low cost. MN250 specifically was determined in a previous experiment to be the most effective commercially available hypercrosslinked adsorbent for removing sulfamethazine in distilled water. Another previous experiment determined the effectiveness of MN250 in removing sulfamethazine in simulated groundwater, differing pH, and different ion concentrated solutions. This experiment was to determine the effect of different structures of antibiotics of the same family on the adsorbance capacity of MN250. The adsorbance effectiveness of MN250 was determined among different antibiotics in different pH and ion concentrations, and simulated groundwater. For sulfamethazine, the adsorbance capacity of MN250 decreased as pH increased, and increased as KCl concentration increased and in changing simulated groundwater solutions. For sulfanilamide, the adsorbance capacity changed with increasing pHs and concentrations of KCl, and increased in changing simulated groundwater solutions. For sulfaguanidine, the adsorbance capacity increased with increasing pHs and in changing simulated groundwater solution, and changed as KCl concentration increased. For sodium benzenesulfonate, the adsorbance capacity decreased as pH increased, increased as KCl concentration increased, and changed in changing simulated groundwater solutions. All antibiotic adsorbance capacities significantly differed from each other in their respective environmental conditions and for all the different environmental conditions.

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

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

251

Fair Category

PS

Project Number

6066

Title: Undulated Leading-Edge Airfoils in Low to Medium Reynolds Number Regime

Student Name(s): K. Vedula

Abstract:

Biologically inspired airfoil designs have become of increasing interest to the aerospace industry in recent years for their aerodynamic versatility and efficiency. One approach involves mimicking the undulating leading-edge of humpback whale fins. Such airfoils have been shown to improve stall characteristics in specific airflow regimes. This research project sought to explore the validity of these biomimetic airfoils in the transitional Reynolds number regime ($Re=120,000-500,000$).

The study features two NACA 2415 airfoils: a traditional design, and an experimental design with a sinusoidal leading-edge that mimics the tubercle protuberances on the leading-edge of humpback whale fins. Wind tunnel testing was conducted in the transitional regime with 3D printed prototypes, and the coefficients of lift and drag were calculated for both airfoils at varying angles of attack. A numerical study using Computational Fluid Dynamics was also executed under the same conditions to provide flow visualization and a secondary set of data.

Experimental data verified numerical predictions that the tubercle airfoil would stall gentler and more consistently compared to the control airfoil. However, the wind tunnel testing revealed that the gain in stability came with a slight loss in efficiency in the transitional regime ($Re\sim 400,000$). Flow visualization highlighted that the troughs in the leading edge acted as vortex generators, accelerating channels of air and inducing a low-pressure region inside the troughs. This explains the biomimetic airfoil's stable performance in the post-stall regime compared to the control airfoil, suggesting its potential aviation applications for low-altitude aircraft.

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

EE AT 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

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- Yes No

CSEF Official Abstract and Certification

Word Count

212

Fair Category

PS

Project
Number

6067

Title: A Study on the Development of Efficient Low Pass Filters for Denoising and Enhancing the Quality of Sounds and Images

Student Name(s): S. Lee

Abstract:

Noise reduction is essential for producing audible sound files and clear images. Various noises disrupt and distort the original signal, resulting in speech or an image that is slightly degraded, or even completely unintelligible, depending on the amount and type of noise. Humans are susceptible to noises, which consist mostly of high frequency waves, because we are more sensitive to high frequency sounds than to low frequency sounds—main sound sources like our voice. As noises are simply inevitable, they must be removed for clear communication. To emphasize and enhance the original signal, we had to diminish noise and amplify the signal. Using mathematical and acoustical knowledge, we executed noise removal by applying Low Pass Filters (LPFs) and various mathematical window functions in MATLAB, a computerized software. Using various combinations of filters and windows, we searched for the most efficient models. We substantiated the efficiency of the filter and window by comparing the pure sample, pure noise, and noise removal outputs. Application of LPFs reduced the amplitude of pure noise, while application of windows augmented the amplitude of the pure voice or image. Therefore, by applying both LPFs and windows, we could execute efficient noise removal. We ultimately found the best-fit filter design to reach the highest efficiency in noise reduction.

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

PH MA 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

229

Fair Category

PS

Project
Number

6068

Title: The Utilization of Light Amplification by Stimulated Emission of Radiation in Amalgamating Free-Space Optical Communication and Wireless Power Transmission

Student Name(s): J. LaPenna

Abstract:

Two laser technologies, free-space optical communication and wireless power transmission share many similarities, and demonstrate many advantages when combined. For instance, it would save mass, volume, and complexity on space crafts, allow unmanned aerial vehicles to stay airborne longer and provide an unhackable method of communication, and is an easy to implement power source and communication device to disaster affected and isolated areas. The proposed system consists of a transceiver and receiver. The transceiver consists of an audio input, an audio transformer, a class II red laser pointer, that uses less than one mW of power, and a battery pack. The receiver is a phototransistor on a solar panel connected to an audio output. The laser is pointed so that the beam makes contact with both the phototransistor and solar panel, the later converts the light into electricity while the former converts it back into digital information. The audio output is akin to FM radio sound quality and the power output of the laser is optimal with 52 lux of background light at a distance of 25 cm, producing about 200 millivolts of electrical energy, which powers the receiver. This premier system was successful in amalgamating free-space optical communication and wireless power transmission. Improvements can be made in all areas from substituting higher end technology that is more efficient and experimenting with the collimation of the beam.

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

EE ET 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

117

Fair Category

PS

Project Number

6071

Title: A Study on the Alternative Space Filling Curve

Student Name(s): J. Lee

Abstract:

The relationship between points on a line segment and points in a square is displayed by the Hilbert curve, which shows the mapping between those points. A new alignment or algorithm can be formed so that one quadrant's end of the curve lines up with the next quadrant's beginning of the curve. The new efficient and fast algorithm can be developed so that one quadrant's end of the curve lines up with the next quadrant's beginning of the curve. This procedure requires recursive thinking. In this paper, we will rigorously define and suggest an alternative Hilbert curve We wish to define a new sequence of functions $f(n):[0,1] \rightarrow [0,1]^2$ that converges to some surjective function.

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

MA 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

194

Fair Category

PS

Project Number

6072

Title: Solar Travels

Student Name(s): O. Hossaini

Abstract:

Abstract:

The purpose of this report is to determine how the different temperatures of the outside world affect the distance traveled by a miniature solar-powered car. Preceding the question, the hypothesis that was formed stated that if the solar-powered car was exposed to a lower temperature then it would travel farther, in the time given of 20 seconds, because the solar cells would overheat faster if the solar-powered car is exposed to higher temperatures. Using the procedure, the hypothesis will be tested for validity. In order for that to be done the solar car needed has to be built and tested outside in the sunlight with the distance traveled recorded under the temperature of that day at 10 AM which has to be done four times over the course of four sunny days. The resulting data shows that the hypothesis was supported with distances ranging from 3.04 meters at 20 degrees Celsius to 3.96 meters at 7 degrees Celsius. Further improving the experiment would require that the weight of the solar-powered car be measured and changed in order to increase or decrease the distance traveled by the solar-powered car.

Technical Disciplines Selected by the Student
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ET EE 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

250

Fair Category

PS

Project
Number

6073

Title: Creating, Optimizing, and Testing a Mathematical Model of the Chemical Production of Biodiesel

Student Name(s): C. Marcuccio

Abstract:

Biofuels present a potentially promising solution to impending global energy and climate crises, yet they face economic barriers. Thus, the purpose of this study was to create, optimize, and test a mathematical model of the chemical production of biodiesel to better approach the problems preventing biodiesel from becoming a mainstream fuel. The investigation was conducted by producing many small batches of biodiesel from transesterification of canola oil with methanol and sodium hydroxide catalyst. Reactants in glass jars were heated and shaken or stirred using 3D-printed stirring apparatuses while variables like the canola oil to methanol ratio, catalyst mass, reaction temperature and time, and separation time were varied independently. The volumetric yield of biodiesel was then measured and graphed against each separate variable. Quadratic regression best modeled the reactant ratio and reaction temperature, logarithmic regression best modeled catalyst mass, and linear regression best modeled reaction time. A simple average yield model and profit model were then constructed and optimized using the Wolfram programming language, determining optimal chemical conditions and revealing that oil costs dominate biodiesel unprofitability. Overall, these results indicate that catalyst mass, reactant ratio, and reaction temperature are most critical for biodiesel production and operate in narrow ranges to obtain maximum yields. Also, the profit model's high sensitivity to oil prices indicates that raw reactants dominate biodiesel costs. Applications of this investigation include optimization of commercial biodiesel production to help alleviate the scarcity and environmental consequences of petrofuels, while potential extensions include using different feedstocks to further reduce costs.

**Technical Disciplines Selected by the Student
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ET CH MA

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4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

235

Fair Category

PS

Project Number

6074

Title: A Novel Heavy Metal Remediation Technique Using a Photocatalyst Driven Graphene-Cupric Oxide Matrix

Student Name(s): C. Odendahl

Abstract:

Heavy metals contaminate soil through mining, manufacturing, and the use of synthetic products. Current methods, such as high temperature treatments, chemical infiltration, and a remediation process pose transportation risks and require copious amounts of energy, time, and money. It is proposed that a novel technique using a matrix composed of graphene-cupric oxide (GCO) will utilize photocatalytic properties to remediate lead from soil. The photocatalytic property of the matrix expands it in the presence of ultraviolet (UV) light, allowing metal ions to bond with the GCO, fixing the metals, as opposed to being in ionic form. Four types of soil samples were prepared in the lab; a control, soil with 20 parts per million (ppm) heavy metal solution, soil with the heavy metal solution and graphene oxide, and soil with the heavy metal solution and GCO. The photocatalyst was activated by placing each of these samples under a UV light (wavelength of 290 - 320 nm) for approximately 1.5 hours. The matrix fixation of the metals was tested with rye grass. Rye grass was grown in the activated soils, as it is known to sequester heavy metals. Heavy metal analysis was performed on the rye grass samples from each experimentation group and evaluated to determine the phyto-sequestration as compared to the GCO fixation levels. This process will allow on-site heavy metal treatment/mitigation and eliminate the substantial costs/risks associated with the current methods.

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

EM CH 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

211

Fair Category

PS

Project
Number

6075

Title: The Creation of an Autonomous Referee using a PIXY Camera and Robotics to Eliminate Human Error by High School Soccer Referees

Student Name(s): S. Minson

Abstract:

I developed an optical robotic referee that can work to eliminate human error in high school soccer games by determines when the ball goes out of bounds. After researching various ways technology is already implemented in other sports to eliminate human error, I searched for an optical tool that can determine different color fields. I found a PIXY camera, a camera that I taught to track an object based on color, size, and shape. I then had to connect the PIXY to the Arduino so that I could use the PIXY's camera to determine the location of the object I taught it to track. I then built a track along the sideline and connected the PIXY to the track, and the motor moving the track to the arduino. I created a code that made the motors run so that the PIXY would follow the ball across the sideline. In developing my design, I tested how accurately the PIXY could tell if the ball was in or out of bounds. In the future, I would like to design a visual alarm that accompanies the out of bounds signal. I would also like to increase the scale of the track, which would allow my project to do its work on a real field.

**Technical Disciplines Selected by the Student
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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

254

Fair Category

PS

Project Number

6076

Title: Hydraulics and their Failures

Student Name(s): A. O'Donnell

Abstract:

I entered this project wanting to explore what factors affect the effectiveness of hydraulics. I knew the generic formulas of $F_1/A_1=F_2/A_2$ and $A_1/A_2=D_2/D_1$ but I wanted so see how well hydraulics matched them. I set up a simple machine with two syringes connected by a tube that could push levers with washers on each side to change the force. The levers attached to each syringe were mirror images of each other so that the only factor in terms of force applied was number of washers. This setup also allowed me to change the size of syringe, tubes, and what is in the tubes. I found that air is much worse than water at transferring force. I also found that the $A_1/A_2=D_2/D_1$ equation was very good at predicting distance travel when the area changes. The most interesting thing I found was that the syringes never even got close to the $F_1/A_1=F_2/A_2$ model. The closest was when it was small syringe to small syringe, medium to medium was next closest, then large to large was the worst. In all my project ended up telling me that hydraulics can be very inefficient and that as the size of the hydraulic system increases the efficiency decreases. I think the largest force to cause this inefficiency is static friction because once the system had enough force to life one washer, it fit the model decently, indicating the force was something that only had to be overcome once.

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

EE MA 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

201

Fair Category

PS

Project Number

6077

Title: Implication of Fuel Type and Volume on Terminal Velocity of Projectiles

Student Name(s): E. Kadambaya

Abstract:

An investigation was completed to determine the impact of helium gas (He₂) on a projectile's terminal speed and distance traveled. A set of projectiles (i.e., a football, basketball, and soccer ball) were filled with both air (i.e., a mixture of gases) and helium of uniform volumes. Projectiles were launched with uniform force and by the same person. The maximum distance traveled was recorded. To measure the terminal speed at which a projectile travels, balls were dropped at a colossal height (20-m) and the amount of time needed for the object to reach the ground was recorded. Terminal speed measurements were recorded on the same day with little to no impact from environmental factors such as wind or rain. All projectiles were dropped from a 90° angle. Both studies were completed in triplicate and descriptive statistics (i.e., mean, standard deviation, and one-way ANOVA). Both studies determined that helium balls weigh less than airballs; The lighter weight of the helium projectiles decreased the initial drag that is used because of a projectile's speed or distance. Furthermore, Newton's Second Law supported this idea. It says, moving an object by pushing or pulling it makes acceleration, a change in the speed of motion.

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

PH PH 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

242

Fair Category

PS

Project
Number

6078

Title: The Impact of Methoxy on the Nucleophilicity of Re(pyridine-oxazoline)(CO)₃Cl and Its Rate of CO₂ Conversion

Student Name(s): N. Nguyen

Abstract:

The amount of carbon dioxide in the atmosphere has been steadily increasing since at least the 1960's. This has led to a growing concern about its effects on global temperature which threaten to destabilize the earth's delicate biosphere. There has been extensive prior research into the capabilities of transition metal complexes as catalysts in the electrochemical reduction of CO₂ to CO, a compound with a variety of uses, especially in fuel. However, the rate of the reduction is not fast enough for it to be feasible to put to use on a global scale. I sought to synthesize a rhenium complex with improved CO₂ reduction capabilities than previous catalysts. A version of the bipyridine ligand was synthesized first with the addition of a functional methoxy group, and then the metal complex Re(pyridine-oxazoline)(CO)₃C was synthesized with the ligand. The ligand synthesized was 2-(6-methoxypyridin-2-yl)-4,5-dihydrooxazole. The metal complex was analyzed for its CO₂ reduction abilities using gas chromatography and cyclic voltammetry. I hypothesized that due to methoxy being an electron donating group, the ligand and therefore the rhenium complex will have an increased electron density, which will reduce the reduction potential and increase the rate of reaction. Data collection and analyzation is currently ongoing, and results may be valuable to the scientific community by helping researchers get a better understanding on methods and mechanisms that can be used to effectively reduce CO₂ to CO.

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

CH

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

268

Fair Category

PS

Project Number

6079

Title: Ambient Carbon Dioxide Capture and Purified Gas Release Using Asphalt-Waste Derived, Porous Carbon Filtration

Student Name(s): M. Woo

Abstract:

Global climate change is the main environmental concern that is directly affected by anthropogenic carbon dioxide emissions from industrial power plants, refineries, and natural gas wells. An efficient carbon dioxide capture technique is needed so that greenhouse CO₂ can be captured prior to release and recycled as purified gas with minimal energy inputs. In this research, such a CO₂-capturing medium was developed. A new activated porous carbon was easily produced using waste, road-side asphalt that was first purified and carbonized through the addition of KOH under N₂-flow at 700oC. The carbonized powder was then impregnated with N₂ with 28% NH₄OH soaking and reduced with H₂-flow at room temperature to produce the finalized asphalt-reduced nitrogen porous carbon (A-rNPC). A similar process was carried out for a sample of Gilsonite, producing G-rNPC for CO₂ capture comparison. 200mg of each porous carbon was placed within a CO₂-filled, sealed, 22ml vial and the CO₂ absorption was determined at room temperature and pressure using gas-phase FTIR. The new A-rNPC absorbed 272ml CO₂/g without stimulation or significant pressure, representing a 14.3x increase in CO₂ capture efficiency compared to recent literature, where 30 bar of pressure was required. G-rNPC, conversely, absorbed only 179mlCO₂/g. Finally, using subtle heating (50oC) that is easily attainable via re-direction of flue waste heat in a potential carbon-capture system, A-rNPC and G-rNPC released purified CO₂ gas with 78% and 73% efficiencies (respectively) relative to the original amount captured. As such, as much as ~212ml CO₂/g A-rNPC could be obtained for commercial reuse.

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

EM EN AT

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

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

4. Is this project a continuation? Yes No

5. 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

6080

Title: Are your running shoes slowing you down? (The Speed is in the Shoes)

Student Name(s): J. Frawley

Abstract:

I investigated how the weight of a runner's running shoe affects their speed over different distances. I tested this by having six volunteer runners run a set distance (either 100 or 800 meters) in two sets of shoes; a heavier training pair and a lighter racing pair. I then found the change in average time for each runner based on their times ran with each shoe then divided that by the distance they ran, then divided that number by the difference in mass of their two types of shoes. This calculation gave me the overall impact the shoe had on the runner over that distance which I could then average between the three runners for each distance. Both the longer and the shorter distance showed a similar relationship between the weight of the shoes and running performance in that the lighter shoes would produce faster times. However, the runners who ran the shorter distance, saw much larger impacts in their times (1.9382 seconds per mile per ounce) compared to those who ran the longer distance (impact of only 1.4851 seconds per mile per ounce). This greater impact in shorter distances is likely due to the limited amount of time for adjustments in running to be made to account for minute changes in the runner's environment. Although this was only tested over two distances with a small number of volunteers, these results provided strong evidence to the weight of one's running shoes affecting their speed, especially over short distances.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

208

Fair Category

PS

Project
Number

6081

Title: The Effect of EsMCsu1, from Eutrema Salsugineum, on Transformed Arabidopsis Related to Drought Resistance

Student Name(s): J. Hopper

Abstract:

Due to the growing drought problem in California, it would be advantageous to transform crops to be more drought resistant. This would aid in maintaining California's agricultural water supply. Arabidopsis, a model plant organism, was transformed with the Eutrema Salsugineum gene, EsMCsu1, allowing it to synthesize more abscisic acid (ABA), a plant hormone. The ABA works to close the stomata, which keeps water that would be transpired through the leaves, inside the plant, thus conserving water for future use. The arabidopsis were transformed via the floral dip method. Transgenic lines were selected for the experiment based on the strength of trans-gene expression found through an analysis of GFP expression. The selected lines experienced a drought simulation where a water content test was performed on the leaves through multiple trials. The results showed that the genetically modified lines retained more water at the end of the test compared to the wild type line. The success of this transformation would be beneficial for farmers because they could save money on irrigation costs, and ration water more efficiently during the drought. Additional steps would be to conduct a study that uses crops, like rice or alfalfa to verify that EsMCsu1 is a viable solution to make crops more drought resistant.

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

PS EN 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

160

Fair Category

PS

Project
Number

6082

Title: Solar Geoengineering: The Capacity of Aerosols to Reflect Light and Reduce Temperature

Student Name(s): R. Glanville

Abstract:

The purpose of this experiment was to test reflectivity of different aerosols and to ascertain if reflectivity of said aerosols would reduce the temperature of a sealed chamber exposed to light. This experiment was completed in two parts. In part one, the solutions of the aerosols were put under a spectrophotometer to test the reflectivity of each of the different solutions. This determined the exact measure of reflectivity of the solutions by measuring how much light was absorbed and reflected by the solution. For the second part of the experiment, the reflectivity of the aerosols was tested based on their ability to affect the temperature of a sealed chamber. The solutions were aerosolized in a sealed chamber using an ultrasonic mist maker, placed under a light source, and the temperature recorded over a set interval. Results indicate that several aerosol solutions minimally impacted the temperature within the chamber when compared with the control, but the results were not statistically significant.

**Technical Disciplines Selected by the Student
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EM EA EN

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- Yes No

CSEF Official Abstract and Certification

Word Count

98

Fair Category

PS

Project
Number

6083

Title: Options Pricing Models Using Machine Learning

Student Name(s): S. Mediboina

Abstract:

In this paper, we explore wavelet and machine learning based nonparametric methodologies for pricing call options. We first apply wavelet transform to remove noise from raw data. We then apply support vector regression as well as neural networks to predict call option prices. These methods, while being prominent in other fields of study, have not heavily been used for financial econometric applications. The accuracy of these methods is compared to the widely used Black Scholes Model. The empirical analysis has shown promising results for nonparametric methodologies to further accuracy in accommodating for the stochastic volatility of financial markets.

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

MA

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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

253

Fair Category

PS

Project
Number

6084

Title: Ammonia on Other Earths: Sensitive Chemical Tests for Future Probes

Student Name(s): M. Papademetris

Abstract:

The advancement of probe technology and innovative experiments on the origins of life are important factors in the human search for life beyond Earth. The presence of ammonia in the atmosphere of a planet could possibly indicate life, as shown by its inclusion in the Miller-Urey experiment. However, ammonia is also toxic to humans in high concentrations, so both the presence of ammonia and its concentration in an atmosphere must be determined. Current methods cannot measure ammonia accurately enough for this purpose, but future robotic probes could conduct more sensitive chemical tests. They could possibly conduct a silver chloride test, in which ammonia allows silver chloride to dissolve in water due to the two forming a water-soluble complex ion, resulting in reduced precipitate. This test was conducted on four different concentrations of ammonia that were determined based upon OSHA's recommended long-term workplace exposure concentration. The test was successful, and it was possible to see that the solutions contained ammonia and even to observe the difference between concentrations due to the different liquid levels. A titration was also conducted using the smallest concentration and a matching concentration of hydrochloric acid; this was unsuccessful due to the small concentration of titrant and analyte, and the titration would need to be repeated with a modified method to obtain clear results. The silver chloride test is therefore a viable method for future robotic probes to determine the presence of ammonia on other planets, accelerating the human search for life and a possible new home.

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

CH PH

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- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

PS

Project Number

6085

Title: Field Testing for Practical Application of OER Catalyst Nickel-Iron Oxide in Extraterrestrial and Underwater Areas

Student Name(s): D. Colgate

Abstract:

Nickel-iron oxide is one of the most recent oxygen evolution reaction (OER) catalysts on the market. This OER catalyst was used so that a practical application could be found for the oxygen gas that was being produced and calculate how much surface area was needed to do so. The nickel-iron oxide micro-particles were attached to aluminum electrodes, and they were placed inside the big container and attached to the oxygen capturing container and connected to the power supply. It was then filled with water and the power supply was turned up to 31.8 volts. The experiment ran until 0.5L of oxygen was collected and the time was recorded. This was repeated at 15.9 volts as well, but it was stopped at 0.25L. The 31.8-volt trial took 150 min and the 15.9-volt trial took 140 min. It can be concluded that oxygen is produced 1/300th of a liter per minute during the 31.8-volt test, and 1/560th of a liter per minute during the 15.9-volt test. This mode of oxygen acquisition would be useful in supplying oxygen to places that would not have the ability to have enough organic carbon-dioxide to oxygen converters to maintain the amount of oxygen a human needs. Application of nickel-iron oxide micro-particles could lead to underwater stationary laboratories, given that oxygen can be created fast enough to sustain human life and hydrogen can be used as fuel to power vehicles.

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

EN CH AT

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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

181

Fair Category

PS

Project Number

6086

Title: Electricity on the Go

Student Name(s): J. Zuklie

Abstract:

Electric cars have recently come into popularity, mainly due to Teslas releases of multiple car models. The electric cars that are on the road today are great, having lower greenhouse gas emissions than gas-powered cars, but they do have some drawbacks. The largest drawback is the time it takes for the car to recharge, compared to the miles it is able to drive on that single charge. Finding a fix to this problem would help make electric cars a more viable option when picking out your next vehicle.

To solve this problem a device could be created to recharge the batteries as the car drives, allowing for a higher mileage for every recharge. The device would use the weight of the car to rotate a magnetic array around a stator wound with enamel coated copper wire. This would produce an electric current that would be used to partially recharge the batteries as you drove. This would allow you to drive further and would further reduce the greenhouse gas emission of you electric car.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

PS

Project Number

6087

Title: The Effectiveness of Different Media of Air Gap Hacking Over Distance

Student Name(s): W. Rojas

Abstract:

This experimentation was done to find which medium of physical communication by a computer (brightness, heat, or sound intensity) is the most effective over distance. This information is useful because of air gap hacking, or retrieving information from a computer that has been disconnected from the internet in order to protect its security, especially the safety of the information on it. Since the hacking of air gapped computers requires a medium to communicate besides the internet or a wired connection, the medium examined which is the best at communicating a message is the most effective for air gap hacking. This means the medium that is the most effective should be guarded against the most. The investigation was done by attempting to convey the message 5 via binary (101) by recording a high value, a low value, and a high value for each medium and finding the average distance between them from point blank, 5, 10, and 30 feet. The percent similarity of the three latter distances to the point blank value of each medium was found. The media with a greater percent similarity were considered more effective, and a point system was developed favoring higher percent similarity over longer distance. The media of brightness and sound intensity each had 7 points, while heat had 12 points. This means that out of the tested media heat is the most effective method of air gap hacking and should be guarded against with the highest priority.

Technical Disciplines Selected by the Student
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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

249

Fair Category

PS

Project Number

6088

Title: Crystal Woods

Student Name(s): A. Jacob

Abstract:

The experiment was to identify the effect of varying quantities of ammonia. My hypothesis indicated the primary purpose of ammonia was to increase the speed of the evaporation process and the crystals will appear faster.

My mentor Mrs. McClelland made sure all precautions are maintained before experiment in DHS lab. 3 different solutions were put into 9 cups for 3 trials. One with no ammonia, one tablespoon of salt, water, and bluing. Another with the same ingredients but 1 tablespoon of ammonia and another with ½ tablespoon. Cardboard trees placed into each solution and put onto a tray at room temperature for 9 days.

On the next day, the solution with no ammonia had no or very little amount of “crystals”. The solution with 1 tablespoon of ammonia had a small amount. The solution with ½ tablespoon of ammonia had a medium or large amount. By day 9, the no ammonia solution had a weak amount of crystals, 1 tablespoon of ammonia had a large amount, and ½ tablespoon became the winner.

The solution has been drawn throughout the trees by capillary action and begins to evaporate accelerated by ammonia, which evaporates more quickly than water. The evaporation allows the salt and bluing particles to crystallize. The same amount of water and ammonia provided the best result. If ammonia is more, there will be less water to accelerate and less salt will appear. Also, if water is more, evaporation will be slower due to absence of motive to go faster.

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

250

Fair Category

PS

Project Number

6089

Title: The Anti-Overdose Pill Bottle - A Proof of Concept

Student Name(s): Z. Hassan

Abstract:

With this project, I aimed to create a proof of concept pill bottle that would limit the chances of patients becoming addicted to painkillers and other addictive opioids. The idea was simple: design a bottle that only dispensed the proper amount of pills at the time designated by the doctor. This would prevent irregular or improper use of the drug, and thus benefit all parties involved.

The project began with the purchase of all the parts required for the main component of the build: a microcontroller, a motor and all other necessary wires and equipment. This technology would be used to dispense the pills at the proper time and in the proper quantities. After measuring all the pieces, work began on 3D modeling the bottle, which had to fit all components and then provide a means of dispensing the pills. After printing with teacher help, the bottle is not completely polished, as there are openings all around and unsecured wires, but it does the job to show how the machine works.

There were always a few inherent issues that hindered the ability to create a polished product. First and foremost, with the 3D print construction used to design the bottle, the possibility of simply breaking the bottle or the electronics within it has lingered. Until the ability is gained to mill the bottle out of metal (too heavy and expensive) or fight a light, but very resilient plastic (hard to 3D print), the design will have to remain as is.

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

EE 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

265

Fair Category

PS

Project Number

6090

Title: Simple Gold Nanoparticle-based Colorimetric Detection of Escherichia coli in a Tap Water Matrix via Microfluidic Chip Assay

Student Name(s): A. Ramachandran

Abstract:

Escherichia coli O157:H7 is a major threat to global health and food safety, as it is often found in undercooked meats and contaminated water sources. For proactive detection of the bacteria, current total coliform count methods require specialized laboratory conditions, need prolonged time, and produce hazardous waste. The need for a rapid E.coli test is clear--particularly in underdeveloped regions where contamination is prevalent. This research investigates the creation of a portable, rapid and simple colorimetric detection system for E.coli in water, based upon aggregation properties of gold nanoparticles (AuNPs). Naturally-red citrate-capped AuNPs will aggregate and turn to blue when exposed to a strong base, as the positive cations bind to the negative citrates. When exposed to non-pathogenic O157:H7 (ATCC -43888) in solution at a 2:1 (v/v, AuNP/O157:H7), with only drops of 0.25M NaOH added, the Na⁺ binds instead to the bacterial cell walls, leaving the AuNPs dispersed, and red in color. Upon the addition of a water sample and NaOH, a red color is interpreted as positive for contamination. Through validation studies, the colorimetric assay was found to predict bacterial CFU/ml content within 7% of pre-determined standards. Migration of the assay to a rapid, visual color test, in ~100ul of solution, produced a positive test result for as little as 30 CFU of E.coli. Finally, the rapid colorimetric AuNP-based E.coli test was adapted for use in a consumer-friendly microfluidic chip. As little as 30 CFU E.coli is detected through visual color change by pipetting the reagents and water into pre-marked wells.

**Technical Disciplines Selected by the Student
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EM CH

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- Yes No

CSEF Official Abstract and Certification

Word Count

259

Fair Category

PS

Project Number

6091

Title: A Prototype Cotton Based Poly(N-isopropylacrylamide) Smart Hydrogel that Undergoes Hydrophilic-to-Hydrophobic Transition to Capture and Release Fresh Water from Humid Air

Student Name(s): J. Oei

Abstract:

The capture of fresh water for irrigation and potability has been raising serious concerns in the 20th century, particularly in inhabited deserts and arid regions. In dry coastal areas, like the Namib Desert, early morning dew and fogs are regular phenomena as the cold, humid air currents of the ocean are pushed inwards into the desert. Since rainfall is scarce, the use of synthetic materials with tuned wet-ability to collect water from this humid air would have a great impact on reducing the water depletion problem in dry areas. The surface of a cotton fabric was modified by the infusion of poly(N -isopropylacrylamide), PNIPAAm polymer. This produces a sponge-like smart hydrogel cotton fabric which autonomously collects and releases water from a humid atmosphere, triggered by temperature variations within the day-and-night range of deserts. This is the result of the structural changes of a temperature-responsive polymer combined with the highly rough surface of the cotton fabric, which leads to reversible switching between two extreme wet-ability states, hydrophilic and hydrophobic. This switch-ability is repeatable and reversible for many cycles. Extensive experimentation in a specially designed humidified micro-climate chamber shows that the optimum performance will occur if the temperature cycles between 90oF (hydrophobic) during the day and 70oF (hydrophilic) during the night with the hydrophilic to hydrophobic inflection point at approximately 78oF. The PNIPAAm polymer absorbed and expelled 336% of its weight in water. This is a significant amount of water that can be collected and released just by using nature's temperature cycle.

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

EN EM 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

250

Fair Category

PS

Project Number

6092

Title: Salty Fuel Energy

Student Name(s): C. Guzman

Abstract:

ABSTRACT

Ever wonder what kind of fuel source was used to power vehicles when they first began inventing them? We know from history that the search for other fuel sources to power vehicles has been going on for centuries. One search alternative going on is Fuel Cell Technology and cars.

The purpose of this research was to give some information regarding vehicle Fuel Cell Technology and an alternative source that can be used. In this project you will see that salt can be used as a conductor of electricity. I attempted this by using different types of salt, mixing it with water and putting drops of this mixture into a fuel cell model car kit used in the experiment. The chemical reaction of the fuel sources used produces the energy to create the power.

The outcome shows that the type of Salt used to produce the electricity does affect how long the fuel cell car drives. After completing the trial runs of the salt the data shows the total average of the Sea Salt was 214.4 minutes. The table salt was next with a total average of 150.4 minutes. The Ice Melt road salt came in at 107.4 minutes and the Epsom salt performed the least at 7.6 minutes.

Sea salt originates in the sea without any other chemicals or nutrients added and not processed. Therefore, it is more concentrated than the other salts used. This alternative fuel energy would be beneficial to our environment and will produce less pollution.

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

ET

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- Yes No

CSEF Official Abstract and Certification

Word Count

245

Fair Category

PS

Project Number

6093

Title: Determining Best 3D Printing Material to Create Model Human Vertebrae

Student Name(s): M. Dixon

Abstract:

Museums are places where people can go to experience artifacts of the past that are often delicate and sensitive due to their age. Models in interactive spaces in museums are often not very realistic and buying realistic model bones or actual bones can cost a lot of money. A price analysis was made to determine if 3D printing a model vertebrae at the establishment would cost less than buying the bone from a biological company. Potential uses of experiment could be for classroom activities, interactive spaces, and replacement bones for models. This experiment had two phases. Phase I was to design realistic 3D printed vertebrae using 3D printing materials and to measure the weight and dimensional data of the models. A Lulzbot Mini 3D printer was used to print model vertebrae from an STL file using the Cura Lulzbot Edition printing program. Laybrick Stone Filament, PLA, and BioFila silk were the materials used to 3D print the models. Phase II was to survey participants to determine which of the materials used to create model vertebrae were the most realistic. The independent variable was the 3D printing material. The dependent variable was how realistic the model human vertebrae appear. The projected result was that the BioFila silk was the most realistic material. Data show that the 3D printed vertebrae have the exact weight and dimensional data as the real vertebrae and that Laybrick Stone Filament was the closest to the real vertebrae based on participant answers.

Technical Disciplines Selected by the Student
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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

250

Fair Category

PS

Project Number

6095

Title: Improving Cybersecurity by Developing a User Authentication System Using Keystroke Dynamics

Student Name(s): K. Yuan

Abstract:

In an increasingly technological world, the need for more secure user authentication methods is more paramount than ever. The objective of this project was to develop a continuous authentication system based on a keystroke analysis of the user that is successful with different environments and varying content. A Python program was developed to record three keystroke characteristics: key hold latency (time between the press and release of the same key), key press latency (time between press of one key and press of the next key), and key interval latency (time between release of one key and press of the next key). Then, data was collected from thirty participants through free type sessions for responses to simple questions and complicated questions typed on flat surfaces as well as their lap. Data for these different settings and contents was collected in order to show that this system of authentication is robust enough to identify users in various situations rather than solely in a standardized setting, which is necessary for real world application. Profiles were created based on each of the different settings and response types. Then, profiles were compared using R-measure to determine threshold R-values to identify genuine users from imposters. Results were then charted on the detection error tradeoff curve. Equal error rates (EER) were lowest for key interval latency, making it the most accurate characteristic for imposter detection. Regardless of environment and content, the verification system had an EER of 0.083, meaning it had a 91.7% authentication rate.

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

CS AT MA

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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

247

Fair Category

PS

Project Number

6096

Title: Snow: The Atmospheric Scrubbing Brush

Student Name(s): C. Welsh

Abstract:

On a cold winter day, freshly fallen snow can look as white and pure as powdered sugar. It may seem harmless and clean, but the snow in our backyards is filled with all sorts of chemicals and pollutants that we just can not see. The chemicals and pollutants start in the air and are absorbed by snow as it falls to the ground. So if snow absorbs pollutants in the air, does that mean snow decreases air pollution? During a snowstorm, a sample of snow was collected every hour. The samples were melted into water, and the water was tested for turbidity levels using a turbidimeter. Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that we generally can not see. The turbidity levels of the samples in the first trial decreased as the time the samples were collected increased. The first sample collected had the highest turbidity, the second sample collected an hour later had a lower turbidity level, the third sample collected an hour after that had an even lower turbidity level, and so on. Less turbidity in the melted snow means there were less particles in the air as time went by, which proves how the snow decreased the amount of pollution in the air. In the second trial the data was more random and did not follow a trend. Because both trials had different results, a conclusion can not be made until further trials are conducted.

Technical Disciplines Selected by the Student
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EV 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

246

Fair Category

PS

Project Number

6097

Title: Comparing the Strengths of Industrial and Medical Cyanoacrylates

Student Name(s): A. Schommer

Abstract:

Dermatological adhesives are often used in medicine to repair minor, external wounds. A majority of these adhesives are cyanoacrylates, which share the same basic chemical formula as popular industrial adhesives such as Krazy Glue®, with the only difference being the subgroups. The aim of this project was to test the tensile strength of medical and industrial cyanoacrylates, because with rising healthcare costs, some patients have turned to using superglues for minor wounds, unaware of the risks and standard medical practices. The hypothesis predicted that the industrial cyanoacrylate, Krazy Glue®, would have more tensile strength than the medical cyanoacrylates, DERMABOND EXCEED®, Liquiband Surgical S®, and Liquiband Exceed®. This is because the industrial cyanoacrylates are meant to last permanently, as opposed to the medical cyanoacrylates, which eventually dissolve. Several test methodologies were attempted, but the testing method of choice included creating beds of glues on a piece of aluminum foil with a one by one inch area. Fishing wire strings measuring 5.25 inches in length were cut and placed to dry in the glues, two for each bed. The beds were hung and slotted masses were hung from them. Each of the masses were held there for ten seconds before another was added, and each trial stopped when a tear appeared on the foil mold. The results of this experiment provided evidence in support of the hypothesis, as Krazy Glue® sustained almost double the mass of the next strongest glues. Future work could test bandages with this procedure.

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

BI EN 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

267

Fair Category

PS

Project Number

6098

Title: Filtration of Heavy Metals from Drinking Water with Used Coffee Grounds Embedded in Discarded Polyurethane Sponges

Student Name(s): V. Yin

Abstract:

Continued contamination of water, particularly by heavy metals such as lead, highlights the need for an easy-to-fabricate, low-cost, and rapid filtration device. Previously, researchers have pointed out the usefulness of used coffee grinds as a means to remove heavy metal contaminants from water, however, with such a filtering device, heavy metal removal is accompanied by inclusion of coffee and its ingredients. Recent development of a coffee-based, bio-elastomeric soaking sponge, on the other hand, requires laboratory synthesis, and 30 hours of soaking time to function. In this research, a new polyurethane-coffee sponge (PUF-C) “filter” was engineered via the combination of a used polyurethane sponge, 2g spent coffee grinds, and 4g of phenol binder/stabilizer to yield a solid porous support incorporated with spent coffee powder. Produced only with physical mixing and low temperature heating easily produced in field, the filter can rapidly (in minutes) remediate at least 1 Liter of 1000 ppb Pb-contaminated water to ~14 ppb (below the EPA water action level for Pb), creating colorless, potable water, that is free of coffee, phenol, or sponge contamination. This corresponds to a removal efficiency of 33µg-Pb/gram of PUF-C filter, or 1.4mg-Pb/gram of incorporated coffee grinds removed. Re-filtration of a single-pass filtrate reduced the Pb content to near negligible amounts (2.0 ppb), with three additional passes through the filter. In the final proposed design, a 30cm³ PUF-C sponge filter can be created by the consumer in only 1 hour, without the need for sophisticated laboratory equipment, at a cost of ~25¢ per device.

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

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

253

Fair Category

PS

Project Number

6099

Title: Sinkhole detection using Wireless Sensor Networks

Student Name(s): S. Wang

Abstract:

Currently, the only sinkhole detection technique is by interferometric synthetic aperture radar (InSAR), which is costly and inefficient. It was hypothesized that designs derived from the structural health monitoring system (SHMS) and the wireless sensor network (WSN) will be used to more efficiently detect sinkholes. MPU 6050 accelerometers were used and WSN establishment allowed for real-time data access via wireless connection. WSN establishment was created through connection to a private IP address in a localized system. The accelerometer was coded with data outputs regarding angular orientation and acceleration. The data was transformed using Processing and a Teapot module to visualize orientation in three dimensions. To test the approach, a cover-collapse sinkhole was created and data was recorded. The sensors were placed in set locations to determine different activity. This system located areas of activity, indicating a sinkhole. The data was then analyzed for patterns and its connection to sinkhole development. The results showed a significant change in the X, Y, and Z axes in angular orientation and acceleration prior to total collapse. Then, the Finite Element Method was applied through GNU Octave, allowing the user to perform numeric experiments on sinkhole composition. The application of WSN and SHMS is a major development in sinkhole detection as the design provides cost effective and efficient data communication in real-time. In the future, this system can be transformed and packaged for communities susceptible to sinkhole activity. If successful, these designs have the potential to save thousands of lives affected by such catastrophic cavities.

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

EE EM CS

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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

257

Fair Category

PS

Project
Number

6100

Title: Measuring and Projecting Effect of External Interference on Ocean Internal Wave Energy Distortion

Student Name(s): A. Srivastava

Abstract:

A common cause of tsunamis, intense natural disasters with destructive consequences, is the release of seismic energy at the ocean floor and the absorption of this seismic energy via internal ocean waves, creating huge tsunami waves due to wave shoaling as the internal wave approaches shore and stratified ocean layers merge. My project seeks to measure the impact of internal wave interference on the height of waves created at shore. I hypothesized that as internal wave interference increases, wave shoaling energy will decrease, leading to decreasing shore wave height. A mock-ocean tank was set up with a constant wave-making contraption at one end of the tank, and a steady 45° angle inclined plane was set up at the other end of the tank as the shore on which wave shoaling would occur. Wave height was then measured and recorded in relation to the amount of cross-section surface area internal wave interference, structured as buoys with limited mobility to model the obstruction of internal wave propagation. Results conclude a positive correlation between internal wave interference and wave shoaling height. Next, an wave-distortion-index was created to predict the effect of surface area cross-section interference on internal wave Coriolis and Brunt–Väisälä frequency bounds on interfacial wave propagation under the theoretical assumption that wave height and frequency proportionally decrease as energy of the wave system decreases. This promising research can be applied to create networked deep-ocean buoys which work to decrease some internal wave energy and reduce incoming tsunami wave and drawback damage.

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

EE EA 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

PS

Project
Number

6101

Title: Development of a Vaccine Transportation Device for Last Mile Delivery Using Renewable Phase Change Materials with a Controlled Heat Transfer Mechanism

Student Name(s): T. Ma

Abstract:

The purpose of this project is to develop a transport container with a passive cooling system that uses natural and renewable phase change materials (PCMs) for vaccine delivery during the last mile. There are 19.4 million people who are unable to receive basic immunization because they live in remote areas. The last mile of vaccine delivery is described as the very last leg of delivery - right before utilization. This encounters many obstacles, one being poor refrigeration. Vaccines need to be stored in a range between 35°F and 46°F; if not, they lose potency and become ineffective. PCMs are used to absorb and release thermal energy in order to maintain a stable temperature but unlike current designs that use industrial PCMs, which are expensive, not readily available, and non-degradable, this device utilizes biodegradable, low-cost, and easily available PCMs.

Several prototypes were designed from data gathered and tested. The final prototype uses two PCMs of ice, which has a large latent heat value, and a mixture of coconut and corn oil, which has a phase change temperature range similar to the storage temperature range for vaccines. The prototype also has a dual chamber design with a heat transfer device to control the rate of heat flow between the vaccine containers and ice. The PCMs help maintain a stable, safe temperature for the vaccines and, combined with the heat transfer device, significantly extends storage time at the necessary temperature. The final prototype had a storage time of up to 33 hours.

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

CH

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

258

Fair Category

PS

Project Number

6102

Title: The Effect of Different Biochars on Phosphate Retention

Student Name(s): T. Barry

Abstract:

Biochar applications have shown to increase turnover of Carbon and hence nutrient cycling and retention, which may provide crop-related benefits. The properties of biochars and their functions in soil and water environments depend on the type of biomass used for biochar production, and the production conditions. The goal of this study was to determine the phosphate (PO₄³⁻) retention capacity of different slow pyrolysis biochars produced at different temperatures. Each biochar was modified by shaking with a polycationic solution (poly di-allyl di-methyl ammonium chloride, poly-DADMAC) for 24 h. After this, the mixture was centrifuged to separate the solid and solution phases and the excess poly-DADMAC was washed with de-ionized water. The biochar was dried at 80-85°C for 72 h. The sorption isotherm experiment was conducted with biochars using different concentrations of PO₄³⁻ solution for 72 h. The resultant mixture was filtered to obtain the clear solution. The PO₄³⁻ concentration in the final solution was measured colorimetrically with a mixed reagent using a UV-vis spectrophotometer at 690 nm wavelength. A standard curve was constructed using different known concentrations of PO₄³⁻ to obtain the relation between absorbance and concentration of PO₄³⁻. Results showed that PO₄³⁻ is more strongly retained on biochars coated with poly-DADMAC than pristine biochars. The anion exchange capacities of the coated biochars enhanced PO₄³⁻ sorption. This study indicates that biochars can be modified or designed to increase sorption of PO₄³⁻. This concept can be used to trap PO₄³⁻ from animal waste into biochars and released back to the soil.

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

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- Yes No

CSEF Official Abstract and Certification

Word Count

217

Fair Category

PS

Project
Number

6104

Title: Variation of Light Radiated from Active Galactic Nucleus of Galaxy NGC 4395

Student Name(s): D. Wasilefsky

Abstract:

The dwarf spiral galaxy NGC 4395 contains a massive black hole at its center. The black hole accretes gas from its host galaxy, which leads to strong radiation at visible wavelengths. As with other “active galactic nuclei” (AGNs), the intensity of this accretion-powered radiation varies with time. However, because the black hole in NGC 4395 is 100 to 1000 times less massive than black holes that reside in larger galaxies, the time scale of this variability is much shorter — hours, rather than weeks. The goal of this study is to characterize the short- and long-term variability of NGC 4395’s nucleus over a wide range of time scales. Images of NGC 4395 obtained at several observatories between 2005 and 2017 were analyzed with the AstroImageJ software. The brightness of the nucleus was compared to that of non-variable stars in the images, which allowed the construction of a “light curve” that spans more than a decade. Over the entire 12-year period covered by the data, the nucleus of NGC 4395 varied significantly over the course of a day and even more over the course of a few days. These results suggest that short-term variability can be used to discover black holes in other dwarf galaxies that are not known to contain an AGN.

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

PH

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

232

Fair Category

PST

Project Number

6501

Title: Effect of Experimental Parameters on Forming Prince Rupert's Drops for Maximum Strength and Toughness.

Student Name(s): S. Godilla, C. Rodriguez

Abstract:

The history of modern glass starts 400 years ago with the creation of the world's first Prince Rupert's Drop—a thermally shocked glass bulb. It is created by dropping molten glass into distilled water causing the glass drop to cool rapidly, forming compression stresses on the exterior of the drop. The inside of the drop cools at a slower rate forming internal tensile stress. The combination of compression and tension make the drop very difficult to break. This research seeks to enhance the strength of the drop by varying the concentrations of contaminants in solution.

Poly vinyl acetate (PVA) as a contaminant suggested the largest increase in strength and was chosen as the principle variable to test. Specimens were prepared with varied concentrations of PVA (2-70%) at constant temperature and solvent composition.

Drops were tested and measured under compression revealing the maximum strength, Young's Modulus, and toughness. As the concentration of PVA increased from 2% to 50%, there was an increase in maximum compression strength and toughness; however, concentrations greater than 50% resulted in a decrease in mechanical performance.

High-speed video analysis during compression testing showed that fracture occurs internally towards the end of the tail, suggesting the air gap has a great effect on the drops strength.

Initial results from finite element analysis (FEA) indicate that the air bubble plays an important role in the fracture of the material.

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

EN 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

216

Fair Category

PST

Project Number

6502

Title: Hardening Dough

Student Name(s): X. Grant, N. Hunte

Abstract:

The purpose of this project is to determine what would happen if we put playdough in specific temperatures. In our project, we had put three different color playdough in three different temperatures to see how temperature effects deformation. The other way the project went was by having weights on top of the playdough to show what happens when a specific amount of weight is applied. The more specific way we started the experiment was by having each step down in order. First, put each playdough in their respected areas and start the five-minute timer on each to make sure we keep track on all of them. Second, when the timer is finished we took them all out and place weights on each of them to see what happens. Within the project, we found out that the playdough that was placed in the freezer had the most deformation than the other. That must have meant that the molecules with the playdough couldn't sustain the weights. This showed us that most likely molecules in cold temperatures have weaker molecules than ones in heat. This could connect with real-world events so if an artist is having a problem with there clay sculptures or anything they can put them in cold temperate area to deform it a lot easier.

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

EN EA CH

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

240

Fair Category

PST

Project Number

6503

Title: Utilization of Vertical Tidal and Wave Range to Generate and Store Energy

Student Name(s): W. George, H. Barringer

Abstract:

The primary objective of this project was to create a mechanical and electrical system to harness energy through out vertical changes of both tides and waves. Through gear manipulation and buoyancy, a mechanism was created to capture electric energy from the vertical movement of tides and waves. The system required one pillar with a toothed track along the length of the it. Mounted on the pillar with the toothed track is a raft that contains a gear system with a generator. When water levels rise or fall, the gears move along the toothed track which activates the generator and produces energy. In order to capture this energy created by the generator, a circuit that uses a diode bridge, a capacitor, resistors, and a switch was added to the mechanism. The capacitor stores the produced electric energy created by the generators. Since the mechanism was being tests in water, steps were taken to waterproof the whole system. A large waterproof box was made out of plexiglass and plywood which the system is mounted in. This box allowed for the fluctuation of the water level which made collecting data possible. In order to simulate the ocean's water movement , water was pumped between a the box containing the mechanism and a smaller tub. To test the success and efficiency of the mechanism as a whole, eight trials were conducted. The amount of energy being generated was measured using a multimeter for each trial.

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

EE ET 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

PST

Project Number

6504

Title: Green Grocer

Student Name(s): V. Novack, S. Laste, T. Jensen

Abstract:

The purpose of designing this demo app, “Green Grocer”, was to reduce household food waste. The idea to reduce food waste came from witnessing how much food is wasted. To build this app, there was a lot of researching and investigating of a variety of app makers and websites. After trying out the different app makers, one was chosen based on which one was the most professional. Once the app maker was found, the interface was designed, included figuring out the colors, content, and features. Additionally, designing how users would navigate through the app was also done by using a sidebar/drop down menu. Putting in personal designs and making the pages of the app had to be done by customizing the pages. By the end of designing the app, only a demo app was created. The app maker was used to design the app but did not provide a database to get a fully functional app and get it on the app store. Originally a database was going to be created but due to time and money constraints, the database could not be created. A fully functional app was not an option using that app maker. In conclusion, there are limitations to using app maker, some things learned were that in order to publish and create an app to put on the app store, a database is needed. If this project was continued, a database would be substantial in making it a fully functional app and available on app store.

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

EM 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

249

Fair Category

PST

Project Number

6505

Title: Mag Mover
Magnetic Air Cushion M.A.C

Student Name(s): N. Fusco, J. Lemrise

Abstract:

Mag mover

“Magnetic Air Cushion”

The project is a hybrid conveyer that could revolutionize the way that transporting and travel is done. The mag mover is a friction free device utilizing the natural law of charges in magnetism in conjunction with air to bridge the gaps in the magnetic field. The air will act as a constant static air pressure to cushion the opposing positive field and the magnets natural repelling action. The air pressure indifference is used to propel the conveyer pod. The possibilities and uses of a device like this could be used to transport commerce or people under the ocean, land or possibly even outer space.

We conducted experiments with natural magnets and electromagnets. Testing their strength using different magnetic pattern arrangements of repelling and attracting forces. We found that the attracting force was easier to amplify and calculate than the reactions of the positive repelling forces in both natural and electromagnets. Other experiments tested comprised of coiling copper wire and using a battery with opposing magnets on each end as an electro-magnetic motor. The process of adding air in the tube or track solved two problems. The air was used to move or convey the object forward also acting as a static air cushion to bridge the weakness in the ever collapsing gaps of the magnetic field. The moving action can be enhanced by increasing air velocity, air density, and static pressure. The mag mover will be an efficient, environmentally friendly method of transportation.

Technical Disciplines Selected by the Student
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EE AT 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

247

Fair Category

PST

Project Number

6506

Title: The research of Tesla's Theory into wireless transmission of Electricity, and construction of a Tesla Coil.

Student Name(s): M. Reid, M. Cloutier

Abstract:

In this project, both Michael and myself, Matthew, took apart our old tesla coil, did research into how they work, and how they help to prove Tesla's theory of wireless transmission of electricity, and then proceeded to construct one ourselves. This project took the better part of four cycles, most of which was spent doing the research. Nikola Tesla had the theory that these coils could be used to ionize a portion of the air in a bubble or field, and then using that ionized air, transfer electricity from one place to another, both wirelessly and safely. He planned to use the lower stratosphere as the transfer medium, due to the naturally insulating layers in the atmosphere created by the different mixes of gases at different levels. Naturally, this did not work, mainly due to the large amount of electricity needed for it to be possible. That doesn't mean that his work went to waste as the Tesla Coil is still an incredibly fascinating piece of technology, and a way of proving that while his theory would not work on the scale that he was hoping for, it still is possible on a smaller level, and a great way of showing off the possibilities of electrical transfer, and how experimentation, while not always resulting in what you wanted or expected, can still provide results in a way that while surprising, is also pleasing. A Tesla coil is a great demonstration of electrical power, ingenuity, and electrical engineering.

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

EE AT ET

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

PST

Project Number

6510

Title: Robotic Hand

Student Name(s): A. Steendam, J. Relaz

Abstract:

Everyone tries to create new and useful items for the future. Something that is destined to be in the future is a robotic arm. Future uses for the robotic hand can be giving people with missing limbs a robotic prosthetic. A beginning to this is building a robotic arm that can be controlled by a person's hand through a rubber glove. By connecting a rubber glove up to a 3D printed hand we are able to control the robotic hand creating the science fair project we made. When you put on the glove you'll be able to control the hand finger by finger. The engineering behind the robotic hand project is that the robotic arm has five MG995 servos inside the forearm, one for each finger, which connect to an Arduino Uno. Each MG995 servo has two strings tied to the tip of the finger running through the hand, one for tightening the finger and one for loosening the finger. When a finger is bent the signal is sent from a flexing resistor to wiring that connects the Arduino Uno and the rubber glove. Next, the signal is sent to the correct finger's MG995 servo and bends the finger tightening or loosening one side of it making the finger flex and retract when the finger bent is unbent by the user. The Arduino is programmed to help send signals from the hand to the glove telling the servos which fingers to bend and the way to turn.

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

EE AT CS

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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

PST

Project Number

6514

Title: Bartholomew's Vest

Student Name(s): L. Pietrangeli, A. Foden

Abstract:

This project aims to modify a bulletproof vest that will offer protection and comfort to law enforcement. There are 64 police officers that lost their lives in a 2016 statistic to firearm-related incidents. The vest will utilize the non-Newtonian fluid, oobleck, to create a lightweight protective vest. It is hypothesized that the oobleck will help the force of the bullet be better distributed throughout the vest. A Connecticut State Trooper was asked to oversee the experimentation in order to make sure that all legal and safety precautions were handled accordingly. He contacted Glastonbury Range and asked for private access during the week and acquired a Level II vest to be used (which minors are not usually allowed access to). The State Trooper also handled all firearms used in the project as he is certified and trained in using firearms. The results supported the idea that the mixture successfully distributed the energy of the high-speed projectile. The most noticeable difference is the projectile that was said to have the most force behind it. Data showed in the demonstration clay that without the mixture the impact area was 7 inches across and 2 inches deep. Using the same projectile but with oobleck has given a different outcome, there was no impact zone in the clay. Future developments will include enhancing the flexibility of the vest and ensuring the wearer will be comfortable as well as making the mixture non-organic while still keeping the properties of oobleck.

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

148

Fair Category

PST

Project Number

6515

Title: Project W- Domestic Water Reuse System

Student Name(s): C. Haupt, C. Ramos, T. Krieder

Abstract:

The purpose of this experiment was to test water quality of the domestic water reuse system. In order to evaluate the water quality, the potability of the system and MBAS(Methylene Blue Anionic Surfactants) were tested for greywater contamination of common household products such as mouthwash, toothpaste, shaving cream and shampoo. (Bacteria was not tested.) The standard water potability test showed that the water was not potable because it had a high pH. The MBAS test showed that the presence of surfactants had been reduced by 75.34%, but had not been eliminated. The levels in the water do not meet the EPA potability standards. While the levels are safe for some household reuse, such as toilet water, at this time additional filtration steps need to be added to the system to further reduce surfactants and pH before it is safe to use to water lawns or wash clothes.

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

EM 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

257

Fair Category

PST

Project Number

6516

Title: The Effects of Micro Vertical Axis Wind Turbine Quantity and Spatial Position in a Mesh Network on Total Efficiency and Electrical Power Output.

Student Name(s): C. Rinaldi, J. Pasato, V. Talanki

Abstract:

A significant percentage of the population relies on fossil fuels to power their electronics. Our project provides a renewable energy alternative using Vertical Axis Wind Turbines (VAWTs) to convert wind power into electricity.

Built off previous year's research regarding the design of individual turbines, an optimized network of VAWTs was developed for maximum power output in low wind conditions. Inspired by the work of Araya, et al, to define potential synergistic wake interactions of networked VAWTs, investigations were conducted for one turbine using smoke flow analysis and Computational Fluid Dynamic modeling. The results were then used to identify the areas of high-velocity wind that exists outside of the low-pressure field.

Unique arrays of six turbines were tested, adjusting their two-dimensional positions to study the wake interactions and determine the optimal placement. This allows the downwind turbines to perform up to three times more efficiently than the leading turbine.

After determining the optimal two-dimensional configuration of the VAWTs, the wake of the turbines was studied from a side view to determine their optimal three-dimensional placement. Using the most efficient two-dimensional positions, several variations were tested in the third dimension, demonstrating an increase in array efficiency of up to 7%. This three-dimensional optimization facilitated the design of an array in which every subsequent turbine is more efficient than the foremost one. The resulting design of the tree-network consists of five branches with six turbines each, and is capable of charging an 800mAh battery in approximately 3.8 hours in light wind conditions.

**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):

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

5. 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

6517

Title: Effect of Adding Reclaimed Polylactic Acid (PLA) to Virgin PLA on the Mechanical Properties

Student Name(s): M. Stefano, J. Manente

Abstract:

Presently, there is not an effective method for recycling material from 3D printers. This results in a significant amount of waste as additive manufacturing grows in popularity. Preparing blends of virgin materials with recycled materials would be beneficial to our environment and be economically favorable. The intention of this project is to investigate an ideal ratio of virgin polylactic acid (PLA) to recycled PLA while maintaining mechanical properties.

Blends of these plastics were compounded in a kit-constructed, single-screw extruder, with a $\frac{1}{8}$ inch diameter nozzle, which brought with it many difficulties. Support material from other project's 3D prints was collected and chopped using a refurbished paper shredder. The shredded material was separated by size using a series of sieves with mesh opening size ranging from 0.187 inches to 0.0937 inches. Mixed batches of ratios ranging from 5% to 50% recycled material were extruded into filament and the mechanical properties were tested.

Under the present processing conditions, it was found that even adding small amounts of recycled PLA to the virgin PLA resulted in a decrease in performance. Visual observations indicated that the experimental filament did not adhere well during 3D printing. Additionally, it was found that the ultimate tensile strength of the filament decreased upon adding more reclaimed PLA to the blend. Ongoing studies are focusing primarily on the system configuration, the consistency of the diameter of the filament produced, and the slicer settings used for 3D printing test samples.

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

EN EE

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 vertebrate animals controlled substances

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

PST

Project Number

6522

Title: Temperature-Viscosity Relationship in Predicting Seasonal Motor Function

Student Name(s): Z. Bachofner, Z. Stock

Abstract:

Viscosity of hydraulic fluid has an impact on performance efficiency. The relationship between temperature and viscosity was examined in a gradient of critical temperatures. The objective was to figure out why hydraulics and other kinds of machinery changes seasonally, and based on preliminary research, it was determined that viscosity of hydraulic fluid is a key factor in determining the speed of a hydraulic system. Viscosity is most widely known as the resistance of a liquid to flow, or in less scientific terms, the thickness of a fluid. For example, water has a very low viscosity (8.90×10^{-4} Pa/sec) compared to molasses (250×10^{-4} Pa/sec) at room temperature. The time it took for a penny to reach the bottom of a beaker filled with maple syrup was recorded at varying temperatures. The room temperature (19°C), which was the control, two hotter temperatures, and two colder temperatures were used for collecting the data. The results showed that the colder the temperature of a liquid, the more viscous it becomes, and the hotter it gets, the less viscous it becomes. This has application in the use of hydraulics because companies could adjust the ways the companies run their hydraulics systems by utilizing the properties of viscosity. Hydraulic manufacturing companies could do things like change the liquids in the system that can withstand colder temperatures. Another things that could improve hydraulics is if more time is spent making sure that systems stay warm so that the viscosity of the fluids stay lower.

Technical Disciplines Selected by the Student
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EN ET EE

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- Yes No

CSEF Official Abstract and Certification

Word Count

232

Fair Category

PST

Project Number

6523

Title: Harnessing Ocean Wave Kinetic Energy in an Eco-Friendly way to Generate Electricity
Applying Faraday's Law of Induction

Student Name(s): A. Zoghol, A. Zein

Abstract:

Today, we rely heavily on electricity, most of which is generated from non-renewable sources that are considered not friendly to the environment. A small portion of our daily electricity is generated from renewable resources at low-efficiencies. This project describes a cost-effective and efficient system to extract ocean water kinetic energy and convert it into usable electricity. The system is comprised of two parallel plates and their magnetic generators supported by 6 springs. In order to generate electricity, coils are attached to the top plate and magnets are attached to the bottom plate so that three electromagnetic inductors are formed. The bottom plate is stationary, and the top plate is designed to move up and down in response to ocean waves. The coils are connected in a series configuration and the resulting electricity was demonstrated to power a 2-volt Light Emitting Diode (LED).

The system is tested by moving the top plate vertically and horizontally. The generated AC electricity is converted into DC power using a circuit with diodes. The system is demonstrated to function in water and generated around 17 bright flickers per 20 seconds. Our system represented a great improvement from our previous first-generation model, which only generated an average of 0.159 volts every 20 seconds, less by a dividend of 12 of what was generated this year and too little to light the same LED used.

Technical Disciplines Selected by the Student
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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

250

Fair Category

PST

Project Number

6524

Title: The Effects of Breaking Down Universal Gold 1%/3% Foam Replacing ingredients with Renewable Resources

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

Abstract:

Fire departments all over the world use foam for many different calls. When it is applied, it creates a blanket on the unignited spill so it could prevent a fire, and the foam provides post-fire security by protecting the hazard until it can be secured or removed. Some fires today, such as mulch fires do not cool down with just water. In stores or landscaping companies that have large piles of mulch, the heat of the sun bakes the mulch and sometimes ignites a fire underneath the surface of the pile. If you place water on the pile it will usually go out, but the high temperature of the ambers are still there and will normally reignite the mulch a few hours later. Throughout our research, we found that there is a class of foam that is used for environmental purposes, but the majority of the materials in the foam are not able to be researched. We looked up different mixtures that could work and came up with water, soap, baking soda, and white vinegar, all of which are environmentally friendly. After developing and testing nine different solutions, we found a foam that has the smothering properties of a normal foam while also soaking through mulch. Solution eight turned out being the best with every 200 mL of water having 10 grams of baking soda, 100 mL of white vinegar, and 2 mL of soap. This foam is a cheaper but still effective method for putting out mulch fires.

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

CH EN 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

238

Fair Category

PST

Project Number

6525

Title: Positive Holes Released are Possible Early Indicators of Earthquake

Student Name(s): E. Findlan, C. Li

Abstract:

On March 11, 2011, there was a magnitude 9 earthquake off the Pacific coast of Tohoku, Japan. Frequent earthquakes in Japan are initiating intensive research for new ways to determine warning signs of an impending earthquake. In recent studies, it was discovered that electronic charge carriers, also known as positive holes, become activated in rocks when stresses are applied. Positive holes are defect electrons on the oxygen anion sublattice of silicate minerals, which are chemically equivalent to O⁻ in a matrix of O₂⁻. It is assumed that these positive holes are ionizing the air and creating an electromagnetic signal. Due to the frequent movement of the Fossa Magna, Japan's longest fault system, there is high air-ionization activity before an earthquake. If air-ionization activity and electromagnetic signals are proportional then it confirms that positive holes are released during an earthquake. The collected data from 4 stations is proportionalized to the seismic data by having the magnitude (M) be raised to the 10th power of M. The total sum of the values will then determine the total energy released by each seismic event. The values from the seismic data will be divided by time, and the resulting data will have a linear trend as it increases over time. Overall, there is a visible correlation with seismic data to air-ionization activity when an earthquake occurs. In conclusion, this data will help predict future earthquakes two to three days before.

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

EA PH

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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

PST

Project
Number

6526

Title: How do various liquids affect the speed of rust made on a metal object

Student Name(s): A. Minteh, M. Thompson, S. Dumornay

Abstract:

In this project, we are testing how various liquids affect the speed of rust on metal objects. Rust is an iron oxide (chemical compounds made of iron and oxygen) that is usually red formed because the iron and a liquid substance and oxygen were interacting. Since many modern day inventions use the iron as a key aspect to build from pipes, nails, and cell bars to making bridges, houses and even reinforced concrete. We decided to choose 4 different liquids that react with iron well over a short period of time, to determine which liquid causes iron to rust faster than usual. we decided to use hydrochloric acid, vinegar, Clorox bleach and water because these are liquids that are used in a lot of precise areas when it comes to dealing with iron. These liquids are all acidic but water. We were under the impression that if a liquid was acidic wouldn't it play a major role in how fast the iron will rust. In our experiment, we submerged the iron in the different liquids, each in separate bowls. We monitored the iron daily to see how much has rusted. All of the iron rusted but the liquids reacted in unique ways. Unfortunately, our hypothesis was proven to be wrong. The Clorox bleach rusted the iron first. Which was quite intriguing, but not a shock.

**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

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- Yes No

CSEF Official Abstract and Certification

Word Count

251

Fair Category

PST

Project Number

6527

Title: Alkalosis and Acidosis: How Dieting Affects Abnormal pH Levels in the Human Body

Student Name(s): C. Tomas, M. Kalala

Abstract:

Does diet affect an individual's pH level? Our goal is to conduct a research experiment to test if dieting can change abnormal pH levels to a more balanced and healthy pH level. We would gather 7 people with alkalosis and 7 people with acidosis and write down the symptoms they experienced in a week. After that, their non-altered and altered diet would be tested in order to see the change in the saliva and urine pH levels in a course of two weeks. The main condition tested in this experiment were alkalosis (a condition that ranges from 8 and above on a pH scale and indicates that an individual has a lot of alkaline food present in their system) and acidosis (a condition that ranges from 6 and below indicating that an individual's diet consists of a lot of acidic foods.) As a result, there were slight changes in the volunteers pH level; whereby the volunteer with the condition alkalosis' pH level reduced heading toward a neutral pH level (7) and the volunteer with the condition acidosis' pH level went up towards the more desired pH level (7). With results such as these, an individual that is experiencing symptoms that could indicate either alkalosis or acidosis, could properly alter their diet in a way that would adjust their pH level into a neutral, ideal and healthy pH level. Our future plan is to bring this information to hospitals and to raise awareness about how important a balanced diet truly is.

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

231

Fair Category

PST

Project Number

6528

Title: Effect of the Size, Shape and Spatial Distribution of the Second Phase Polymer in a 3D Printed Polymer/Polymer Composite on the Mechanical Properties of the Material

Student Name(s): G. Guzzo, A. Lacunza

Abstract:

Polymer composites are becoming increasingly prevalent in everyday life. New products rely on the synergistic combination of multiple materials to form unique properties. Present manufacturing processes mix polymers randomly, resulting in a random distribution of the secondary material, or second phase. By controlling the spatial order of the second phase in the polymer matrix, composites with unique properties can result.

This project investigated the mechanical properties of a spatially ordered polymer/polymer composite by varying the size and ordered spatial distribution of a second phase polymer in a polymer matrix. In both polymer composites investigated, PLA (polylactic acid) was used as the matrix material. The second phase was comprised of either nylon or PLA. Solid models of the composites were created using Autodesk Inventor and manufactured using the Prusa i3 MK2S with the MMU4 multi-material extruder (3D printer). This extruder is unique in that it can print multiple materials within a single layer, rather than changing materials from one layer to the next. Mechanical testing was performed to determine the ultimate strength and toughness of the composite. Video and photographic analysis provided information on the nature of the fracture mechanism.

Significant increases in maximum compressive strength and toughness were found in composites of PLA/PLA as compared with composites of nylon/PLA. Initial findings indicate that inter-material adhesion effects crack propagation and ultimately the mechanical performance of the composite.

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

EN AT

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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

163

Fair Category

PST

Project Number

6529

Title: Harvesting Kinetic Energy from Waves using "Sea-Saw Floating Arms"

Student Name(s): D. Swigart, P. Chadwell

Abstract:

The objective of this project was to find a way to harvest the kinetic energy from the waves and to transform it into electrical energy. The initial design of this engineering project was to build an inexpensive device using gears, generators, and floating arms. This project was completed in four phases. The first phase was to design the "Sea-Saw", then create a 3D print file of the design. This was done on the tinkercad.com. This had to be done carefully because the gears used to turn the generator needed to match the size of the 3D printed "Sea-Saw". The second phase consisted of printing, altering and building the gearing system, then building the base, arm and other necessary additions. Phase three consisted of creating a wave tank in order to test the "Sea-Saw". The fourth and final phase consisted of testing the final product by measuring the wattage output from the device. Data was collected and analyzed for statistical relevance.

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

EE ET PH

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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

PST

Project
Number

6530

Title: Effect of Increasing the Polyethylene Oxide in Bombyx mori Silk Fibroin on Mechanical Properties of Polymer Blend Systems

Student Name(s): A. Wilson, P. Gupta, S. Kasmani

Abstract:

Bombyx mori silk fibroin (silkworm silk) is a fibrous protein composed of beta sheet structures with various biomechanical properties such as biocompatibility, bioadhesion, and morphologic flexibility. Research suggests that this biomaterial can be used for a variety of biomedical applications involving silk scaffolds in tissue engineering. However, Bombyx mori silk fibroin must first be modified for optimal production. The addition of polymer polyethylene oxide (PEO) in silk solution should enhance the flexibility of this material, increasing ultimate strength.

This study investigates the effects of adding varying amounts of PEO in concentrations of 0.5%, 1%, and 2% on the mechanical properties of microfiber films. To prepare the silk solution, silk was extracted from Bombyx mori cocoons and added to each silk batch such that the ratio of the LiBr solution to the polymer is 4:1. The solution was placed in an oven, resulting in a viscous amber-colored silk solution. The solution was dialyzed and filtered, and various ratios of silk solution and PEO were blended together and cast films were poured. Samples cut from cast films were tested in tension using PASCO Materials Testing system and data was analyzed to find toughness, Young's Modulus and ultimate yield strength. Analysis of preliminary data shows an increase in mechanical properties with only the addition of 0.5% PEO. Further testing should reveal the ratio of PEO to silk solution that optimizes the flexibility and other biomechanical properties, significantly increasing biomedical applications and providing concrete evidence of the advantages of silkworm silk modification.

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

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

242

Fair Category

PST

Project Number

6531

Title: Analysis of Car Crash Causes in Specific areas of New Haven

Student Name(s): A. Gilbride, J. Benedetti

Abstract:

Many crashes occur in New Haven every year. The reason for the occurrence of these crashes are wide ranging, but remedies to reducing these crash numbers are very possible. Some specific areas in New Haven where crashes occur are on MLK Jr. Boulevard, Whalley Avenue near Edgewood Park, and the intersection of Trumbull Street and Whitney Avenue. The reason that these areas in particular see so many accidents, compared to other busy locations, has not been addressed well enough to see a decline in the number of accidents.

This study will be looking at trends in the data for certain types of crashes (rear end, side swipe), time of day of the accidents, and weather at the time of the accident. This will be performed by analyzing the data from the Department of Transportation (DOT) from January 1st, 2015 to June 1st, 2017, allowing us to work with 2 ½ years of crash-data. Data will be statistically analyzed by using Microsoft Excel.

Method of analyzing the data in this project will come from organizing the data from the DOT in Excel. We will organize the data by coding algorithms into the program to separate the data.

Implications of this project are we will be able to address traffic problems in areas of New Haven that see frequent crashes. It will be possible to draft a proposal to the city engineer on how to fix problems to prevent the crashes from occurring.

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

ET 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

184

Fair Category

PST

Project Number

6532

Title: Examination of the Magnetic Levitation Wind Turbine and its Conventional Counterpart

Student Name(s): P. Lehrman, A. Morgan

Abstract:

The objective of this project was to create a magnetic levitation wind turbine and test its ability to produce energy when compared with a standard wind turbine. Different designs of the “Maglev” wind turbine were explored to determine which was the least expensive, most reasonable, most effective solution for alternative energy. The greatest challenge of typical wind turbines is finding adequate space to put a wind farm. If a more efficient turbine was created, less space would have to be used to provide sufficient power. A way to increase efficiency was to reduce the friction in the typical wind turbine. Two magnets repelling each other create a near “frictionless” environment between the two magnets. A vertical axis wind turbine is the most ideal way to attach magnets; therefore, a metal rod connected to a base keeping it upright was used to place the magnets on it. Thin metal blades were then attached to the magnets and the generator was attached to a gear to produce the energy. Energy produced was measured on a Wattage output device. Results were collected and analyzed for statistical relevance.

Technical Disciplines Selected by the Student
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EE ET AT

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- Yes No

CSEF Official Abstract and Certification

Word Count

218

Fair Category

PST

Project Number

6533

Title: Effects of Ratio and Dimensions of Polyethylene Glycol and Silica Nanoparticles in a Rheological Dilatant on Shock Absorption and Unequal Shear Transfer Rate

Student Name(s): N. McMahon, E. Ngo

Abstract:

Many people die or are injured from earthquakes each year. These numbers can be limited or minimized through the reinforcement of structures and shelters for public use. Our project is to design a cost-effective system based on the addition of a dilatant (non-Newtonian fluid) into a concrete foundation to provide additional support during an earthquake. The dilatant would act as a sort of adhesive to a damaged foundation and fill cracks that are formed by the force of an earthquake.

We investigated six dilatants comprised of Polyethylene Glycol (PEG), Silica Nanoparticles (SiO₂), and distilled water. The amounts of PEG and SiO₂ were held constant, and the amount of water added ranged from 100 mL to 200 mL. A containment unit was designed and constructed for the earthquake simulator such that we could observe the movement of a metal block when placed in a volume of the dilatant. Each dilatant mixture was tested twice at four different frequencies, ranging from 8 Hz to 16 Hz. Video analysis was performed to provide information on the relative distances that the metal block moved when placed in the dilatant mixture. The ideal system would be a combination of minimal displacement and low viscosity prior to testing. Initial results show that the dilatant with 200 mL of water performed the best.

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

EN PH 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

202

Fair Category

PST

Project Number

6534

Title: How Substance pH Affects Gummy Bear Mass

Student Name(s): R. Smith, S. Senior, L. Lac

Abstract:

Diffusion is the process which molecules move from a highly concentrated state to a lowly concentrated state. This can include particles in the air as well as in liquids. When a tea bag is added to water, the particles inside the bag diffuse into the water. Even when cooking, factors like heat can affect the rate of diffusion. When the pasta is added to water, it is concentrated. The water then enters the substance causing it to become less concentrated. Diffusion happens all around us every day, especially in our bodies. Our bodies diffuse substances in our stomachs to reach the organs all around our body. Our bodies also diffuse gases in our blood and lungs. Diffusion helps our body to process many particles to keep us healthy. However, the purpose of this experiment is to test how the different pH's of various substances affect the rate of diffusion. We measured the rate by testing the weight of our gummy bears after one night of being saturated. We found that the more acidic the substance was, the better the rate of diffusion. The gummy bear that was left inside the vinegar (pH 2) had the largest mass (g) compares to the others.

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

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- Yes No