73rd Annual Fair

Connecticut Science & Engineering Fair

March 8 - 20, 2021

Student Abstracts

Middle School Life Sciences

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	Fair Category	Project Number
157	LT	1001

Title: Winter Bugs: How Arthropods Survive Winter

Student Name(s): S. Pierce , C. Wilcox

Abstract:

We have always wondered why different species of insects live outside during the winter, and how they survive in the cold winter temperatures… When you go outside in the winter you don't see bugs in plain sight but they can be found hidden in the dirt, under rocks, or sometimes near a pile of wood, or even a compost pile. When we looked outside for bugs we found a few different species throughout the three days we looked for them. and recorded the temperatures where they were found and outside, We put the bugs into beakers, after that we put them in the freezer and checked their condition , after about five minutes we checked on them to see if they were still active or not active, and then we left them in there for about 10 hours. In conclusion we found out bugs need to stay in warm places like under the dirt and or under rocks.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
215	LT	1002

Title: How Does Digestion Affect Body Temperature?

Student Name(s): H. Rogers, N. Ferreira

Abstract:

The main purpose of our experiment was to investigate how the digestion of food affects body temperature. We predicted that body temperature would increase during digestion. To test this hypothesis, we took the temperature of 10 people over the course of 8 days, both before and after the intake of food. We recorded 4 temperatures from each person per day, before and after snack and before and after lunch. After 8 days of testing, we concluded that our hypothesis was partially correct. On average, the body temperatures of our participants varied during the digestion of their snacks. However, the body temperatures of our participants during the digestion of their lunch increased consistently over the course of the experiment. If we were to conduct this experiment again, there are several things that we would like to change or do differently. First of all, we would like to test our hypothesis for a longer period of time, perhaps 2 or 3 weeks instead of 1. Second of all, we would like to record what people ate each day to see if certain foods or certain amounts of food contribute to the outcome of our results. We would also test on more people and use another tool for measuring temperature, such as a thermometer, for more accurate results.

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	Fair Category	Project Number
253	LT	1003

Title: The Effect of Pollutants on Brine Shrimp Hatching

Student Name(s): A. Marcus , E. Janush

Abstract:

Using the scientific method, our project's goal is to examine how specific common nonpoint pollutants affect brine shrimp hatching. Our experiment consisted of two trials, each of which took place over a three-day time period. Each trial contained five petri dishes with two hundred brine shrimp eggs in them. Three of the dishes each contained pollutants to mimic common forms of runoff (eco-friendly dish soap, calcium chloride, and plant fertilizer). Another contained unpolluted tap water, and the last had water from the local river. We expected to find that the hatch rates in the river would be relatively high compared to groups with polluted water, indicating that our river is healthy. After the shrimp hatched, we counted them using a precise method and recorded our results. We took the average of the data from both trials. From these results, we found that the eco-friendly dish soap was extremely detrimental to our waterways, as zero out of two hundred eggs hatched in the sample polluted with dish soap. One shortcoming to our project was that in a real river, fertilizer causes algal blooms which harm ecosystems, but in our project, algae wasn't added as a factor. Our findings conclude that all three of the added pollutants cause a decrease in hatch rate compared to our control group, but by far, it is most important for people to minimize their dish soap usage, no matter if it is eco-friendly or not, because it causes major harm to our waterways through runoff.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
222	LT	1004

Title: Agricultural Plants Reaction To Climate Change

Student Name(s): M. Serrano, J. Asapokhai, A. Croal

Abstract:

The rising amounts of carbon dioxide (CO2) in our atmosphere is interfering with plant survival rates. The purpose of our investigation was to identify which agricultural plant can best withstand the rising levels of CO2 due to climate change.

In order to prove our hypothesis that high levels of CO2 in the air will affect plants in a negative way, we conducted an experiment where radishes (Raphanus sativus) and garden beans (Phaseolus vulgaris) were planted in an environment with excessive amounts of CO2.

In our variable environment, in order to mimic a climate change affected area, we grew our variables in an air tight sealed terrarium with a water filled sponge at the bottom of the tank to act as a watering system.

Our control, (plants without increased levels of carbon), was grown in an open sunny area and watered 50ml on weekdays.

At first, we found that the variable plants flourished but ended up dying within a few weeks. This is most likely caused by an overload of CO2. Increased CO2 in the air can break through the atmosphere causing the earth to heat up.

In conclusion, we found that when agricultural sproutlings are exposed to high amounts of CO2 it affects their photosynthesis process. This is done by shrinking their pores and deterring them from creating sustainable amounts of nutrients.

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
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☒ Yes ☐ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
179	LT	1005

Title: Drought effects on plants

Student Name(s): H. Cohen, R. Forti

Abstract:

Our experiment was designed to simulate the effects droughts have on plants.We hypothesize that the plants with little water will have a hard time growing, or they will grow but not tall and healthy like A plant with an average amount of water would. We believe that the plants with high amounts of water will overflow the containers and cause the seeds to drown in the water, resulting in failed growth. The plants with no water won't grow at all because it won't have the essential water it needs in order to live.We planted six radish seeds in potting soil and watered each plant every other day. We had six different water levels in which we added to the different plants. We observed that the plant with no water didn't grow at all.The plants with high amounts of water had trouble growing because the water flooded the jars.The plants with low and minimal amounts of water grew significantly well. In conclusion, we discovered that plants will most likely have trouble surviving in droughts, as well as overflows of water.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
251	LT	1006

Title: Studying Four Climate Change Factors that Impact Plant Growth

Student Name(s): D. Isaacs, G. Haron

Abstract:

Climate change is one of the biggest global challenges of the 21st century. Man-made greenhouse gases have led to a rise in atmospheric CO2 and temperature. The goal of this project is to test the impact that climate change has on the growth of plants. We designed four experiments to study the growth of three plants - grass, radish, and mustard - under different levels of water, magnesium, and nitrogen-phosphorus-potassium (NPK). These variables are predicted to change due to a rise in CO2 and temperature, and we studied plant growth under four conditions of each variable. We hypothesized that low volumes of water would prevent plant growth and that low levels of magnesium and NPK would aid growth to a certain point after which growth would be impeded. A fourth variable was studied to simulate forest fires, which are expected to increase if climate change is not reversed. In this condition, we added different amounts of burnt wood and studied the impact of plant growth. We observed no plant growth in the control and low water levels with increasing growth at the medium and high levels. We observed minimal growth in the magnesium and NPK groups, suggesting that excess nutrients were added. Interestingly, we observed striking growth in all plants supplemented with burnt wood with a noticeable decrease in growth at the highest level of burnt wood. This project studied the impact of four factors on plant growth to aid efforts to predict and prevent damage inflicted by climate change.

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	Fair Category	Project Number
250	LT	1008

Title: A Comparison of Three Types of Honey on CO2 Emissions from Yeast

Student Name(s): A. Gumkowski, T. Salisbury

Abstract:

In this experiment, we wanted to see how three different types of honey would affect the fermentation of yeast cells. Many experiments have been done measuring the effects of honey on different types of prokaryotic bacteria proving that they do have antimicrobial properties. In particular, manuka and tualang honey are well known for this. They contain methylglyoxal, an organic compound that is known for its antimicrobial effects. Also, regular store-bought, or pasture honey, contains hydrogen peroxide, another compound used for treating minor wounds. We wanted to see how these three would affect the eukaryotic cell's ability to ferment. Saccharomyces cerevisiae, commonly known as baker's yeast, was a perfect option. We diluted 10g of each honey in water and added 2 ¼ teaspoons of yeast. Once in individual Erlenmeyer flasks, we added balloons to trap and measure any carbon dioxide that the yeast would produce. If the honey's antimicrobial properties killed the yeast, it would not ferment, therefore not producing any carbon dioxide.

In the end, we did not prove our original hypothesis that the manuka and tualang honey would kill more of the yeast than pasture honey. Out of the three, the pasture honey had a

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No
4. Is this project a continuation? ☐ Yes ☒ No
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☒ Yes ☐ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
125	L7	2001

Title: How water temperature affects seed germination.

Student Name(s): D. Delgado

Abstract:

In my experiment I wanted to see if water temperature affects seed germination. In order to test this out I grabbed 3 paper towels, made a lentil sandwich with the towels and put the same temperature of water on them. The idea is that the water temperature will change with the environment the seeds are in. The three environments I put them in are cold (refrigerator, 2.8 C), Warm (Room temperature (23.9 C), and Hot (Lamp (26.7 C). After doing this for 2 days I saw that the lentils exposed to the hot temperature water grew the largest. In conclusion plants or seeds exposed to hot water grew the largest. On the other hand the seeds exposed to the cold temperature water grew the slowest.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EA EV 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	Fair Category	Project Number
248	L7	2002

Title: Do Different Frequencies Affect Children's Ability to Concentrate

Student Name(s): P. Liu

Abstract:

The main purpose of this experiment is to figure out if different sounds or frequencies affect children's concentration. There are different methods that claim to help children concentrate more, such as taking breaks in between tasks and eating a healthy diet. I wondered if noises and the frequencies of those noises played any role in how well children could concentrate. The question was if playing background noise or working in a quiet environment was better for children's concentration, and which frequency, ranging from low to high, would result in a better score. The specific type of memory I'm dealing with is semantic memory, which is responsible for learning and making connections from past experiences. The tests I'm conducting are word memory tests and each one conducts 30 words separated by 3 sections (10 words per section). To make sure that each section of the test was fair, I made the words unrelated to each other. I divided my participants into 2 separate groups and had one as the control and the other as the variable. The control group had no sounds playing when they did the test while the variable group listened to low-to-high frequencies while taking the test. Once everyone from both groups was tested, I averaged out their scores on the tests and compared them to each other to see if there was any difference. In the end, I've found out that the variable group had overall better test scores than the control group.

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

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3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
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CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
231	L7	2003

Title: Does gender affect smiling

Student Name(s): A. DeRosia-Estwick

Abstract:

I did a project on smiling. I asked the question," Does Gender Affect Smiling?" I based my research on a website about someone who did a project similar to mine on smiling, which I found on the Internet. In the procedure, I gathered old yearbooks and used the photographs in them as my test subjects. I went through the pictures to see who was smiling or not. The test subjects were 10 boys' photos and at least 7 girls' photos. Then I analyzed the data by making a table comparing the percentage of girls and boys smiling. The results from my project showed that the girls smiled more than the boys. From the data I collected, I realized that there was a difference between boys and girls. I noticed that even if there were fewer girls in the class, the number of girls smiling was larger than the boys. Grades 4th, 5th, and 6th were studied in this project. Each grade consisted of a selection of 10 boys and at least 7 girls. I noticed that the girls were smiling more than the boys were. Overall this study has shown that gender does have an effect on smiling. A future study that could be done would be to see how blindness affects smiling. Another study that could be done would be to see if boys see a smile differently than girls.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
243	L7	2004

Title: Aquaponics VS Traditional Farming

Student Name(s): S. Martin

Abstract:

This project investigated and compared different ways to grow plants.The hypothesis stated that plants grown in aquaponic systems would produce more growth, measured in centimeters per liter of water, than traditional farming. A YouTube inspired, self-designed grow rack/pump system was built for testing. Tomatoes, basil and lettuce were each planted in a soil system and expanded clay was used as a growth medium for the aquaponic system. Plants were placed under a grow light, side by side in an environment designed to reduce confounding factors. Plants were measured every evening at seven pm. All three species grown aquaponically had greater average leaf widths and lengths. Height measurements had mixed results: tomatoes were taller in soil, basil in aquaponics and lettuce was the same for both. Confounding factors were also observed with the aquaponic system design. Measuring the plants was difficult due to the clay shifting whenever the water was pumped in, the fish were accidentally overfed causing a water change needed because the nitrates in the fish tank were at an unhealthy level. After the water was changed, the leaves of the plants started showing distress. In conclusion, the aquaponic plants grew more centimeters per liter than the soil plants with the exception of soil tomatoes. More research on growth habits and preferences of plant types is needed for future work. Developing a natural spray fertilizer to apply on plants which is also safe for fish is a potential research extension.

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

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- ☒ vertebrate animals
- ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☐ Yes ☒ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
98	L7	2005

Title: The effects of a clinostat on Garden Cress

Student Name(s): Z. Colon

Abstract:

The purpose is to see how plants grow in lower gravity. What happens when garden cress goes into low gravity? The plant on the clinostat will grow faster than the normal plant. To assemble, you must attach the 1rpm motor to the reused knife stand, drill out holes, screw the 1rpm motor in place, get the sponge set up, and turn it on. The results of the tests came out that the clinostat grew faster than the normal plants. My hypothesis was supported with data from the experiments conducted and evidence from other sources and my own research.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
240	L7	2006

Title: The Effects of Soil Type on Allolobophora caliginosa's Enrichment of NPK, pH, and Moisture Value in Soil.

Student Name(s): K. Brahmkshatriya

Abstract:

After observing my family's yard with my father, I wondered how we can better improve the yard's health without the use of chemicals. When fertilizers are used, the remaining chemicals can infect our local waterways. The purpose of this experiment is to gain further information on Allolobophora caliginosa and how their productivity changes the NPK, pH, and moisture in different soil types. This study is important because it helps with growing improved crops without the use of chemical fertilizers. The problem addressed in this experiment is: How do worms enrich and change the soil differently in various soil types including Acidic, Alkaline, Peat, Clay, and Loam/store-bought? In the experiment, 15 worms were added into 6 different soil types for 7 days. The pH, moisture, nitrogen, phosphorus, potassium of the soils were tracked using a pH and moisture meter and an NPK soil test kit. The results attained are that the pH's went towards 7, the moisture went towards the 10 level and the nitrogen, phosphorus, and potassium increased. Conclusions included that clay soil had been improved in phosphorus and potassium, and the alkaline soil the most in nitrogen. The peat ended the most acidic and alkaline soil, the most alkaline. Alkaline excelled in moisture. Scientists would use lab reports to confirm test soils. In future studies, this would be preferred. This study can help further scientists' understanding of the impact that Allolobophora caliginosa has on various soil types.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EA 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	Fair Category	Project Number
185	L7	2007

Title: The Effect of the Bee Box Volume on the Temperature and Humidity of a Wintering Hive

Student Name(s): L. LaRosa

Abstract:

The purpose of the research is to find out what size beehive boxes are best for wintering bees. How does the volume of a bee box affect the humidity and temperature of a wintering hive? The hypothesis is that the bee box with the smallest volume would have the highest temperature and humidity because the hives have about the same number of bees but the smaller box would have a higher population density. Humidity and temperature measurements were taken at three different times of the day from three different sized hives. To test the inside of the hive, a sensor slot custom piece was built for the bee box with a removable plug so you can put the pocketlab air inside the hive without harming the bees. The data shows the medium sized box had a larger change in temperature during the day. The largest and smallest boxes had an overall higher temperature and also maintained steady temperature and humidity levels. Overall, the volume had some effect on the hive environment but differences in hive conditions are also changed by the strength of the Queen.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AS EV 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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
153	L7	2008

Title: Will It Survive?

Student Name(s): S. Cuaya

Abstract:

The purpose of this experiment is to show what liquids you could and could not use to extend the life of your cut flowers (roses in this case). People should care about my project because I feel like there might be a good way to help flowers live longer, especially if they have a nice smell or if their color is just perfect for decor. My experiment gives new information to science because scientists could try and use the ingredients in vodka or in fertilizer to make a new liquid that could help cut flowers survive for a longer time (a month or even two). This could improve our lives since most people give flowers as gifts to others and it might be special and they might want to have it as a memory. Not only that, but for moms. My mom loves flowers and she loves to have them around the house.

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):

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
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	Fair Category	Project Number
169	L7	2009

Title: Does Color Affect Memory

Student Name(s): C. Colon

Abstract:

The purpose of my science project is to see if reading colored words affects memory. I created a test of 30 words in different colors and the test subject would have 30 seconds to memorize them. They would turn the paper over or cover the words and write down all the words they remembered for 30 seconds. After collecting the data, I would see how many words in each color the subjects remembered and graph it out. I predicted that yellow and red will be more forgetful than black and blue because they are lighter and don't have as much pigment as the darker colors. Results showed that red came back as the most remembered followed by black and yellow. The blue, purple, orange and green all scored much lower. The results prove people are more attracted to black since it's a dark, more prominent color and red words the subjects were alerted to it being a brighter, bold color to remember. Other colors proved to be more forgetful.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
190	L7	2010

Title: Extracting Onion DNA

Student Name(s): S. Weber

Abstract:

The reason I chose this experiment is because in class at the beginning of the year we started to learn about DNA and I wanted to learn more about it. In class we made our own slides and we looked at pre-made slides but I wanted to see MORE, so that's when I decided to Extract Onion DNA from five kinds of onions. The purpose of this experiment was to extract the DNA from onions. I used shampoo, water, and salt to extract the DNA from the onions and then I used ethanol to separate the DNA from the water. I filtered the DNA and weighed it. Different onions had different amounts of DNA. I found that the Red Onion gave me the most DNA and the White and Spanish onions had the least amount of DNA. I realize that this experiment was not comparing equal weights of the various onions so I do not know for a fact that one onion give more DNA than another. A further experiment might be to compare DNA from equal weights of onion starting material; or to study other plants, like strawberries.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
126	L7	2011

Title: The Effects of UV Light on Bacteria From a Horse Bit

Student Name(s): S. Blumenreich

Abstract:

The purpose of this project was to determine how UV light affected bacteria that came from a horse bit. How does exposure to UV light affect the bacteria on a horse bit? If you expose a horse bit to UV light, the bacteria on it will be killed. A used horse bit was exposed to UV light for four different times, 0 minutes, 5 minutes, 10 minutes, and 20 minutes, and after the bacteria grew, the petri dishes were compared. The longer the horse bit was exposed to UV light, the more bacteria was killed. Prior to experimentation, it was hypothesized that if you expose a horse to UV light, the bacteria on it will be killed. The decreasing trend in the data supports this hypothesis.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) AS 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	Fair Category	Project Number
239	L7	2012

Title: Does the 5-Second Rule really work?

Student Name(s): K. Ochoa

Abstract:

I have seen many kids eat the food that they drop because they believe in the 5-second rule. I wanted to see if it was safe to eat any food that fell on the ground by testing the 5-second rule. This was accomplished by getting apple slices, 2 containers, gloves, cotton swabs, and a timer. First, an apple slice was dropped on the floor for 1 second using the timer. Then, put your gloves on, get one cotton swap and a container, and spread the cotton swap on the apple slice. Next, take the same cotton swap and spread it around the sides of the first container, put the apple slice inside, and close it. After, take a piece of paper and write the 1 second apple slice to label it. Afterward, repeat the above-mentioned procedure with the second apple slice, except you will let sit on the ground for about 6 seconds. Finally, take the second piece of paper and label it the 6 seconds apple slice. Set both containers in a safe spot for about a week and check on it throughout the week. As a result, the 1 second apple slice was about 15% covered by mold and the 6 seconds apple slice was about 55% covered by mold. In conclusion, the 6 seconds apple slice is riskier to eat than the 1 second apple slice due to the greater mold growth observed.

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	Fair Category	Project Number
246	L7	2013

Title: Effects of X-Ray Radiation on Seeds

Student Name(s): S. Wu

Abstract:

X-rays are a unique wavelength of radiation that manifests interesting qualities and properties when living organisms are exposed to it. It can allow one to see a person's bones by making skin and tissue transparent. They are used as a method to treat cancer by irradiating cells and obliterating them. Here, four simple species of plants will be tested against this peculiar force. Cucumber, carrot, jalapeno, and wild strawberry seeds will be assessed on their reactions to x-rays and measured for responses.

For maximum growing efficiency, the seeds will be placed inside a sealed box for darkness. The reason for this is because some seeds have a growing mechanism called Phytochrome, which is a trigger to start the germination process. This pigment isn't activated when exposed to light and is only active in darkness.

After a few weeks of growing, there didn't appear to be any significant changes between sprouts in the x-ray group and the control group. They appeared regular and typical, without any special mutations or alterations. I conducted further research into previous studies and discovered that other experiments found the same result. Seeds have remarkable resistance to radiation. Mutations due to x-ray exposure only occur in seedlings.

Of the species that have been tested, some have been found to have majorly increased speeds from normal germination processes. Overall, x-ray irradiation could possibly be implemented in future methods of plant growth, making it an important subject for world health.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No
4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
153	L7	2014

Title: Using earthworms to enhance bioremediation of oil contaminated soil

Student Name(s): S. Sanchez - luna

Abstract:

My experiment is about using earthworms to enhance bioremediation of oil contaminated soil. My questions was, "Can earthworms and redworms breakdown oil in soil". I had 3 containers. One container had soil and oil (control), a second container had earthworms & redworms, and a third container had earthworms,, redworms, and PSEUDOMONAS PUTIDA bacteria. I added 10 ml of oil to all containers and then allowed the experiment to run for 2 weeks. I did keep the soil moist by adding water because worms do not like dry soil. I used Hydrocarbon detection strips to detect if there were any hydrocarbons from the oil present in the soil. My results showed that the container with only worms had mostly oil present according to the test strips and my container with worms and bacteria showed some oil present. So according to the results, adding soil bacteria in with earthworms helps to break down oil in soil.

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

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

☐ human subjects ☐ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
186	L7	2015

Title: Bedrock vs. Trees: Is There A Connection?

Student Name(s): A. Panigrahi

Abstract:

Trees are so important to the air we breathe but the common person rarely considers why a tree may grow where it does. This project considers any possible connections between different types of bedrock and the species of oak trees growing on the soil above. Analysis of the favored growing locations of six of Connecticut's most common species of oak trees was done in this project. The red oak, scarlet oak, black oak, white oak, pin oak, and the chestnut oak were the species that were used in observation. The hypothesis of this project states that there may be a correlation between the bedrock and where the oak trees are growing based on the variation and adaptability of oak trees but the data collected has proved insufficient. The results show how because of the sheer number of variables and factors to consider, the project has inconclusive results. There was just too much variation in the data to make any conclusions. The conclusion derived from this discusses potential areas for further research and possibilities of expanding the scale of this project to some degree in the future.

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

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

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2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
249	L7	2016

Title: Can you get more bees with honey?

Student Name(s): J. Spiers

Abstract:

During this experiment, I thought that the honey bees would prefer the manufactured sources of sugar. I feel that more bees will be attracted to these items because they have extra sugar added to the natural products. So they would be able to consume the highest amount of sugars. I don't believe they will go for the flowers or the honey the most because they have these sources available the most in their natural habitat. For my project I set up a table in a bee apiary that had approximately seventy hives in a ½ acre area in a field. On one side of the table, I placed six natural sources: Honey, Flowers, Apple Slices, Sliced Strawberries, Sliced Peaches, and Raw Granulated Sugar. On the other side, I placed five manufactured sugar sources: Sugar Syrup, Strawberry Jelly, Maple Syrup, Apple Cider, and Canned Peaches in Syrup on plates. I waited a half hour for the bees to smell and become attracted to the sources. I then took a photo every 15 minutes for one hour to get a "bee count" on each plate sample. The bees went mainly for the honey, with that plate having a large swarm until then honey was completely gone. The manufactured samples had very few bees during the course of the hour. The one with the most bees (approx. 60) was the peaches in syrup. So my hypothesis was incorrect, perhaps they wanted honey because it is already in its necessary form for storage.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
167	L8	2501

Title: The Circulatory System

Student Name(s): C. Huerta-Arriaga

Abstract:

My experiment is based on the circulatory system.Since I was a child I have been amazed how the circulatory system work. Once I came across the video about the circulatory system,I thought it would be a great idea to experiment on it.My hypothesis is Can I build a model that shows how the blood flows throughout the human body using the video as a guide. My Independent Variable-A bigger heart model than the regular one used in the video.My Dependent Variable-The amount of blood that can be pumped from each model.In the end, my hypothesis was proven because I managed to build 2 models 1 using the video instructions and the other making it bigger (only the ball),in order to see which model would pump the most water/blood.In conclusion, this experiment is a great way to educate how the circulate the blood and how much important is the heart in our body system and also how to prevent any problems inthe future.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
236	L8	2502

Title: Feathers and Oil

Student Name(s): C. Silverman

Abstract:

I wanted to do this experiment because I realized the seriousness of the pollution that happens when oil is spilled in our oceans. I investigated which soap cleaned oiled feathers best. While conducting the experiment, I noticed changes- even though there wasn't much oil used- that were caused to the once-clear water. One thing I noticed was how quickly the water would get foggy, to where I could put the feather at the bottom of the bucket and not see it. Imagine that, but with more oil, more water, and more animals.

I used three different soaps and three feathers for each. I'd let the feathers soak in the oil for only a minute, but it was obvious oil clumped the different parts together. Then I would take them out and put them into the soap and water mix I made. Instead of scrubbing the feathers, gently swish them around because scrubbing could damage parts of the feathers. When rinsing the feathers in water after washing them with soap, I noticed and marked when the water showed signs of fogging or residue on the bottom of the bucket.

In conclusion, the feathers were cleaned best by Dawn because the bucket had no residue and showed no signs of fogging. Palm Olive was a close second, but its water eventually did turn foggy and Ajax left residue and fogged up the water in under six seconds.

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

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3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
193	L8	2503

Title: Circadian Rhythms with Manduca Sexta Caterpillars

Student Name(s): S. Asano

Abstract:

My research question is does the amount of light a Manduca Sexta (Hornworm caterpillar) receive impact its growth? The light and dark cycle/day and night cycle should have an effect on caterpillars, as the natural cycle of physical, mental, and behavioral changes that the body/mind goes through within a 25 hour day and night cycle. This is called a circadian rhythm. The Hornworm caterpillar has five different instars, and at last, they turn into a pupae, where they will soon be ready to turn into a large moth. Just like most insects, they lay lots of eggs because many of the young caterpillars are not expected to survive, and perhaps, a matter of a day and night cycle could be a factor in deciding their fate. To be able to see how the circadian rhythm would have an effect on the caterpillar, we needed to see how healthy they were at the end of their growth after living through different day/night cycles. This could be done by measuring their length and weight once they had reached their pupae stage. The heavier and longer the caterpillar is, the healthier they are.

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

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3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
246	L8	2504

Title: Hoe Does COVID-19 Affect Different Personality Types and Demographics Emotionally?

Student Name(s): K. Kapilotis

Abstract:

This study consisted of two surveys, a standardized public domain Myers-Briggs personality test and a self designed demographics and attitudes Google Forms survey. Respondents were asked to rate their anxiety and depression before and during COVID-19 on a scale of 1 (never) to 5 (daily). Other questions examined sleep, eating and demographic categories. The data was analyzed by adding up each specific categories' responses and calculating percentage increase from before and during COVID-19. Although there was a low survey return rate, (21%), the data seemed to indicate that certain personality types and demographic groups are affected more than others. The hypothesis proposed that COVID-19 would affect different personality types and demographics differently and the hypothesis was somewhat supported. Anxiety, depression, sleep disturbances and eating disorders showed increases in most groups between the pre-COVID-19 and during COVID-19 time periods. Gender, age and personality type differences were noted during the data analysis. Females tended to have higher rates of the surveyed concerns in general, but less difference in the before and during COVID-19 percentages. ALL age groups reported increases in anxiety and depression since COVID-19 began with the largest increases reported in the 18-30 bracket. Validity of the conclusions would be improved by extending the data collection to different types of populations, increasing survey numbers, collecting data with a different survey method such as person-to-person interviews and studying whether stressors other than COVID-19 might be involved.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
154	L8	2505

Title: Farmer's Market vs. Supermarket Vegetables: Which has higher nutritional content?

Student Name(s): E. Baltrukonis

Abstract:

I enjoy cooking and have heard many people say vegetables from a Farmer's market are better. I tested this by determining whether vegetables purchased at a local Farmer's market were more nutritious than vegetables purchased from a supermarket. The vegetables I used in my experiment were radishes, carrots, and lettuce. I used a garlic press to extract juice from the vegetables and a Refractometer to then measure the nutrient content of the vegetable. I took measurements of the nutrients from the vegetables every 2 days for a week. I repeated my experiment three times. I found that the carrots purchased from the Farmer's market did have a higher nutrient content and tended to keep longer. However, the radishes from the supermarket and Farmer's market had about the same nutrient content. The conclusions from this experiment is that there is essentially no difference in nutrient content between vegetables purchased at a Farmer's market and supermarket.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) PS 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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
241	L8	2508

Title: No To Nanosilver: A Natural Approach To Nanosilver Filtration

Student Name(s): N. Kathir

Abstract:

Nanosilver (AgNP), a material 1 to 100 nm in size, is in many consumer products. Every year about 300 tons of AgNP are used worldwide, some of which is released into wastewater. This type of silver can be harmful to fish and many other marine organisms. Daphnia Magna (DM), also known as 'water flea', is an organism that is sensitive to changes was utilized to measure the toxicity of AgNP. The results from this experiment indicate that AgNP is harmful to DM even at low concentrations (0.125ppm). Hence finding an environmentally friendly solution is critical. Removal of AgNP can be achieved through chemical coagulation, but this method is very expensive and can generate 'sludge' as well as chemical waste. To develop an efficient method that is environmentally friendly, and cost-effective for AgNP removal from water system, multiple natural coagulants such as Moringa Oleifera (MO), Cicer Arietinum (CA), Activated Charcoal (AC), and Strychnos Potatorum (SP) were investigated. Our results indicate that MO was superior to all other agents in removal of AgNP and survival rate of DM significantly improved (> 99% of DM were alive even after 6 hours in MO treated - nanosilver solution). SP and CA were also effective in removing AgNP. Activated charcoal (AC) which is commonly used as a water purifier is failed to remove AgNp. To the best of our knowledge, this is the first time it is reported to effectively remove nanosilver from water using renewable biomass.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EV 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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
251	L8	2509

Title: The Use of “Essential Oils” as Punishing Stimuli on Dubia Roaches

Student Name(s): O. Morrison

Abstract:

Prior to my collection of data, I was aiming to test to see if I could train dubia roaches (Blaptica dubia) to prefer a certain food using eucalyptus and peppermint oil as punishment. This idea did not work out as expected because the roaches were not responsive enough towards the different food. The new purpose of my research and data in my project is to see if eucalyptus oil and/or peppermint oil is truly able to repel dubia roaches. I wanted to see if the oils incited a negative reaction in the roaches, thus proving their potential use in the real world as an insect and pest repellent. I used a y-shaped tube, putting either one oil on one side and nothing on the other side, or one oil on each side. I put the roach down the entrance and collected data based on which side the roach chose. I found that the multiple roaches I tested preferred peppermint and eucalyptus oil individually over the side with nothing, at the same rate. The roaches chose the side with oil progressively less, a hint at the possibility that they may be “trainable”. Overall the roaches did not prefer eucalyptus or peppermint when faced with both, but the roaches individually had different preferences. Some chose the side with peppermint or eucalyptus significantly more. These preferences could allude to the possibility that these roaches have individual "personalities." I found that these oils truly have the ability to be used to repel roaches.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
243	L8	2510

Title: COVID-19's Impact on Water Quality in Recreational Areas Along the Long Island Sound Coastline

Student Name(s): I. D'Agostino

Abstract:

When the pandemic started, other countries reported a drop in forms of pollution. Italy reported they finally had clear water in the Venice canals. This was attributed to strict lockdown measures that were put in place limiting all economic and non-necessary activity. When I heard about this I wanted to see if Long Island Sound would experience the similar effects on its water quality as other countries that were going through lockdown. For the past two years, I have gathered water quality information by testing salinity, pH, ammonia, phosphate, nitrate, nitrite, calcium and carbonate hardness at six recreational coastal beaches. Data was taken from previous years and compared to this year's data collections during a six-month interval. It was seen that many of the parameters did not follow the typical trend line that was observed in 2018 and 2019. Improved water quality was recorded at recreational areas adjacent to metropolitan areas, while in more rural areas, the water quality fluctuated, perhaps due to the increased social activity of families seeking recreation during the pandemic. It was seen that 2020's ammonia levels increased about 50.01% from 2019 and 48.81% from 2018. The pH levels from 2020 decreased by about 3.04% from 2019 and about 3.29% from 2018. These are examples of how the pandemic could have affected the Sound and I am interested to see how the water quality continues to trend in 2021 as we move out of the pandemic.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EV 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
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
262	L8	2511

Title: Dog-Be Gone-No Plastic: An evaluation of dog waste bag materials and biodegradation

Student Name(s): P. Pitsoulis

Abstract:

From 2019-2020, in the U.S., 63.4 million household dog owners used over a billion waste bags in just one month. The increased amount of dog ownership also resulted in the usage of plastic bags that cause significant pollution to the environment as they are non-dissolvable, are a source of waste in landfills and oceans, resulting microplastics and chemicals leaching out of the plastic into the environment cause health problems in humans and ecosystems.

I wanted to find a way to substitute those plastic bags with an environmentally friendly biodegradable material that will help reduce harmful waste from entering the environment. I have tested bags created by EPI (Environmental Products Inc.) technology, biodegradable starch materials, made of plants and vegetables, made of corn, biodegradable high-quality HDPE (High-Density Polyethylene) plastic, water-soluble material, and PVA (Polyvinyl Alcohol) material.

I created controlled environments using tabletop greenhouses. The environments-maintained temperatures between 27-47°F -and above 75°F- with a humidity range 65-80%. The water-soluble bags exceeded the biodegradation time of all the other materials, as they dissolved in 5 minutes (above 75°F-and/or humidity range 65-80%) and 15 minutes (27--47°F). However, they can be hard to use, especially in hot and rainy/humid environments, as they dissolve so quickly without giving dog owners a chance to dispose of them appropriately. Therefore, I would recommend the second-best bags, the vegetable/plant-based bags, that still dissolving quickly, 5 days (above 75°F- and/or humidity range 65-80%) and 20 days (27--47°F) and the dog owners can dispose of them without worries.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
248	L8	2512

Title: The Effect of Macronutrients (NPK) on Plant Growth and Development

Student Name(s): S. Choppakatla

Abstract:

Nitrogen (N), Phosphorus (P), and Potassium (K) are plant macronutrients present in most plant foods/fertilizers. The objective of this study was to see which of these nutrient elements play a major role in overall plant growth and development. The study hypothesis was that plants that receive all three elements would grow the most. To evaluate this hypothesis, an experiment was designed using Tomato and Lettuce plants as experimental units. Tomato and Lettuce seed (35 each) were planted in soilless media. Germinated seedlings were then transplanted into another soilless medium. Lettuce seedlings did not establish successfully. Hence, the experiment was continued with just Tomatoes. Transplanted seedlings were split into five treatment groups (N, P, K, NPK, and UTC) with five plants per group. N group was given Nitrogen (Urea). The P group was given Phosphorus (Super Phosphate) and the K group was given Potassium (Potassium Sulfate). NPK group was given all three nutrients. UTC group did not receive any nutrient solution. All treatment groups including UTC received micronutrients. Nutrient applications were made twice (2 and 6 weeks after seeding). After 7 weeks of growth, plant height was measured followed by measurements of fresh and dry shoot weights. All measurements were averaged by treatment and analyzed for treatment effects. Due to indoor growing conditions, plant growth and development were not adequate. As hypothesized, plants in NPK group were taller with the highest fresh/dry shoot weights. Interestingly, potassium seems to have the greatest influence on plant height and weight.

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):

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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	Fair Category	Project Number
248	L8	2513

Title: Effectiveness of Whitening Toothpastes

Student Name(s): C. Doran

Abstract:

For my science fair project, I decided to see if different whitening toothpastes work better than others to whiten stained teeth. In theory, a hard-boiled egg's shell works similarly to the enamel on a tooth. Both an egg and our tooth's enamel are made up of calcium. Because of certain ingredients in toothpastes, they are able to get out the worst stains. This experiment demonstrates how beverage choice can make an impact on our teeth.

To test my hypothesis, I used hard-boiled eggs soaked in 5 different beverages for 24 hours. The eggs were then taken out and stored in a refrigerator. The eggs shell was tested using the tooth dental shade guide provided by a Registered Dental Hygienist. I brushed the eggs for 1 minute, twice a day, for 14 days. The eggs were then examined to see the difference between the shell before and after the brushing.

The toothpastes used in this experiment were Crest, Colgate, and Arm & Hammer. There was no difference found between the three toothpastes on removing the wine stains. All three had a minimal effect. Coffee displayed the greatest difference in using Arm & Hammer to remove the stain. There were slight differences in Gatorade but Colgate faired better. While Arm & Hammer worked best on removing iced tea stains, Crest was the winner for whitening Coca-Cola stains. Overall, Coffee and wine seemed to be the hardest stains to remove. Arm & Hammer displayed the greatest shades of whitening across all beverages.

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	Fair Category	Project Number
168	L8	2514

Title: Light 'Em Up

Student Name(s): M. Chirayil

Abstract:

Bacteria are prokaryotic, microscopic organisms that can be found anywhere in the world. Commensal, or "good'' bacteria are normally found in human beings and are vital to their health. There are also very harmful bacteria that can cause serious infections and can even lead to death. These kinds of bacteria can be sterilized in many different ways. A common way to sterilize bacteria is to use light. In this experiment, multiple kinds of lights were tested to find out which one was the most effective in killing bacteria. A total of eight lights were used in this experiment including UV-C light, black light, blue light, red light, white light, sunlight, infrared light, and a microwave. Disinfecting wipes were also used in the experiment to see how well they did compared to how the lights did. To determine which light was the most effective, the bacteria spores in each petri dish were counted. The petri dish with the least amount of bacteria showed which light did the best.

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

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

☐ human subjects ☒ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☒ Yes ☐ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
248	L8	2515

Title: Building and Testing a Simple Portable Constructed Wetland to Purify Greywater

Student Name(s): T. Zoghol

Abstract:

Around the world, lack of adequate sanitation and clean water is a growing issue. In many countries like Mozambique, Niger, Chad, Angola, Somalia, and Ethiopia, child malnutrition, and diseases are prevalent due to the lack of clean drinking, bathing, and cooking water. Many children have to walk miles two to three times a day to obtain water for their families. However, most of these water sources are not sanitary and hold numerous viruses and diseases. Since most people have no other water sources, they are left with opaque, dirty, and infected water, and often get sick and suffer health problems or die from it. The goal of this project was to devise and test a simple, cheap, natural, and effective system to purify dirty and unsanitary water using reusable recycled items such as bins, pipes, and tubes. This system uses a variety of wetland plants specifically cattail, growing in a rectangle 1" 10inch reusable box. At the "entrance" of the water system, a layer of gravel was added for even water distribution and the wetland plants would absorb the nutrients and filter the water in its root bed. The system was built as a natural water filtration system and was successful in effectively cleaning the water leaving it with no visible sediment after it went through the system. This system can be made and used around the world on a single-household scale to improve water sanitation and lower the risk of death or sickness from dirty water.

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

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

☐ human subjects ☒ potentially hazardous biological agents
☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
248	L8	2516

Title: The impacts of the presence of Canada Geese (Branta Canadensis) on the water quality in local ponds and lakes.

Student Name(s): E. Quijada

Abstract:

My project 'The impacts of the presence of Canada Geese (Branta Canadensis) on the water quality in local ponds and lakes studys how the amount of geese and rainfall affect phosphate and nitrate levels in bodies of freshwater. My hypothesis was that the more rain that has fallen in the past week, and the more geese estimated at that location will increase the amounts of nitrates and phosphates in the water, because the nutrients contained in waste from the geese would be washed into the water. I conducted this experiment by going to two locations: a pond at Meig's Ravine and a lake at Butternut Park in Middletown, CT and took samples every Saturday while also estimating the amount of geese at each location. I tested these samples for temperature, ph, nitrate, phosphate levels and noting any unusual circumstances. I used an online source to record rainfall amounts and air temperature. After 8 weeks I concluded the testing period. I consistently recorded 0ppm for phosphate levels, which supports that the amount of geese and rainfall did not adversely affect that parameter. Using trend lines to interpret my data I noticed that more rainfall lowered nitrate levels and increased ph levels slightly. They also showed that nitrate levels rose as geese numbers also rose but ph levels dropped slightly. Overall, the data showed a healthy water quality in these ponds. If I were to do this project again, I would test more often and make efforts to increase accuracy.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EV 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	Fair Category	Project Number
244	L8	2517

Title: Microplastic Concentration in Four Harbor Locations in Fairfield County, CT

Student Name(s): S. Atehortua

Abstract:

The purpose of my project is to analyze and compare the amount of microplastic particles that are found in (1,000 ml) of ocean water after gathering water samples from Four Harbor Locations in Fairfield County, CT. (Milford, Westport, Bridgeport, and Norwalk). To compare the microplastic particles found in all harbors I created four filter devices made of 2 inch PVC tubing and nitex screening (plankton netting) of four sizes (400, 200, 80, and 30 micron sibs). To see the microplastic particles I used a fluorescent U.V light in the dark and a magnifying glass to supply the dissecting scope function. This process was effective and showed results. Microplastics are small pieces of plastic, less than 0.2 inch in length, that occur in the environment as a consequence of plastic pollution. Plastic pollution in many forms breaks down into tiny bits of plastic no bigger than the period at the end of this sentence. My hypothesis was not supported by data because I stated that Bridgeport Harbor in comparison to the Westport, Milford, and Norwalk locations will be the most polluted because of the increased number of human population and industry present. Norwalk Harbor was the most polluted (with an average of 374 particles), Milford Harbor was the second most polluted (with an average of 281.25 particles), Westport Harbor was the third most polluted (with an average of 242.25 particles), and Bridgeport Harbor resulted being the least polluted harbor (with an average of 100.5 particles).

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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2. Student independently performed all procedures as outlined in 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	Fair Category	Project Number
188	L8	2518

Title: Let's Get Scrubbing!

Student Name(s): C. Wilhelm

Abstract:

Now, especially during the COVID-19 era, I've always been told, "wash your hands for twenty seconds." I became curious, do you actually have to wash your hands for the duration of singing "happy birthday" twice, and do you need to wash with antibacterial or regular soap? I turned this into an experiment by testing how quick and effective of killing germs on your hands is antibacterial vs. regular soaps. Using Glo Gel to simulate germs I first rubbed that on my hands, followed by different types of soaps (antibacterial and regular) - one at a time - and washed my hands under warm water. Every five seconds, I shone an Ultraviolet (UV) Light to see how long it would take for all germs to come off my hands and which type of soaps works best. My results showed that antibacterial soaps work only VERY slightly better than regular soaps. Also, by fifteen seconds, every soap that I tested removed the germs completely. Based on my experiments, it is totally fine to use regular soaps in a non-healthcare setting and they do a very effective job in removing germs.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
190	L8	2519

Title: Can trust kill? Covid-19 and Social Capital.

Student Name(s): Z. Haque

Abstract:

Covid-19 is the most critical issue facing humanity right now. It is vital to conduct research on the factors that contribute to Covid-19 cases and deaths so that we can better understand which populations and communities are most vulnerable to this virus. My project investigates whether 'Social Capital' is correlated with Covid-19 cases and deaths. Social Capital measures the amount of trust and web of connections among members of a community or region. Using county-level data from the US Senate and The New York Times, I used multivariate regressions to statistically test the relationship between Covid cases/deaths and Social Capital. After controlling for Income, Diabetes, Minorities, Density & %65 years old+, I found that Social Capital has a positive and statistically significant correlation with Covid cases and deaths. The component of Social Capital that is most strongly correlated with Covid cases and deaths is Family Unity. Overall, my findings indicate that a potential downside of high social trust is that it may lead to greater transmission of Covid-19. These results will be of interest to policymakers and healthcare providers in the fight against Covid-19.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in this abstract. ☒ Yes ☐ No
3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification

Word Count	Fair Category	Project Number
181	L8	2520

Title: Heart Rate Recovery Times

Student Name(s): T. Frouge

Abstract:

Heart rate recovery times differ for everyone more specifically athletes and nonathletes. So what I am testing is whether athletes' heart rates recover faster than nonathletes. What I predicted was that athletes' heart rates would recover faster than nonathletes because their lungs are more accustomed to having less oxygen or being winded from running or doing physical activity. So what I did was have a group of athletes and nonathletes each run-up and down the stairs for 2 minutes each. But first, I checked their resting heart rate which is their heart rate before exercising. Then they ran up and down the stairs for 2 minutes. Immediately following the exercise I recorded their heart rates and wrote them down. Then I timed how long it took each athlete and each nonathlete to get back to their regular heart rate. The results were that all of the athletes recovered faster than the nonathletes after exercising. In conclusion, my hypothesis was correct the athletes did recovery faster and they also had a lower heart rate than all of the nonathletes after exercising.

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