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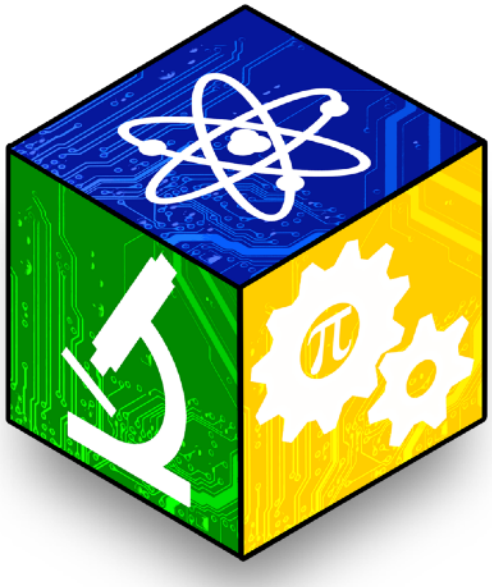

75th Annual Fair
March 6-18, 2023

Student Abstracts

Fair Categories

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

Technical Disciplines

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

Technical Discipline 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
2023

Word Count	Fair Category	Project Number
252	LT	1001

Title: Self Sustaining Fish tank

Student Name(s): M. Bielanski, M. Cerkanowicz, N. Bohonowicz

Abstract:

We wanted to prove that the tank successfully could survive on its own without needing human interaction. We filled the tank with filtered tap water, a dechlorinate, substrate, lava rocks, wood, and plants. We waited a week so the log could become waterlogged. Then, we added 10 ghost shrimp to prove that animals could survive in this self-sufficient tank. We did not add fish due to the harm from the lack of a water filter. Next, we documented the water temperature each day to guarantee it stayed between 20-30°C. The lava rock provided the bacteria with more area to grow, preventing the build-up of ammonia which could harm the inhabitants within the tank. We observed the tank for over a month. Before this, we learned about the nitrogen cycle involving the fish eating food that produces ammonia. The animal feces contains ammonia, which floats in the water and is consumed by the animal. Too much ammonia is harmful to the tank. To keep the tank self-sustaining, the bacteria that grow independently must consume the ammonia. By the end of the month, 8 shrimp thrived in the tank and produced more shrimp. The bacteria is thriving and is throughout the tank. We know the tank is self-sustaining because the survival rate of the shrimp after the initial month exceeds the original number. A self-sustaining fish tank can be used as a model to create other self-sustaining environments. In particular, as humans explore sustainability and life on Mars.

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
2023

Word Count	Fair Category	Project Number
193	LT	1002

Title: Promoting Outdoors Safety By Altering Pregnancy Tests to Detect Urushiol

Student Name(s): A. Tran, V. Villacres, T. Lazo

Abstract:

This project aimed to design an indicator to detect when an allergenic toxic in poison ivy fluids is present. This study determined whether or not a pregnancy test could be altered using treatment compounds and proceed to detect urushiol in fluids successfully. The proposed solution to this problem was to create an indicator using a pregnancy test to indicate if urushiol, the allergen in poison ivy fluids that cause allergic reactions, is present. The prototype, which has been named Generation One: IvyX, did not succeed with a success percentage of 0%, as it did not result in a negative nor positive test; however, Generation Two: IvyX and Generation Three: TechNu had a success rate of 50%, and the urushiol was able to set off dye pods to produce a negative test, but not the antibodies to create a positive test. The altered pregnancy test designs display promise to work to full potential by creating both accurate positive and negative tests and also to have a lasting impact on society if perhaps more advanced and complex antibodies were used to bind with the urushiol, set off the dye pods, and produce a truthful test.

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

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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
2023

Word Count	Fair Category	Project Number
115	LT	1003

Title: Water H20?

Student Name(s): V. Morris, J. Batista

Abstract:

Abstract: The purpose of our science fair project for this year was to aid students in understanding a chemical reaction in a nutshell. I believe people should care about our work because it simplifies and assists people in understanding electrolysis and properties of chemicals and elements. This project gives us new scientific information because it shows how at home appliances can also be used to create our invention "The Divorcer" that uses electrolysis to create a chemical reaction. This information can also be used to improve lives by giving new scientific information. This information not only simplifies scientific processes but can help us understand the usage of the LUX provided from the chemical reaction.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) CH 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
2023

Word Count	Fair Category	Project Number
124	LT	1005

Title: Does Personality Affect Memory?

Student Name(s): A. Jacobs, M. Abreu

Abstract:

The purpose of this project is to see if personality affects memory. For this project, we used the Myers-Briggs personality test to find out if our participants were introverted or extroverted. Then we had them take a memory quiz to find out their memory percentage. Then we had to calculate their personality results. We did this by adding whatever their result was to 50 and then subtracting your answer from 100. We continued to test 10 people and we did 2 a day so we had time to write their results. We found out personality does affect memory. Extroverted people remembered more than introverted people. We did this project because we thought that introverted people would remember more and we were proved wrong.

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
2023

Word Count	Fair Category	Project Number
205	LT	1006

Title: The effect of caffeine on plants

Student Name(s): K. Cieslak, S. Patel, B. Dugas

Abstract:

How does caffeine affect the growth of plants? A positive effect on plants would be a cheap and efficient way to improve the growth of crops therefore making more food and saving many people's lives. Our hypothesis stated that a higher concentration of caffeine would stunt the plant's growth and a lower concentration would possibly enhance it. In order to test this, we used four different variables with different concentrations of caffeinated solutions- a 10%, 20%, 30%, and 40% solution. We then would water them every day except for weekends (three days with tap water and two days with their designated caffeine solutions). We found that high solutions of caffeine stunt the growth of plants. The average growth of the plants that were watered with high concentrations of caffeine was significantly less than our controls. We suspect this is because when the plants were watered with the high concentrations of caffeine the plants could not take in as much water as they needed in order to survive. The reason the plants did not get enough water was because according to a recent study by Sarah Ferguson, caffeine decreased the surface area of the plants roots therefore decreasing the amount of water it could take in.

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):

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☐ vertebrate animals ☐ controlled substances

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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
2023

Word Count	Fair Category	Project Number
240	LT	1007

Title: The Effect of Microplastics on the Lifespan of Daphnia magna

Student Name(s): Z. Wirgin, M. Wirgin

Abstract:

The increasing presence of microplastics in oceans, rivers, and lakes around the world has raised great concern in recent years, however their toxicities to natural ecosystems and human populations are largely unknown. In this study, we hypothesized that microplastics are toxic to vital components of ecosystems. Daphnia magna is an important small crustacean species in freshwater ecosystems that consume bacteria, algae, and phytoplankton that are critical components at the base of aquatic food chains. It is a widely used organism in toxicity testing. We addressed our hypothesis by testing whether 1uM polystyrene microplastic beads decrease the survivorship of Daphnia. We exposed 20 Daphnia to each of five different concentrations of microplastics and a negative clean water control. We counted twice daily the number of Daphnia that were still alive after exposure. Within 24 hours all of the specimens exposed to the three highest volumes of microplastics (20uL, 50uL, and 100uL) had died. After ten days of exposure, the survivorship was greater in the negative control than the Daphnia treated with 5uL and 10uL of microplastics. Therefore, our results showed a dose responsive decrease in survivorship of Daphnia over the course of our experiment. We conclude that microplastics may impair ecosystems by reducing the survivorship of the invertebrate populations at the base of their food chains. Our experiment was important because it was one of the first to demonstrate that exposure to microplastics can negatively affect the viability of aquatic invertebrate populations.

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
2023

Word Count	Fair Category	Project Number
215	LT	1008

Title: The Effects of Different Materials on The Strength of Bioplastic.

Student Name(s): P. Maher, R. Rodriguez, K. Paguay

Abstract:

This experiment is designed to test which bioplastic would have the qualities of normal plastic. Bioplastic is more environmentally friendly than plastic. Find a quality bioplastic and turn it into cups to compare it to normal plastic.

We made different bioplastics and tried to make them like plastic. We used a spring scale which we used to weigh, stretch, and test the durability of the bioplastic. We compared the bioplastic to plastic by each making them do the same test. We had to make the bioplastic and then let it harden for 2 days to make it harden, when it hardened that is when we did the tests.

The Bioplastics had almost the same durability and stretchiness as bottled plastic which shows that all the bioplastics can be used as plastic. This shows that the bioplastics are all around 8 -10 N for durability. This supports that bioplastic can be used as plastic because they almost all have the same data results. But the bioplastic didn't have the same weight as the bottled plastic at 20 g and bioplastic weighed around 8 to 10 GM. So the overall trend is that the Bioplastics almost had the same durability and stretchiness as bottled plastic which shows that bioplastics can be used as plastic with some minor improvements.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) 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
2023

Word Count	Fair Category	Project Number
190	LT	1009

Title: 5 Second Rule

Student Name(s): E. Drexel, M. Athanasiadis

Abstract:

This experiment is about whether or not food that has hit the floor for a certain period of time is still safe to eat. Many people think the five-second rule does not affect the food, so they just pick it up and eat it. However, it has the potential to attract lots of germs that shouldn't be consumed. This will be tested by dropping different foods and timing how many germs will attract to the food in five seconds. After we will pick up the food with tweezers and swab the food on the side we dropped, then gently place the swabbed liquid in the sterilized petri dish. By sterilizing the petri dish, one cup of water is placed in the microwave for one minute or until the water boils. The water then cools and one teaspoon of Nutrient Agar Powder is poured into the cooled-down water. The agar powder dissolves in warm water and is poured into the Petri Dish. This experiment was to see if the five-second rule was effective and how it would help kids worldwide. This experiment could prevent food waste and sickness.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
220	LT	1010

Title: How Different Liquids Affect the Growth of Plants

Student Name(s): S. Pagano, S. Gnoza

Abstract:

Plants need liquid to grow. But does the type of liquid make a difference? We wanted to know if different liquids would affect the growth of plants. To find this out, we first planted marigold seeds in 5 pots. We assigned each plant with a different type of liquid. These liquids include rainwater, bottled spring water, tap water, salt water, and juice. We then put the plants in a spot with sunlight and watered the plants every other day with their designated liquid. We observed that out of all three times we performed the experiment, the liquid that is most effective for plants is bottled spring water. The salt water and juice did not produce any sprouts during all three of our experiments. This is because salt water and juice contain harmful ingredients such as food dyes and sugars that can stunt plant growth or cause the plants not to grow at all. We concluded that the bottled spring water works the best to grow your plants. The plants watered with bottled spring water grew the tallest and fullest out of all 5 liquids. We feel that bottled spring water may be the cleanest and purest water out of all of the liquids, which proved beneficial to plants. We also concluded that rainwater may possibly contain pollutants that inhibited growth.

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
2023

Word Count	Fair Category	Project Number
237	LT	1011

Title: How Lawn Chemicals Affect Soil Biodiversity

Student Name(s): D. Lamattina, C. Wilson, S. Plaz

Abstract:

Does the application of lawn pesticides affect soil diversity? We surveyed 3 sites for biodiversity, a well maintained soccer field, an abandoned baseball field, and an untended field behind our school's chicken coop. We believe that the soccer field, which uses pesticides and herbicides, will have far less biodiversity than the baseball field and chicken coop field, which do not use them. Soil biodiversity reflects a wide web of biological activity between an ecosystem's flora and fauna. This web represents a series of relationships that serves as an anchor for many ecosystems. Other benefits of a large soil biodiversity include improved water retention and a growing carbon sink. Initially, we collected soil samples from the 3 fields. We used a microscope to inspect and sort the types of invertebrates and plant life. We also used a LusterLeaf Soil Kit to test for phosphorus, nitrogen, pH, and potassium levels. We determined that the soccer field was more acidic and had less biodiversity than the other two fields. It also unexpectedly contained low amounts of nitrogen and potassium levels since it is treated on a regular basis. The nontreated baseball and chicken coop fields contained more invertebrates and types of plants, contributing to their overall high biodiversity levels. Our project can assist scientists and landscapers in learning about the effects of pesticides and herbicides on soil flora and fauna so more solutions can be found to prevent biodiversity loss.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) PS EA 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
2023

Word Count	Fair Category	Project Number
206	LT	1012

Title: The Effect of Fertilizer Runoff From Golf Courses and Suburban Areas on the Growth of Pea Plants

Student Name(s): C. Gleason, E. Speicher

Abstract:

Fertilizer runoff in streams and rivers can have cascading effects throughout various ecosystems threatening the lives of plants and animals. We wanted to see the difference of fertilizer runoff in the streams before the golf course, after the golf course, before the neighborhoods and after the neighborhoods. To do this we collected water samples from the beginning of the golf course, and the end of the golf course. Then the beginning of the neighborhood stream, and the end of the neighborhood stream. We tested these water samples by planting sets of pea plants, each consisting of one of the different water sources. By watching the different growth in the pea plants we were able to see how the fertilizer, or how the amount of fertilizer affects the ecosystem. From the results of our experiment we found that from the stream before the golf course, the plants grew less, they were weak and they didn't grow as fast. On the other hand the plants after the golf course were stronger, grew faster and grew taller. This shows that the golf course most likely has a lot of fertilizer runoff. In conclusion, this fertilizer runoff is polluting our water supply and making our rivers dirtier by the day.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EV PS 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
2023

Word Count	Fair Category	Project Number
245	LT	1013

Title: Amazing Ants. Which Type of Fruit do Ants Like Best?

Student Name(s): N. Gendreau, D. Ghezzi

Abstract:

After watching an ant crawl on a squashed pumpkin, we wanted to determine what type of fruit ants like the most. To answer this question we created an experiment where we measured how long it took Harvester Ants to travel to slices of fruits such as apple, lime and watermelon. Our hypothesis was that watermelon would attract the ants the fastest out of all these fruits. We constructed a wood container with a plexiglass cover. Then ants were given the opportunity, one at a time, to seek the sliced fruit at the far end of a container. Using a different ant for each of 5 trials, we timed how fast it took the ants to arrive at the end with no fruit present or with a slice of one of the three fruits. On average the ants made their way to a slice of lime in the shortest amount of time. The average amount of time it took the ants to seek the lime slice was 131 secs. This is a 58 second improvement over the average time when no fruit was present. It is 56 seconds faster than the average time it took the ants to arrive at a slice of watermelon. Our conclusion is that our Harvester Ants like lime the best when compared to apple and watermelon or no fruit. One interesting result was that the fastest trek to a fruit was made to sliced watermelon in a time of 6.6 secs.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
200	LT	1015

Title: Lettuce Tell You About Hydroponics

Student Name(s): C. Johansen, M. Scalzo, B. Caserta

Abstract:

For our experiment, we observed and documented the growth of two lettuce plants. One lettuce plant grown hydroponically in a peat pod and one lettuce plant grown in soil in a pot. We observed these two plants each day for 4 weeks. We watered the lettuce plant in the soil daily to keep the plant damp. The hydroponic lettuce plant is grown in water so we did not need to water that plant. We also placed both lettuce plants under a plant heat lamp for a few hours each day to help with their growth. We took pictures and observed the plants. We came to the conclusion that the lettuce plant in the soil grew at a faster rate and grew slightly larger, however, the hydroponic lettuce plant did grow but at a slower rate. The hydroponic lettuce plant could be an option for someone that does not have the time to take care of the plants in the soil since the plants in the soil require watering daily and hydroponics does not. Hydroponics is also a great option for year-round if the climate outside is not conducive to growing or if there is not any space to grow.

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
2023

Word Count	Fair Category	Project Number
244	LT	1016

Title: Recycling Graywater for Plant Growth

Student Name(s): D. Pappas, H. Buttrey, C. Quinby

Abstract:

Global climate change is causing more severe droughts and water shortages. Therefore, it is important to look at new methods of water conservation and recycling. Graywater is waste water from households, which is uncontaminated by fecal matter. This includes the leftover, untreated water generated from washing machines, bathtubs, and sinks. In our experiment, we tested how graywater from different laundry detergents affects the growth of plants. We hypothesized that graywater, from eco-friendly detergents (Ecos, Blueland, and soap nuts), would be better for plant growth. Graywater with the Tide detergent would be detrimental to the plants because of high levels of sodium according to studies done at UMass. Their study showed sodium causes the plants to dry out and stunts their growth. In our test, we used chia, lentil, and grass seeds. We ran one wash cycle per detergent and connected the drain pipe of the washing machine to a rain barrel to collect the four graywaters. Each series of plants were regularly given the same amounts of graywater over the given time. We observed that the plants watered with Tide, soap nuts, and Blueland grew the same as our control plants, which were watered with standard tap water. However, the plants that were given the Ecos wastewater did not grow as well. Graywater needs to be further studied so it can be used to its fullest potential, but based on our testing, it is a practicable solution for water conservation in all communities.

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

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

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
187	LT	1019

Title: The Benefit Of The BioBroth Bubbler On Formaldehyde-Infected Air

Student Name(s): B. Kaur, N. Giron

Abstract:

The proposed solution to the problem was to create a prototype named the 'BioBroth Bubbler' using indoor plants and Grow-Tone Esposma biofertilizer to make air healthy for humans and animals by removing Formaldehyde. A model system was made in a closed system with high Formaldehyde levels, in which Azotobacter was bubbling with the help of an air pump as the Peace Lilies grew in the fertilizer. The project aims to design a prototype that decreases indoor toxins, specifically Formaldehyde. This study determined how the amount of a bacterial fertilizer (Esposma) in a BioBroth Bubbler impacted Formaldehyde levels in the air. The overall trend noticed in the experiment was that the Esposma Organic biofertilizer (bacterial fertilizer) was the main assistant to Formaldehyde decreasing. The 3rd generation of the BioBroth Bubbler with the lowered pH level deducted most of the Formaldehyde in the closed system, fulfilling the goal of reducing the levels of Formaldehyde from the polluted air. There were better results with a lower pH substance because we learned that a slightly acidic substance might provide beneficial nutrients for the plant to achieve maximum growth and productivity.

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

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4. Is this project a continuation? ☐ Yes ☒ No
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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
132	LT	1020

Title: How Does the Application Method of Strontium Aluminate Affect the Amount of Glow Transferred to Leaves?

Student Name(s): I. Smith, S. Olabisi, N. Alfonso

Abstract:

This experiment was designed to create an eco-friendly light source, using glowing flowers, for paths, sidewalks, etc.

Strontium aluminate was added to three begonia plants, in different ways. It was added to the soil of one plant, the water of another plant (daily), and the third plant had strontium illuminate "painted" on its leaves weekly. The plants were placed under a black light daily, and the Light Meter app was used to measure each plant's lumens.

After approximately three weeks, the "painted leaf" plant glowed at 26 lumens, the water plant glowed at 6 lumens, the soil plant glowed at 3 lumens.

This project determined that the begonia with paint applied to its leaves on a weekly basis produced the most lumens, thus was the most successful eco-friendly light source.

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
2023

Word Count	Fair Category	Project Number
243	LT	1021

Title: Which plant is more efficient at reducing carbon dioxide from the air, through photosynthesis?

Student Name(s): M. Agrafojo, A. Burnham

Abstract:

Which plant is more efficient at reducing carbon dioxide through photosynthesis? Our hypothesis stated Bamboo, which is fast growing and a resource for carbon sequestration, would be most efficient. We created three air-tight containers, connected to water tubes and the Vernier Labquest 2 sensor. In the sealed containers were Devil's Ivy (Epipremnum aureum), Lucky Bamboo (Dracaena sanderiana), and Snake Plant (Dracaena trifasciata). One Alka seltzer was inserted in each container (1.9 grams) in 4 ounces of water causing a reaction releasing CO2 starting the numbers around 15,000 ppm. The plants received 4 ounces of water weekly. We measured the amount of carbon in each container for 16 days. Recordings show bamboo as the most efficient at reducing CO2 levels to 2,921 ppm, whereas Devil's Ivy reduced to 7,429 ppm and Snake Plant to 13,135 ppm. We conclude that our hypothesis was accurate. Bamboo is most efficient at reducing CO2. This is proved because Bamboo decreased CO2 levels by 83.4%, while Devil's Ivy reduced them to 50.2%, and Snake Plant to 16.7%. According to Nature India, the stem of Bamboo reduces carbon to 86% deciliters through cortical photosynthesis while the leaves' reduction is 5% deciliters. Since other plants lack these stems, they reduce less than Bamboo. Increases in CO2 levels and greenhouse gasses in the atmosphere lead to climate change. By increasing the planting of bamboo globally on a larger scale, we can decrease CO2 levels and reduce the effects of climate change.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) PS BI 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
2023

Word Count	Fair Category	Project Number
219	L7	2002

Title: Shining light on cricket growth

Student Name(s): R. Copley

Abstract:

My experiment's goal was to find the best exposure of light for crickets to grow the best. This is important because crickets are a very good food source. They can provide protein and high levels of calories for people and their pets. There are also billions of crickets across the globe so widely eating them will not negatively affect the ecosystem as much as traditional food sources. Crickets could also replace food that is harming the environment, for example, cows CO2 emissions are causing many issues with greenhouse gasses, and the process for many fruits and vegetables use machinery that have harmful emissions coming from them. I conducted my project by putting 3 containers in different cabinets, each container had about 100 crickets, and in each cabinet was either a light that stayed on for 24 hours, a light that only stayed on for 12 hours, and one cabinet had no light in it at all. Through the span of 4 weeks I measured them until I got a final result. At the end of the test, the result came back that the 24 hour light did provide the most efficient growth. When raising crickets for food, it is best to raise them with a light completely shining on them for 24 hours a day, 7 days a week.

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

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

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

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

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
251	L7	2004

Title: Finding the most effective substances to kill germs and bacteria on door knobs using natural substances(lemon juice, cold/hot/room temperature tap water, and saltwater).

Student Name(s): S. Alla, S. Alla

Abstract:

Due to the COVID-19 pandemic, eliminating germs on daily use items such as door knobs has become more critical to our health and safety than ever. My experiment looked into which natural substances would work best to clean bacteria spread through contaminated surfaces similar to door knobs. To start my experiment I cleaned a door knob with a clorox wipe and applied glo germ on my door knob. For each material I applied one ml. of glo germ to the door knob in an upwards pattern, using a cotton swab. After applying the glo germ, I shone my flashlight on it to record how it looked before cleaning it. Next, I dipped my cotton swab into either lemon juice, salt water, room temperature water, hot water or cold water and used the substance on the door knob to clean the knob. Afterwards I cleaned off the substance with a clorox wipe. After using the substance to clean I recorded the results for each one. In the end, my hypothesis was proven to be partially correct as the lemon juice did appear to clean off the most glo germ. However, instead of cleaning off the knob, each substance either moved around or transferred onto the cotton swab. In conclusion, while the results yielded that my hypothesis was correct, to understand which natural substance cleans the best I would need to redo the experiment with a more accurate alternative to simulate bacteria as the glo germ can't be killed like bacteria can.

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
2023

Word Count	Fair Category	Project Number
249	L7	2005

Title: How can water be filtered in an inexpensive way?

Student Name(s): R. Lamp

Abstract:

According to the World Health Organization, over 2 billion people live in water-stressed countries. In wealthier countries such as the U.S., we are able to afford water treatments, but in very poor countries, people often do not have easy access to clean water. Sadly, every two minutes a child dies from not having access to clean water as dirty water causes disease. When there is safe water available, it is often far away and it is often the case that women and children are the ones who have the burden of carrying the water long distance which is not only hard on their bodies but the children lose out on education while doing this. Therefore, for my project, I wanted to experiment on inexpensive methods of cleaning water. I took dirty pond water that was opaque and brown, and divided it into three containers. One sample received no treatment and when tested, indicated it was positive for bacteria. Another sample was placed through a home filter system of rocks, pebbles, sand, charcoal, and cotton. After filtering it, this sample became clear in color and tested negative for bacteria. The last sample was exposed to sunlight for 48 hours and afterward tested positive for bacteria and was still brown in color.

My experiment has shown that there are inexpensive and easily available methods to filter water. I think additional studies should be conducted to see if people understand the dangers of dirty water and ways to clean their water.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
247	L7	2006

Title: The Stroop Effect

Student Name(s): J. Gonzalez

Abstract:

The purpose of my project was to determine if age has an impact on the Stroop effect. I hypothesized that children between the ages of 10 and 15 would perform better on the Stroop test than adults between the ages of 40 and 50. I tested my hypothesis by showing ten volunteers in each age category four sets of notecards. The first set had a color word written in the corresponding color ink. The second set had a color word written in a noncorresponding color ink. The third set had a shape and the name of the corresponding shape on the notecard. The fourth set had a shape and the name of a noncorresponding shape on the notecard. I timed each volunteer on each set of notecards and recorded their times. I calculated the average time it took for each age group to complete each of the four sets of cards. I then found how much additional time it took each group to identify the incongruent cards from the congruent cards. Upon reviewing these numbers, I observed that the adults took less time to adjust to the conflicting stimuli. Thus, adults between the ages of 40 and 50 scored better on the Stroop test than children between the ages of 10 and 15. Even though my hypothesis was incorrect, I concluded that the adults scored better because they were able to figure out what my project was testing and adapted to avoid having a delayed reaction time.

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
2023

Word Count	Fair Category	Project Number
233	L7	2007

Title: Determining the optimal mixture of chicken compost and sand for bean seeds.

Student Name(s): M. LaCroix, J. Eldridge

Abstract:

Composted chicken manure provides a slow-release source of macro- and micronutrients and acts as a soil amendment. Chicken manure and the associated litter are higher in nitrogen and calcium and are also rich in organic matter. We used 5 gardening pots, 15 bean seeds, a water source, an area with sunlight, chicken manure, and sand. We planted 3 beans inside 5 pots. The pots included mixtures of 100% compost/ 0% sand, 75% compost/25% sand, 50% compost/50% sand, 25% compost/ 75% sand, and 0% compost/100% sand. Our hypothesis is that 50% compost/50% sand would be the best because the sand lets water trickle through the grains and the compost holds the water and adds nutrients to the soil. Initially, the best plant growth was the 100% compost/0% sand mostly because of all the chicken manure mixed in. It made the plants grow faster. Sand affects soil by making it lighter. It adds alkaline and provides good drainage, however, increased drainage washes away more nutrients. It is also important to note that sand does not add nutrients to the soil; it is a pure inorganic matter called silica. Less than half of the plants are still living. The remaining plants are in 100% sand, 50% compost/50% sand, and 100% compost. The tallest plant is in 100% sand and is 2' 7". The shortest is 100% compost at 8".

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

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
241	L7	2008

Title: Color VS. Memory

Student Name(s): A. Hamlin

Abstract:

My experiment was designed to answer the question, 'How do colored images vs. black and white images affect your memory?' My hypothesis was that people would remember pictures better when it contained color rather than pictures that were black and white, due to the fact that different colors stand out and the variety of shades would be more memorable. For my procedure, I took one participant at a time into a silent room and told them how it would work. First, I would flash a slideshow of animal pictures on my chromebook in front of them, and every picture would be shown for a second each. When I finished the slideshow, they would tell me which animals they remembered in total, and I would keep track on a separate piece of paper. I had four participants in total and I split them into two groups of two; one group watched a slideshow with color and the other with a grayscale. The pictures in each slideshow and order of them were the same, the only difference was whether or not they had color. Overall, color was better remembered, as shown from my data. Color was remembered with an average of 62% of pictures recalled, whereas black and white was remembered with an average of 46% of pictures recalled. The purpose of my experiment is to understand the importance of color on our memory and how it can help in our everyday lives.

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
2023

Word Count	Fair Category	Project Number
81	L7	2009

Title: How does the genre of game affect stress?

Student Name(s): G. Brito

Abstract:

I was trying to find how the genre of video games affect stress in humans. I thought that puzzle genre of games was going to cause the most stress for people because it's mentally tiring. I ran my experiment by running a survey where people rated their level of stress from puzzle, action games, and war games on scale of 1 to 10 (1 being least stressful, 10 being extremely stressful. I found that puzzle games cause humans the most stress.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
119	L7	2010

Title: Should You Buy Grow Lights?

Student Name(s): J. Xu

Abstract:

My experiment's purpose is to find if grow lights actually make plants grow faster than other lights. This is important because indoor agriculture is becoming more efficient than traditional farms and those farms use lights instead of relying on the sun. To test if grow lights are better than LED lights, I planted a few basil seedlings and put them under the lights to measure growth over time. I then used leaves from full grown basil plants to measure the starch content in them by staining with iodine. I found that the basil under the grow light had slightly more starch and the seedlings were slightly bigger. However, the differences between the two are negligible and are not significant.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) PS EE 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
2023

Word Count	Fair Category	Project Number
123	L7	2011

Title: Betterment with Peppermint

Student Name(s): P. Twedt

Abstract:

This experiment was designed to test the hypothesis that peppermint improves performance on physical tasks. Subjects played a game with the BlazePods that tested reaction time and accuracy. The game required the subjects to hit a randomly appearing blue light as fast as they could. They played the game twice. Before each game, they either smelled peppermint aroma or water. All subjects had the most correct hits on the blue light after inhaling peppermint aroma. All but two subjects had improved reaction time after inhaling peppermint aroma. The two subjects that had a faster reaction time after smelling water also had more incorrect hits with water. This data supports the idea that peppermint aroma helps to improve performance and reaction time with tasks.

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
2023

Word Count	Fair Category	Project Number
164	L7	2013

Title: Removing Sodium Nitrate from Run Off Water

Student Name(s): J. Brooks

Abstract:

The purpose of this investigation is to remove sodium nitrate from a sodium nitrate solution. This was done to eliminate the dangerous effects of sodium nitrate in drinking water. Sodium nitrate in drinking water can cause trouble breathing, collapsing or death. The hypothesis is that coconut husk biochar will remove sodium nitrate from water.

Coconut husk biochar was made by burning the husk in a low fire. A sodium nitrate solution was prepared and poured over varying amounts of the biochar. The filtered solution was collected and tested for traces of sodium nitrate. Using a spectrophotometer the data was analyzed by how much sodium nitrate was left in the test tubes after the biochar was put in the test tubes.

In conclusion, the biochar had not fully removed the sodium nitrate. However, using an increased amount of biochar did decrease the amount of sodium nitrate remaining. In the future, using other natural components to create biochar would be worth testing to determine their effectiveness.

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
2023

Word Count	Fair Category	Project Number
128	L7	2014

Title: Effects on Radish Seeds with Acidified Water

Student Name(s): E. Gordon

Abstract:

Industrial emissions of sulfur dioxide and nitrogen oxides cause a phenomenon known as acid rain. This may result in growth inhibition of plant life. This experiment was designed to model the effect of acidified rainwater on inhibition of plant growth using a radish seed model. After a week of germination, two groups of thirty-six seedlings were watered with either distilled water at a pH of 5.6 or a solution of distilled water and white vinegar at a pH of 4.3. This was done daily for two weeks. After fourteen days the radish seedlings that were provided acidified water grew at a lower percentage compared to the control group (83.46% vs. 93.67%). The results of this experiment indicate that acid rain may have negative effects on plant growth.

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

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
250	L7	2015

Title: The Eggtastic Egg Experiment

Student Name(s): M. Bohrer

Abstract:

My experiment is The Eggtastic Egg Experiment. I decided to try this experiment because I wanted to see how different liquids affected the staining of your teeth. Whenever you go to the dentist you always hear them saying, you need to brush better, or avoid sugary drinks, so I wanted to test if different sugary drinks where really the problem behind stained teeth. So the hypothesis that I created was, If different liquids are used on a hard boiled egg (Representing teeth) then, Red Gatorade will be the liquid that is the hardest to get off the egg after brushing it because gatorade is a powerful red color, it has more electrolytes in it than Diet Coke and Iced Tea, and electrolytes are bad for your teeth.

Once I figured out my hypothesis I conducted my experiment. Some key moments in this experiment where taking the eggs out of the liquids, and brushing them off with the toothpaste. I conducted this investigation by letting the eggs sit and then observing them everyday before I took them out of the liquids. For my data I have found that all the eggs had some kind of stain on them no matter the liquid.

For my conclusion I have found that Red Gatorade stained the eggs the most. Some other extensions that I could complete are why the Gatorade stained the teeth the most, or if it is just red Gatorade that stains your the most or if it is any color Gatorade.

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

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

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

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

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
183	L7	2016

Title: Aquatic Plants In Action

Student Name(s): S. Previty

Abstract:

Have you ever wondered what those little green things are on the top of a pond, well that's Duckweed. For my project I tested to see what type of water works best for growing duckweed. If I grow duckweed in different types of water then The water with fertilizer will do the best. First, I got five bowls then I put the same amount of five different types of water in each of the bowls. One different type of water in each bowl. Lastly, I let it grow for four weeks and measured its growth by measuring the length and width of each of the plants once every week. I found out that distilled water is best for growing duckweed out of the types of water I tested. My hypothesis was proven wrong because I thought water with fertilizer would do the best. Distilled water has the most plants and measures 7.1 inches in length and 6.5 inches in width. Overall my project was successful. The only thing I would change is the type of fertilizer I used on the water with fertilizer.

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
2023

Word Count	Fair Category	Project Number
243	L7	2017

Title: Soil Stability

Student Name(s): C. Calomeni

Abstract:

Environmental change is causing global warming, drought, flooding and a reduction in our food supply. Scientists agree that damage is occurring because of man-made pressures, including the use of chemicals, burning of fossil fuels and poor land management. Reducing the effects of flooding is important, because of the severe consequences on the environment and communities across the globe.

In this project, I researched the composition of soil; to understand whether the structure (stability) of soil changed depending on how we treat it. I had the hypothesis that if we manage soil poorly, soil structure would break down, resulting in the potential for erosion, and therefore flooding, to be worse. I used the 'SLAKES App', developed by the University of Sydney, to test the soil structure of 24 soil samples taken from corn fields, grasslands and forests throughout Connecticut and New York.

I concluded that soil that has been significantly tilled (and often treated with chemical fertilizers) has a poor soil structure compared to soil found in forests that are rarely touched. From my research, I understand that poor soil structure makes it difficult for water to quickly soak into the ground. Instead, soil tends to run off with the water, causing erosion.

Soil stability, or strong soil structure, is required for microbes to live in the soil and for plants to grow strong. Land that has been constantly tilled, worked and not left to regenerate will contribute to climate change, including flooding.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
248	L7	2019

Title: Do human and dog saliva have special antibacterial properties and help heal wounds?

Student Name(s): A. ASLAN

Abstract:

Background: As dogs lick their wounds when hurt and humans bring their fingers into their mouths when suffering a paper cut, there have been debates on whether saliva has any healing properties that kill bacteria and help heal wounds. In this project, I tested and compared human and dog saliva applied to samples of Staphylococcus epidermidis and Escherichia coli (E. coli).

Hypothesis: If bacteria are treated with either human or dog saliva, then less bacteria will form or develop than when saliva is not applied, and the dog saliva will kill the bacteria faster than the human saliva, because it has stronger antibacterial properties.

Methods: I used 8 agar plates to test my hypothesis. Four plates had E. coli, with one being the control, while the other 3 having inserted blotter paper topped with dog saliva, human saliva, and water. Similarly, four plates were inoculated with Staphylococcus. All plates were observed and analyzed on day 3, day 6, and day 11.

Results: The human saliva blotter paper had less bacteria around it than the dog saliva and water papers on day 3, and also on day 6. However, over time both bacteria samples showed resistance to the human and dog saliva, overwhelming the blotter paper.

Conclusion: My hypothesis was partly incorrect in both the E. coli and Staphylococcus experiments, showing that the human saliva had stronger antibacterial properties than the dog saliva. Overall, saliva treated plates had less bacteria than those with only E. coli or Staphylococcus, respectively.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) ME MI 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
2023

Word Count	Fair Category	Project Number
274	L7	2020

Title: The Power of Your Produce!

Student Name(s): N. Khan

Abstract:

The goal for project was to determine effect the of banana peels on contaminated water.The hypothesis is if banana peels are mixed into contaminated water, then the amount of contaminants in that water would decrease.Objective: See if banana peels can be used as a purifier for contaminated water, with and unhealthy amounts of other substances.The experimental set-up was made of 4 types of water.Filtered water(BRITA),as control.Then experimental waters;run-off water,Norwalk river water, Horseshoe lake water-(Wilton).Each water was tested with "Dr. Tim Wang" strips for,nitrate, nitrite,hardness,chlorine,copper, bromine,iron,lead,sulfite,cyanuric acid,carbonate,ph.Each water was tested with bananas in five different ways: dried made into a filter, dried made into tea bag, dried then mixed, chopped mixed,phloem bundles mixed.5 glasses for each of the 3 waters were filled with 50 ml. Then each banana type was added to one of the five glasses for each kind of water. After purification was done for each water sample, they were tested for what was listed before, to compare results from original water samples.Results indicted, that on average for all 3 types of water, after purifying, nitrate increased by 35 ppm, total hardness decreased by 22.5 ppm, iron decreased 1.5 ppm,lead decreased 23 ppm, carbonate decreased 48 ppm, ph decreased 0.55, and total chlorine decreased 0.33 ppm,no change in other factors rest. My results support my hypothesis; banana peels have a positive effect in removing contaminants and unhealthy amounts of different substances in contaminated water.Banana peels can be considered as a natural and environment friendly method for removing impurities from contaminated water.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
252	L7	2021

Title: Brush Your Teeth

Student Name(s): M. Taylor

Abstract:

This experiment was conducted to determine if using toothpaste helps prevent decay and stains on teeth. There were three goals with this experiment: 1.To see the effects of various drinks on eggshells, 2.To show that toothpaste has a protective effect, 3.Encourage others on the importance of brushing teeth.

Sugar and acids, found in most beverages, are very harmful to teeth. Acids dissolve enamel, giving bacteria a way to begin decaying teeth and sugar promotes this decay. Eggshells are loaded with calcium and so is the enamel on teeth. Therefore making eggs a good substitute for teeth in this experiment. The experiment consisted of soaking eggs for 24 hours in 6 different common beverages. The process used was to have two cups filled with each beverage. One egg was placed in each cup. One of the eggs in each beverage set is brushed with toothpaste before being placed in the liquid. The eggs were compared at 3, 6 and 24 hours and observations were noted. At the end of the 24 hours the eggs were run under water, and the toothpaste eggs were brushed and rinsed mimicking the teeth brushing process.

Overall, the eggs with toothpaste are less damaged than the eggs without toothpaste. The Cranberry juice seems to have done the most damage to the eggshell both with and without toothpaste. The toothpaste appears to have aided in protecting the eggshells from stains and damage. The control eggs, eggs in water, both appear the same with and without toothpaste.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
177	L7	2022

Title: How Do Different Colors of Light Affect Plant Growth

Student Name(s): K. Roitman

Abstract:

We already know that normal sunlight works well for growing plants. The purpose of this project was to investigate if other colors of light worked even better than sunlight for growing bean sprouts. Beans were grown under different colors of cellophane. Sunlight shone through the cellophane, creating red and purple light. The hypothesis for this experiment was that the plants under the red light would grow the fastest. The basis for this hypothesis was that chlorophyll strongly absorbs red light. Chlorophyll creates the food for plants, therefore, heavily absorbing red light could help the plant grow faster.The plant that ended up growing the tallest was one of the sprouts under purple light. The second tallest plant was one of the plants under the red light. In conclusion, the plants under the purple and red light both grew very well. There may have been a problem with the beans, because only four out of twenty plants sprouted. Since so many plants failed to germinate, the results cannot be taken as conclusive, but the results do support the hypothesis.

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
4. Is this project a continuation? ☐ Yes ☒ No
5. My display board includes photographs/visual depictions of humans (other than myself or my family):

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
233	L7	2023

Title: Impacts of Contaminants of Emerging Concern on Bean Seed

Student Name(s): A. Cadmus

Abstract:

Contaminants of Emerging Concern (CECs) are chemicals, including pharmaceuticals and personal care products (PPCPs), which may have a positive impact on human life but may have unintended results in ecosystems. The purpose of my science fair project is to determine the effect of over-the-counter drugs (pharmaceuticals) and other chemicals on the germination and growth of plants. I hypothesize that chemicals such as aspirin, ibuprofen, bleach, and cough medicine will have a negative effect on plant germination and growth. I also think that vitamin C and coffee will have a positive effect on plant growth and germination. Seven tests were performed in duplicate to determine if household chemicals would affect bean plant germination and growth. To test this, twelve plant pots containing three bean seeds were watered with six household chemicals and two plant pots were watered with tap water (control). The chemicals used were aspirin, cough medicine, vitamin C, ibuprofen, bleach, and coffee. The results of this experiment showed that plants treated with vitamin C and coffee produced results similar to the growth of the control plant while bleach, ibuprofen, cough medicine, and aspirin limited the growth of the bean seeds compared to a control (water only). In conclusion, this experiment shows that PPCP can alter plant germination and growth. Therefore, it is important to further understand the influence these chemicals will have on the environment if discharged into the water.

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
2023

Word Count	Fair Category	Project Number
250	L7	2024

Title: Is Your Bottled Water Really Worth It?

Student Name(s): N. Waldron

Abstract:

The marketplace is full of high cost bottled waters including popular alkaline water. Consumers are led to believe that these bottled waters are superior in water quality to tap water. This experiment was performed to determine whether bottled waters are superior in water quality to tap. My hypothesis was that the more expensive commercial bottled waters were superior in water quality to the less expensive tap water given the corporate messaging. 10 bottled waters and tap water were tested for lead, fluoride, nitrate and nitrite contaminants using water testing strips. The same samples were also tested for acid neutrality by testing the pH of the water using water testing strips and pH drops. Additional contaminant and pH tests were conducted on the 10 bottled waters and tap water after being filtered through a household carbon filter. The data collected through testing did not support my hypothesis. The tap water fell within the neutral range for acidity just as 7/10 sampled bottled waters. Marginally higher pH levels existed in 6 bottled waters compared to tap water but any additional health benefit from the fractional increase in alkalinity are unproven. Lead, fluoride, nitrate and nitrite contaminants were not detected in all 10 bottled waters and the tap water tested. My testing results show tap water is a quality alternative to more expensive bottled waters that come with significant environmental costs. Consumers should perform at-home baseline tap water quality tests and specific testing if questions about taste, clarity and faucet residue arise.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
250	L7	2025

Title: Apple Preservation (Non Organic vs Organic)

Student Name(s): K. LaFlamme

Abstract:

Knowing how to store apples to keep them usable longer is important. This is because it reduces waste of unused products. This experiment was of three different varieties of apple slices in three different environments to find the duration of time needed for significant oxidation and mold growth to occur. Air vs. no air was also a part of the testing. Organic and non organic apples were compared. The predicted outcome was that the non-organic apples stored in the refrigerator with no air would oxidize and grow mold the slowest.

The results showed that out of the three environments (grow light, no light, refrigerator), the apples under the grow light began to grow mold quickest. Out of the varieties of apples (Pink Lady, Red Delicious, Fuji), the Pink Lady apple became soft and oxidized quickest. By the third day, Pink Lady organic apples in air had at least 2 cm of mold. In all of the environments, the apples in air began to soften and grow mold quicker than the apples with no air. This is most likely due to bacteria being in the air. The inorganic apple held up for longer than the organic apple.

The hypothesis was correct in this experiment. The apples that remained mold free the longest were refrigerated with no air. This is useful because it shows the best way to store apples, and what type to buy to ensure the longest lifespan. This could reduce food waste caused by rotting and mold growth.

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
194	L7	2026

Title: What color light is a cockroach's favorite?

Student Name(s): Y. Hsiao

Abstract:

Cockroaches are found all over the world and mostly viewed as a pest, and you always see advertisements for better and better traps. But what if cockroaches are attracted to certain color lights? This experiment tests if cockroaches are attracted to certain color lights over others. Red, blue, green and white light are used in this experiment. A cage was modified so there was a divider separating two sides. A different color light was shown into the cage, and after 5, 10, and 15 minutes, the amount of cockroaches on each side was counted. For each trial, a different set of cockroaches was used to guarantee results as accurate as possible. The experiment found that cockroaches are attracted more to the color red, though over time they seemed to be attracted to the color white. Also when white was one of the colors compared, there were fewer cockroaches in the middle. Green seemed to be the ones best at repelling cockroaches. Blue and white were not especially good at repelling or attracting cockroaches. So when trying to catch cockroaches choose red, and when attempting to repel cockroaches, choose green as the color of choice.

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

Word Count: 198

CSEF Official Abstract and Certification
2023

Fair Category: L8

Project Number: 2501

Title: How Can Interacting with Different Species of Animals Have Different Mental Effects on Humans?

Student Name(s): L. Sassu-Martin, N. N/A, N. N/A

Abstract:

This study explored the interaction of humans with two different species of common household pets, cats and dogs. Participants' mood and energy levels were studied before and after they interacted with the species (they were asked to fill out a questionnaire). Participants were also asked to spend some time in solitude and also report how they felt before and after. My hypothesis for this experiment was that if people were to interact with dogs, then they will have a higher energy level afterward, and they will feel happier because dogs are generally more energetic than cats, which might in turn cause the humans to feel happier and more energetic because of them. The results differed depending on what kind of animal that the person had interacted with. Our results have shown that most people feel happier but have a lower energy level after interacting with cats, but when people interact with dogs, their energy levels increase. Our results also showed that some people's energy level benefits from alone time, but some people do not. Most times that the participants spent time alone, their mood decreased as a result as well. My hypothesis was proven correct by this experiment.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
246	L8	2502

Title: The Effect of Ocean Acidification on Coral Reef Growth

Student Name(s): A. Variar

Abstract:

Ocean acidification is the decrease in pH of ocean water after carbon dioxide is absorbed by it and converted into carbonic acid. Due to the burning of fossil fuels, and the eventual build-up of atmospheric carbon dioxide, ocean acidity has increased by 30% since the industrial revolution. Aquatic life can be harmed by significant changes in the ocean water's pH, because similar conditions lead to the degradation of the skeletons of several types of oysters, clams, and coral reefs. My project aims to determine the effects of ocean acidification on the growth of coral. The model species Pachyclavularia violacea (Green star polyp) was propagated into 4 tanks, then cultured for 2 weeks prior to the experiment, when the pH of the tank's water was 8.2. Some control variables include salinity (consistently at 34 grams per liter, which is the salinity of ocean water), water temperature (75 °F), and lighting (medium). At the beginning of the experiment, citric acid was added to tanks A,B, and C, with the exception of D, which then had pHs of 7.9, 8.0, 8.1, and 8.2 respectively. pH strips were used to monitor pH every 2 days in order to ensure this. The polyps were monitored for 4 weeks in total. The polyp in tank A stopped blooming on the 4th day of the experiment, and the other polyps continued to bloom. In conclusion, the results of this experiment show that ocean acidification can negatively impact the growth of coral.

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

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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
2023

Word Count	Fair Category	Project Number
262	L8	2503

Title: Enhancement of Circadian Rhythms Through Music

Student Name(s): R. Goldenberg

Abstract:

Research has shown that the best physical and mental health is rooted in proper sleeping habits. To that end, many sleep aides have been promoted, whose goal is to provide longer and deeper sleep cycles, ranging from dietary supplements, pharmaceutics, and use of background noise. This research investigated the latter, where drosophila melanogaster (fruit flies) was used as a model for humans to investigate the use of low-volume background music, or white noise, during the evening sleep hours. Single, normal flies (Stock #5; Bloomington Drosophila Stock Center) were loaded into separate sleep monitor tubes, which were inserted into the activity monitor of a TriTech DAM system. In the first experiment, to simulate typical sleep, fly day and night activities were monitored for 4000 minutes, or 2.8 days. Comparison of night-to-day activities (in a Night/Day ratio) highlights 0.23, or ~23% of night activity, relative to the day, which acted as the control/comparison throughout the research. In subsequent experiments, low-volume classical music was played at 8pm (Lights out) for 12 hours, and separately for 2 hours (8-10pm), resulting in night/day ratios of 0.76 and 0.45, respectively. These highlight increased agitation, and interruption of sleep, relative to no-music. Following, smooth jazz was played from 8-10pm, which resulted in a 0.28 night/day ratio, which approaches but does not improve, typical, no-music sleep. Finally, white noise (consistent static) was played from 8-10pm, resulting in an increased night/day ratio of 0.31. This surprising result contradicts the use of white-noise for sleep enhancement, during onset of sleep.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in 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
2023

Word Count	Fair Category	Project Number
210	L8	2504

Title: Does different genres affect plant growth

Student Name(s): C. Fetridge

Abstract:

I conducted this experiment to see if the music that we listen to affects plants in a negative or positive way. You should care about this because the music that you listen to might be doing something bad to you. You should stop listening to rap music because in other experiments it has been shown to make plants shrivel up, die, or stunt growth, but in this experiment the rap stunted the plants growth. My hypothesis was if you play Classical Music then it will affect a plant's growth the most. That hypothesis was not supported by the data, the data showed that Rock had the most growth in the plants. I investigated by looking at trusted sources to see the results of past experiments and I made sure that the experiment was possible. I obtained many results on the height and growth of the plants. The starting average for group 1 was 3.75 and the ending average was 4.5625, the starting average of group 2 was 4.625 and the ending average was 6.125, and the starting average of group 3 was 3.625 and the ending average was 4.25. I met my objective because I successfully showed and proved my hypothesis, and showed that certain genres do affect plant growth.

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

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
176	L8	2505

Title: The Effect of Lysozyme on the Spoilage of Food.

Student Name(s): C. Tscheppe

Abstract:

Food waste is an issue in society that may be able to be solved using lysozymes. In this experiment, lysozymes were used to slow the spoilage of fish. This will help solve food waste because a lot of it is caused by food going bad before it can be eaten. This experiment was conducted using two different pieces of fish, one having lysozymes and the other without them. After five days, the amount of methane produced from each of the rotting fish was measured by the displacement of gas in a graduated cylinder of water. The two fish were in separate airtight containers that used tubes to lead the methane gas into an upside down graduated cylinder filled with water. For the results, the level of water in the graduated cylinders was measured after each day. The results showed that the lysozymes did not seem to affect the level of methane gas produced by the rotting fish. From this experiment, it can be concluded that with or without lysozymes, food will spoil at the same rate.

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
228	L8	2506

Title: How does the application of granular sodium chloride and liquid magnesium chloride before and during winter weather events affect the quality of nearby bodies of water?

Student Name(s): E. D'Agostino

Abstract:

When you see salt on the road before a big snow storm where do you think it goes when the snow melts? Every time I see road treatments put down, I wonder how it could affect the environment. With the recent change in seasons I wondered where all the salt goes. I chose four local ponds and tested the water for pH, ammonia, nitrite, phosphate, alkalinity, hardness, cyanuric acid, total chlorine, free chlorine, bromine, copper, mercury and carbonate root. I tested each water body weekly for a period of 12 weeks.

The most noticeable changes were observed during week 8. During this week I observed a decrease in pH, indicating more acidic water. The compounds used for salting the roads, sodium chloride and liquid magnesium chloride, have properties that would make a body of water acidic. Additionally that week, there was a singular increase in nitrite for one of the parks. During week 11, there was also sodium chloride and liquid magnesium chloride laid on the roads, and there was a notable decrease in total alkalinity for a majority of the parks. Weeks that had a high amount of sodium chloride and liquid magnesium chloride applied were Week 4, Week 7, Week 8 and Week 11. Overall, my data shows a correlation between road salts being laid and a change in the pH and alkalinity of the water.

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
245	L8	2507

Title: Can different frequencies influence how an earthworm moves?

Student Name(s): F. Ramirez Moreno

Abstract:

Background: How do our brains react when listening to different types of frequencies? In everyday life it is important to react to our surroundings, including what we hear. What we hear also affects how we take in information and handle everyday tasks. Therefore, it is important to know how sound affects us. The purpose of my experiment was to determine how different frequencies influence how an earthworm moves.

Hypothesis: If earthworms sense louder lower frequencies then they will move slower because they will not feel in danger.

Methods: 12 earthworms were used and divided into four groups based on sound frequencies. Each group had its own container where they were observed. Later each group attempted one easy obstacle course, followed by a medium level and then a hard level. How much each worm completed its obstacle course and how fast was measured.

Results: Group B (High frequency) had the most success across all levels of the obstacle courses. My hypothesis was supported, meaning that if earthworms sense louder frequencies they will move faster and when they sense lower and louder frequencies they move slower. Each group has completed different amounts of each obstacle by the end of 15 minutes.

Conclusion: The hypothesis mentioned before was supported. The control group delivered less success with the obstacle course than the other groups. Because of this, we can conclude that listening to music that is louder and has a high frequency will cause faster and more active movements.

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
2023

Word Count	Fair Category	Project Number
271	L8	2508

Title: Wavelength-Specific Illumination of Hydroponic Growth Systems, for Increased Crop Production

Student Name(s): K. Wick

Abstract:

Soil grown crops are unsustainable for an ever-growing population, using up large amounts of land and destroying ecosystems. Although hydroponic methods can solve many problems with traditional farming by maximizing water efficiency, nutrition and creating a controlled environment, critical problems remain. First, these facilities use white light to accurately replicate the sun; however, little has been done to explore the impact of isolated wavelengths. Furthermore, Fusarium verticillium is a fungus that causes plant wilting and eventual crop death in plants, especially hydroponic ones. This research investigated the effects of wavelength-specific lighting of hydroponic soybeans using inexpensive, readily-available, colored films to potentially increase growth outcomes. Plants were grown in hydroponic towers, separately with blue, green, yellow, red and white (control) illumination, for healthy plants and F. verticillium-infected plants. Following 1 month of growth, red and yellow illuminated healthy plants outgrew traditional-white by 30.3% and 12.4% (43cm-red and 37.1cm-yellow), as compared to 33cm for white. Similarly, growth rates of red and yellow illumination were far-improved; 1.50-cm/day and 1.30-cm/day, respectively, as compared to 1.15-cm/day for white light. These combined results highlight promotion of growth by longer-wavelength, color-specific plant lightings. Fungal infection caused a 43% decline in growth-rate for all illumination colors, however the wilting condition was partially restored to normal with red and yellow lighting. Measure of the UV-Vis reflectance and Photochemical Reflectance Index for soybean leaves highlights normal photosynthetic activity for all healthy plants/illumination. For Fusarium, white-lit leaves possessed chlorophyll-a deficiency, and 146% PRI decrease, which is resolved with color-specific lighting.

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

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
248	L8	2509

Title: Investigating The Effectiveness Of Biochar In Remediating Soil Contamination By Heavy Metals and Hydrocarbons

Student Name(s): S. Aliminate

Abstract:

Soil contamination of heavy metals, metalloids, and petroleum hydrocarbon contamination has become an increasingly severe global environmental issue in recent years. High concentrations of these metals and hydrocarbons in soil demonstrate a threat to the environment, plant growth, food safety, and human and animal health. Biochar, produced from the high-temperature decomposition of plant material, has a large surface area and a high capacity to absorb soil contaminants. I hypothesize that if Coconut Shell Biochar is used, then it will be more effective at remediating heavy metals and hydrocarbons than Activated Carbon Biochar. To perform this experiment, I contaminated soil with motor oil. I then treated some soil with each type of Biochar to remediate this contamination. I also grew plants in one contaminated, and one remediated soil sample to test for heavy metals in the leaves and stems of the plants. I sent soil and plants to the UCONN Soil Nutrient Analysis Laboratory for standard nutrient analysis. Arsenic and Hydrocarbon testing was performed using at-home kits. In all the tests, although both types of Biochar effectively remediated the soil up to the government's standards, Coconut Shell Biochar showed the most promising results for industrial usage. The application of activated carbon reduced the amount of arsenic in soil by 10 pph and zinc by 0.4 ppm, while coconut shell reduced arsenic by 20 pph and zinc by 1.1 ppm. My experiment can conclude that Biochar can effectively and efficiently remediate heavy metals and petroleum hydrocarbons from soil.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
247	L8	2510

Title: Do Different types of water affect plant growth

Student Name(s): D. Phillips, n. n/a, n. n/a

Abstract:

For this experiment I wanted to see how different water types affect plant growth. The importance of this would show which water types will harm a plant or which types will grow tall, healthy plants. I was expecting that the salt water plant was going to die in 2 weeks. I assumed the sugar water plant was also going to die early. In my research I learned sugar can cause severe osmosis and could eventually kill the plant early. . I thought the tap watered plant would grow to be the tallest, healthiest plant of all. The problem this experiment solves is what water types are best for plant growth and which water harms plants. My approach for investigating was to use my project to persuade people into picking the best water to ensure a healthy plant. The answer I obtained is that the sugar watered plant grew the tallest at 4.67 centimeters. The tap water grew to 4.17 centimeters, and the salt water had the least growth with a height of only 2 inches after the conclusion of the experiment. I think I only half met my objective because my hypothesis was not 100% correct. In the end, none of the plants died and the sugared watered plant which I expected to die within days ended up growing the tallest! Concluding this abstract, I would stay away from salt water and maybe try sugar water. If you want to stay safe then I would choose tap water.

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

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☐ vertebrate animals ☐ controlled substances

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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
2023

Word Count	Fair Category	Project Number
280	L8	2511

Title: Simple, Rapid Detection of Early Maturity-Onset Diabetes of the Young (MODY) via Random-C-Peptide Biomarkers

Student Name(s): L. Wang

Abstract:

MODY (Maturity-onset diabetes of the young) is a form of diabetes that is caused by genetic mutation. It differs from both type 1 (from birth) and type 2 (diet-induced), and those who have a parent with MODY have a 50% chance of inheriting the mutation. Many who suffer from high blood sugar are unaware of a possible MODY diagnosis, as current testing for the disease is solely lab-based, and the diagnostic/causative path to these blood tests are often missed. A rapid and simple diagnostic for the detection of MODY is needed. Recently, findings by Majidi pointed out that those with MODY possess elevated levels of Random C-Peptide (RCP), at a urine concentration of 0.5ng/mL for early onset of the disease, when patients are symptom-free. As such, RCP would be an excellent diagnostic biomarker for early MODY detection. Herein, a rapid and easily-read lateral flow diagnostic assay (LFDA) for the early-diagnosis of MODY, based on detection of RCP, was developed. Based on sandwich-ELISA technology, LFDA test/control lines were constructed with 100µg/ml biotinylated-RCP capture antibody stacked atop streptavidin-on-nitrocellulose strips, with HRP-tagged 100µg/ml human RCP detection antibody and TMB embedded in sample wicks. Visible as blue stripes for positive test and control results, the MODY LFDA detected 80ug/ml in synthetic urine, for early-onset MODY. Test-line color response was found to be linear, based on smartphone image RGB-analysis, thereby extending the LFDA-diagnosis beyond a simple Positive/Negative, to RCP concentration and disease-progression. Currently configured, this MODY-LFDA represents proof-of-concept for detection of 0.5ng/ml-RCP, with enhanced-concentration reagents.

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

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3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
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CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
243	L8	2512

Title: The Effect of Heat on Trypsin

Student Name(s): C. Zebrowski

Abstract:

Reptiles are eco-therms, which means that they depend on external sources for heat. Reptiles absorb heat to get energy. Most of this heat is used for digestion and nutrient capture, which gives the animal energy. Scientists have found that biological substances called enzymes do the most work “digesting”. The purpose of my experiment is to see if enzymatic levels will increase with heat.

If we put three different containers with food and enzymes in them, in three different places with different temperatures, then the container with the most heat will have produced the most enzymatic substrate because enzymatic activity increases with heat. I placed 9 crickets and 9 super worms across 3 jars, and put 100mlg of trypsin solution (PBS no Calcium and magnesium, and trypsin powder) in each. The 3 jars were placed in three separate climates, hot environment (Souvie), control environment (room temperature), and cold environment (refrigerator). I left them there for three days. At the halfway point and end I measured their weight. Data showed the bugs in the hot jar weighed the least (182g), the cold the most (184g), and the control was the middle (183). The PH was different between each. Hot 3.0. Control 3.5. Cold 5.5. The bugs were mushier the hotter the condition they were kept in. My hypothesis is correct, the ph results showed there was a stronger chemical reaction in hotter jars. The weight showed that the trypsin “digested” more in hotter climates.

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

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

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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
2023

Word Count	Fair Category	Project Number
232	L8	2513

Title: Natural Plant Dyes

Student Name(s): A. Ryan

Abstract:

Many people enjoy painting and using dyes but are looking for more natural ways to do so. What materials work best when trying to make natural dyes using plants? The goal of this science fair project, "Which plant produces the brightest color after being processed with (and without) vinegar and being washed with laundry detergent," involved making natural dyes using different plants. The variables that changed were which plant you used and the addition or omission of vinegar.

The first part of this research project was to find types of plants that would give off color when boiled. Beets, raspberries, blackberries, and cherries were the best option because they have vibrant colors and are easily found in local grocery stores. I then had to decide how to make the dye, and how to incorporate vinegar into the process to see if it would affect the color stay ability after washing.

My hypothesis was that beets would be the most effective plants of the ones I tested and that the vinegar will slightly affect the color and will make the dye hold better in the fabric. Based on the results of the experiment, the beet by far was the best for creating a vibrant color dye and maintaining the most color after washing. I was baffled by the fact that the use of vinegar did not get the same results for each plant.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) PS 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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CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
262	L8	2514

Title: Use of Simple, Home-Remedy Cleansers to Selectively Inhibit Harmful Bacteria on Classroom Surfaces

Student Name(s): A. Khwaja-Patel

Abstract:

The need to develop cleaners that kill only harmful microbes, while not polluting the environment is

important to both humans and nature. Current efforts to create such an eco-safe, and effective cleanser remain unsuccessful. In this research, three environmentally-friendly, and easily fabricated cleansers were investigated, and compared to Lysol, for their ability to remove only harmful bacteria, while leaving the cleaned-surface free of residue. Swabs of the laboratory surfaces, as well as the student researcher's mouth and hands, were cultured in TSB for 1-week at 32 o C, and sent for outside analysis of their microbiome. Following, a wood ash, home-made vinegar, and castile-soap cleansers were prepared, and used on segregated tabletop surfaces for 1-week, in comparison to Lysol. While the pre-clean microbiome of laboratory surfaces were each composed of 99% bacillus weihenstephanensis (a soil/duct bacterium), minor constituents included organisms from the human gut and decayed food. Conversely, the microbiome of the student researcher's mouth and hands included organisms from human skin, the GI-tract, the oral cavity, and dairy. Following 1-week, daily cleaning of the tabletop with the four cleaners, microbiome re-examination highlighted the elimination of 99% of organisms by each, including dust microbes and the vast majority of minor organisms previously found. For each cleanser, the post cleaning tabletop microbiome was indicative of harmless organisms from active ingredients of the cleansers themselves. Finally, FTIR-spectroscopic analysis of simulated use of the cleansers provided compelling evidence that each left the surface free of residue and dirt, once cleaned and polished.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) ME EN 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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CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
136	L8	2515

Title: Growing Plants from Food Waste

Student Name(s): V. DiMatteo

Abstract:

This experiment examined food waste to determine if it will be a good source of nutrients that will help plants grow in hydroponics. This could help areas without nutrient rich soil increase crop growth. In this experiment two mason jars were set up with a mixture of bananas, black beans, and egg shells and two with the standard store bought hydroponic food. In each jar there were 6 plants with the average height of 6cm. During this experiment the average height of each setup was measured . Also, other qualitative observations on the overall health of the plants were made. The results of this investigation shows that when blended, food waste will not be a good source of nutrients for a plant to survive, But, when composted, food waste will help the plant thrive and grow healthy.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
177	L8	2516

Title: The Effect of Fertilizer On Hydroponic Gardening

Student Name(s): C. McMahon

Abstract:

This experiment came from my gardening background. Every summer I have many plants that I put in my mini garden. Gardening to me is very fun and fascinating how such little things become big things. The purpose of this experiment was to see if Group A, (Miracle-Grow) or Group B, (Flora Grow) or our control variable Group C, which was plain water, if it would work better then both fertilizer groups, as well as which would be the most productive fertilizer. This experiment is very important to me because it shows me and others the difference between the two fertilizers and what is the better buy. My hypothesis was "If Flora Grow is used then there will be a larger circumference of the lettuce, then the other groups". My hypothesis was supported as the data from Group B read 8.3 inches while Group A at 5.1 inches, and Group C at 2 inches. My results were gathered by averaging all of the groups then making a table and a bar graph from the data I collected.

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

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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
2023

Word Count	Fair Category	Project Number
253	L8	2517

Title: How different environmental conditions affect the growth of e-coli bacteria

Student Name(s): A. Sticca

Abstract:

Purpose: This project's purpose was to find the best environmental condition for maximum e-coli growth.

Hypothesis:

If the bodily temperature (37° C) is able to support many different kinds of bacteria inside the body, then the 37° C environment will have the most e-coli growth, compared to the 6° C temperature which is not able to support the optimal growth of most bacteria.

Procedure:

E-coli was suspended in 10 prepared petri dishes. They were divided into five different groups: body temperature (37°C), 6°C, constant darkness, constant light, and high humidity which also had access to light. All groups not including temperature as the changed variable were placed at room temperature. Two petri dishes were placed into each of the groups. The petri dishes were left for two weeks and a day, pictures were taken as a form of data and placed into tables.

Data/Observations:

The two different temperatures varied in which the 37°C continued to grow and the 6°C seemed to preserve the growth but didn't have more growth than if started with. The constant darkness groups appeared to have slightly larger bacteria growth compared to the constant light groups. Both had very similar pictures; starting with lots of bacteria but having a noticeable decrease in growth by the end of the trials. High humidity was very similar to the Constant Darkness trials. Although the humidity trials did see light, the light wasn't constant. The high humidity and constant darkness petri dish pictures were very similar throughout the experiment.

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
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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
251	L8	2518

Title: The Effect of Plant-Based Natural Pesticides on Tenebrio Molitors

Student Name(s): C. Mladen

Abstract:

This project's goal was to determine which plant-based natural pesticide was the most effective against pests. This project is relevant to the farming community because it demonstrates a great alternative to pesticides, which are plant-based natural pesticides that have the same properties as regular pesticides while being safer. The research question is how effective non-toxic pesticides are at repelling Tenebrio Molitors from plants. The hypothesis is that if the Lavender Tincture keeps the Tenebrio Molitors the farthest away from the potato, it is the most effective Plant-Based Natural Pesticide for preventing the Tenebrio Molitors from getting close to and eating the potato. The procedure was that a potato was placed in a storage box and various plant-based natural pesticides were applied to it to see how far beetles were repelled from it and how much mass of the potato was lost due to the beetles eating it. According to the results, the potato with no pesticides was the least effective at repelling the beetles, with an average of 3.2 cm and 6 grams eaten from the potato, while the lavender tincture was the most effective at repelling the beetles, with an average of 14 cm and 1 gram eaten from the potato. In conclusion, the lavender tincture was the most effective of the three plant-based natural pesticides tested, which were Neem oil, Peppermint oil, and Lavender tincture, indicating that the hypothesis that the lavender tincture would be the most effective was supported by the results.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
239	L8	2519

Title: The Effect of Sugar on Yeast Fermentation

Student Name(s): T. Adeniran

Abstract:

Yeast is a common ingredient used in pastries such as bread. It is a single-cell organism that feeds on sugars and starches, releasing carbon dioxide as a result. This process is called fermentation. This project aims to find which type and amount of sugar will create the most fermentation. It was hypothesized that the largest amount of cane sugar would cause the most fermentation. During experimentation, 3 plastic water bottles were taken and 1 tsp of yeast was poured into each bottle. After this, 10 fl oz. of 95°F water was added to each bottle. 0.5 tsp of sugar was placed into each bottle. One bottle was given white sugar, the second bottle was given cane sugar, and the last bottle was given brown sugar. A balloon was placed on each bottle and was checked 15 and 20 minutes later. The process was repeated with 1 and 1.5 tsp of sugar. It was found that white sugar created the most fermentation. The balloon was 0.2 cm larger in diameter than the cane sugar balloon. It was also found that the best amount of sugar to use was 1 tsp. In conclusion, the data found does not support the hypothesis. When using 1 tsp of yeast the most fermentation is created using 1 tsp of white sugar. This project could be continued by testing different amounts of yeast or by using other sugars that are not mostly sucrose.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
139	L8	2520

Title: Pancreatic Cancer Treatment

Student Name(s): M. Dragunat

Abstract:

I chose to investigate pancreatic cancer because it is the fourth leading cause of death in women and men. Pancreatic cancer can not be detected in the early stages, because there are no symptoms. In this project the different treatments for pancreatic cancer were investigated. It was hypothesized that out of the two different treatment options studied that immunotherapy would be the most successful option. Simulations were used to understand how chemotherapy works and how the body's immune system works. Results and background research showed that immunotherapy indeed is a promising treatment option for pancreatic cancer.

Understanding the success of different treatment options for pancreatic cancer will help scientists determine the best treatment option for their patients. This can also help to inform people that know they have pancreatic cancer so they can advocate for the best treatment option.

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

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☒ Yes ☐ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
287	L8	2521

Title: Reducing Food Waste with Early, Visual Detection of Bread-Mold via BODIPY-Colorimetric Card Detection of 1-Octen-3-ol

Student Name(s): A. Foell

Abstract:

Food waste is problematic, where our ability to feed an ever-growing society is difficult. To fight food waste, this research has developed a 1,3,5,7-Tetramethyl-8-phenyl-4,4-difluoroboradiazaindacene (BODIPY)-Rhodamine-6G dual-dye bread mold sensor that detects 1-octen-3-ol, the most prominent VOC emitted by bread mold. SEM/GC analyses of bread mold growth provides evidence that mold can be present on bread ~12 days prior to our ability to see it through packaging, with as much as 19.3ppm of 1-octen-3-ol outgassed by the unseen mold. The newly developed BM-Sensor is constructed by adding 20µl of a 4:1 ratio of 0.2g/L-BODIPY and 0.2g/L-Rhodamine-6 (in ethanol) to a 1:1cm cotton sensor, on plastic backing. When exposed to as little as 0.5ppm of 1-octen-3-ol gas from bread mold, within bread packaging, the BM-Sensor's color changes based on selective conjugation of the mold's 1-octen-3-ol outgas to BODIPY, and BODIPY's interaction with Rhodamine-6G, via fluorescence-resonance-energy-transfer. The two-dye BM-sensor's color-change is interpreted via spectrometer, by its 400nm-induced spectral emission, which increases linearly with rising 1-octen-3-ol exposure. Smartphone imagery of the BM-Sensor within the bread packaging is a quicker and consumer-friendly system, which is then converted to RGB values via smartphone application, to predict 1-octen-3-ol content within the bread bag. Prediction of 1-octen-3-ol concentrations between 0.5-19.3ppm highlights initial stages of BM growth, alerting the consumer that the bread has spoiled. Conversely, negative BM-Sensor detection of 1-octen-3-ol will provide consumer confidence of bread freshness, regardless of its sell-by date.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
189	L8	2522

Title: Blue Light Blues

Student Name(s): S. DIaz

Abstract:

Background: The eye is made up of many parts. The cornea, the lens, the pupil, the iris, and the retina are a few of these. Nowadays, we constantly are being bombarded with artificial light, and in particular, blue light. This type of light in moderation is helpful in setting a sleep schedule, but as we approach this digital age it is getting out of hand and causing damage.

Hypothesis: If eyes are exposed to digital blue light without any protection, then they will be negatively affected in comparison to eyes without any exposure or eyes protected with blue light blocker glasses because of the increasing optical strain in our eyes.

Methods: Taking place outdoors, I had volunteers first fill out a questionnaire, before reading on a computer at full brightness for 10 minutes, then fill out the questionnaire again. Finally, I had participants take a five-minute break before they read on the computer with the glasses before filling out the questionnaire one final time.

Results: The Qualitative data I collected indicates a slight optical irritation due to the artificial light, further results require an expansion of further testing.

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

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CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
251	L8	2523

Title: Affect of 3 solutions (Tap water, Salt Water, and Sugar Water) on plants in Natural Light vs. Artificial light as it relates to plant growth.

Student Name(s): S. Alla

Abstract:

Plant growth in relation to outside factors such as type of sunlight and type of liquid going into the plant. The purpose of this project was to show the best outcome of plant growth, in this case arugula plants. This experiment took 6 identical terracotta pots with the same amount of seeds and same amount of soil, 3 being put under sunlight and three being put under artificial light. I believed that the tap water would result in the best growth. Under the sunlight one pot would receive ½ cup of salt water, one with sugar-water, and one with tap water nightly. This was the same for the plants under artificial light. This process would be repeated every night for 2.5 months. After the first week, there was significant growth in the pots with tap water and sugar-water under the artificial light and none under the sunlight. But after one more week the tap water plant under the sunlight seemed to grow the most. The artificial plants started slowing down. After the first month the highest growth was 1 inch. But as time went on the plants under artificial light seemed to mold and dry out, while the natural light plants seemed still strong. The plants fed with salt water under both lights did not grow at all. The plant with tap water under natural light grew the most. All of the ones under artificial light didn't grow based on the fact of the intense pressure of the light.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
248	L8	2524

Title: Conservation of the Monarch Butterfly

Understanding the Monarch population and habitat availability

Student Name(s): G. Giovanelli

Abstract:

The purpose of this project is to help understand the decreasing population of Monarch butterflies who were added to the endangered species list in July 2022.The question I am trying to answer is, Would enhancement of milkweed and nectar resources help with Monarch conservation? My hypothesis is if there is more milkweed and nectar resources throughout Monarch breeding and migration habitats, then there will be more female Monarch butterflies than male Monarch butterflies. Milkweed is the only viable food source for Monarch larvae.I partnered with Mystic Aquarium and tagged Monarch butterflies within nature preserves in Mystic and Stonington, CT. Additionally, I expanded tagging of Monarchs in pollinator gardens in Westerly, RI. As part of my experiment, I identified the gender of the Monarch butterflies based on the number of captures and habitat locations. I learned that habitat location (nature preserve vs. pollinator garden) may be irrelevant as similar numbers of female Monarchs verses male Monarchs regardless of habitat location were captured. It is difficult to make a full assessment with only one season of results, therefore it would be beneficial to look for trends over several seasons. With additional data, trends in migrational behavior and the overall impact of habitat can be analyzed to fully understand factors required to conserve Monarch butterflies from extinction. If we can ensure there is adequate access to milkweed and other pollinator plants along migration routes to support larvae, then we can have a positive impact to the conservation of Monarch butterflies.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
250	L8	2525

Title: Preventing Hypoxia Using Magnetism

Student Name(s): A. Saagi

Abstract:

This project aimed to create a small-scale solution for preventing hypoxia in water bodies. Hypoxia is a condition in which there is a lack of oxygen in water bodies, caused by the uncontrolled growth of algae, so in this project, an experiment was conducted to see if it was possible to utilize magnetism to prevent hypoxia early on in the algae growth. The experiment had three parts - first, I had to cultivate algae indoors using an algae cultivation kit from the Algae Research Supply. I used culture salts to give the algae the nutrients it would have found naturally, so it was not nutrient deprived. The next step was running the actual experiment. In my final experiment, I ended up taking three mason jars. One, I left alone as my control group. One, I added a teaspoon of iron oxide to, and mixed it at high speed for 10 minutes, then removed it with a magnet. In the last one, I left a magnet in overnight. I did this because in my research, I found two magnetization methods. Ultimately, the method in which I used a magnet was the most effective. After a sample was taken from each bottle and observed under a microscope, I saw that the magnet sample had the lowest concentration of algae microorganisms. This method was also environmentally effective, as such high amounts of iron oxide would be copious to the wildlife in that area. In contrast, a magnet would not affect wildlife so drastically.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project): CB 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
2023

Word Count	Fair Category	Project Number
239	L8	2526

Title: How Does Different Types of Water Affect Tomato Plant Growth?

Student Name(s): A. Bruno

Abstract:

I am doing this experiment because I wanted to test how different types of water affect tomato plant growth with regular tap water, salt water, sugar water, and seltzer water. This research is important because if different types of water affect how fast a tomato grows then everyone else should use this type of water that makes their tomatoes grow faster, if a certain type of water kills tomatoes, then people should avoid using that type of water for their tomatoes. The purpose of this project is to see how watering tomato plants with different types of water affects their growth. I put equal amounts of soil in sixteen pots and planted one tomato seed in each pot. I performed four trials. Four pots were watered with, tap water, four with seltzer water, four with salt water, and four with sugar water. I watered the plants every other day and measured their growth once a week for six weeks. The data was analyzed, and the conclusion was drawn that the plants watered with seltzer water grew the most. The plants watered with salt water did not sprout at all.

The question which started this experiment is: “How does different types of water affect tomato plant growth?” The hypothesis is: “If different types of water affect plant growth, then regular tap water will help the tomato plant grow the most.” The tomato Plants thrived with being watered by seltzer water.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
218	L8	2527

Title: F.I.C (Fraternal, Identical, cousin)

Student Name(s): Z. Milani

Abstract:

Why do people who have strong genetic links share so much? It is tied to impact and average people going about their daily lives, I learned.

If two cousins do not live in the same environment, they will have more in common than those who do, such as fraternal and identical twins, since the cousins do not see each other every day, and they haven't seen each other so often that they have grown apart, like identical twins.

The three groups were given a questionnaire with 14 questions on the individuals' unique interests. Following the completion of the questionnaire, individual group interviews were conducted.

During testing, the factors revealed that, although you may be genetically identical (twins or cousins), you may have very different interests. The identical twins demonstrated that, although being bonded when they were younger, they had grown apart. The fraternal twins demonstrated that despite living in the same environment and being exposed to the same things, their interests differed. The cousins have opposing interests. The two variables did not grow up together, they did so in two different nations with completely different environments

That led me to the conclusion that interests are easily influenced and controlled by the environment you live in, the peers you're surrounded with, and the things you have been introduced to.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
244	L8	2528

Title: Mushrooms the Ultimate Survival Food

Student Name(s): O. Nicholas

Abstract:

For my project I chose to explore the process of growing mushrooms. I have always wanted to learn more about mushrooms since in the Spring I usually see mushrooms all over my backyard. So, I have always been curious to learn more about this mysterious Fungi. At the beginning of my research I realized that with all the possible ways to grow these, I thought that they could be easily grown and provide a sustainable source of food. In the event that conventional food sources were not available and resources, such as sunlight or fertilizer were scarce, mushrooms would be a nutritious alternative with minimal growing requirements and many ways to grow them.To start my experiment I bought two Oyster Mushroom grow kits from amazon, received the package and followed all the basic instructions. I put one kit away in a dark closet with no light, and the other kit under a UV grow light and observed how each one grew everyday. The mushrooms under the UV light grew faster. They had a brighter, more vibrant color, and were more full in regards to size. The ones in the dark had a more dull, gray color, and were smaller and thinner compared to the other ones, but they both grew and produced a significant crop. If I were to repeat my project, I would probably try to grow the mushrooms from scratch instead of using a kit. Everything else I would keep the same.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
251	L8	2529

Title: Bioutilization of Italian Rye Grass to remove oily pollutants from soil

Student Name(s): Y. Galicia Herrera

Abstract:

Can Italian Ryegrass remove oil in soil? Oil contamination is usually caused by oil spills from tanks, pipelines, drilling rigs, and storage facilities. Oil has negative effects such as causing pore spaces to become blocked, lower soil aeration, decrease water infiltration, and decrease plant growth. Like many plants, Italian Ryegrass absorbs water/liquids, through its roots (transpiration). However, because they lack the polarity that allows them to attract water, parts of the root's cells that are made of oily substances, collect and cling to Polycyclic Aromatic Hydrocarbons. The negative substances stay inside the plants' tissues or the roots absorb the pollutants; sometimes they get converted into less harmful substances. In this experiment, there were 6 Italian ryegrass seeds planted in 4 different pots, 2 had motor oil in the soil (experiment), while the other 2 did not have motor oil (control). Using the Oil in Soil test kit, all 4 pots were tested. Initially, when each pot was tested, the control pot was green, which means that there was less than 500 ppm (parts per million) within the soil. While the experiment pot was a reddish pink, meaning there was more than 500 ppm. After testing each pot again 2 days later, the experiment pot turned green in the test kit. This indicates that the soil's concentration was now lower than 500 ppm. In conclusion, Italian Ryegrass can remove oil from soil in as little as 2 days. Consideration should be given to planting Italian Ryegrass where oil spills may occur.

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
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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
2023

Word Count	Fair Category	Project Number
168	L8	2530

Title: Does sugar effect reaction time?

Student Name(s): I. Mezheritskiy

Abstract:

My experiment's purpose was to determine if your reaction time changes based on intake of sugar. I was proving whether or not sugar has an effect on your brain. In order to do this I had to get candy and participants to participate in it. First I gave one of each colored skittle, then three Hershey kisses. I made sure to not touch the unwrapped candy; skittles. After I had everyone finish the experiment I collected all my data. Almost all the participants' reaction times slowed, some stayed the same and others went up by a small a mount. I concluded that the skittles mainly lowered reaction time while the Hershey kisses were split in half. When the reaction times for Hershey kisses were going down the times had a longer “space” in between than when the reaction times were increasing. What I researched helped me understand the science behind how the brain takes in the sugar and helps you do things and work faster and more efficiently.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in 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
2023

Word Count	Fair Category	Project Number
275	L8	2531

Title: Implemenation of Rhizobium Nitrogen-Fixation to Increase Overall Crop Production, and Inhibit Fusarium Wilt

Student Name(s): H. Dcruz

Abstract:

Although comprising of 78% of our air, plants are unable to absorb nitrogen in its natural form. Nitrogen fixation is mediated by bacteria, and represents a favorable approach to provide nitrogen to plants without harm to nature. To feed a growing global population, new methods to increase crop production, and inhibit the wilting effects of plant pathogens, is essential. This research investigated improvements in plant biomass/growth for soybean via addition of nitrogen-fixing bacteria (Rhizobium meliloti), for healthy plants, as well as those afflicted with Fusarium verticillium, and compared to similar growth studies for urea fertilizers. One-month growth results highlight a 15% increase in soybean growth rate, at 0.61cm/day, versus 0.53cm/day for normal plants. Similarly, the average height of N 2 - fixation plants was 1.25x higher than normal plants (16.5cm, vs. 13.2m) at 25 days. Soybean plants infected with Fusarium were 19% smaller (10.7cm for wilt vs.

13.2cm for normal). However, the addition of N-bacteria overcame the pathogen's wilting effect, to a 25-day growth of 15.5cm, which is 17% higher than healthy plants. The Normalized-Difference-Nitrogen-Index (NDNI) for each leaf/plant condition was determined via Near-IR analysis of each configuration's leaf,highlighting nitrogen uptake. The NDNI for N-bacteria plants was 0.062, or 32% higher than normal plants (0.047). Fusarium reduced nitrogen-uptake by 19% (0.038), however the addition of N-bacteria to the fungal plants increased plant N-content to normal levels (0.043). Finally, SEM/EDS analysis highlights a 26.6% increase in Nitrogen/Carbon for N-bacteria-assisted growth; urea-assisted plants were unchanged. N-bacteria raised Fusarium-plant N/C content to normal levels.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) EN EV 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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2. Student independently performed all procedures as outlined in 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
2023

Word Count	Fair Category	Project Number
250	L8	2532

Title: The effect of light color on plants

Student Name(s): A. de Graaf

Abstract:

The purpose of my experiment was to see how different colors affect plant growth.

Studies were performed with cat grass, with 10-15 seeds per planter. The plants were placed in a styrofoam box in groups of three that received the same light color. Dividers separated the different colors, as well as removed outside light. The light sources were 42 Watt LED lights covered with colored plastic. Two experiments were done, (1) 12 hours of light per day for 4 days and (2) 3 hours of light per day for 9 days. At the start of each experiment, all plants were cut to 50 mm length. The average plant height was measured once per day.

In experiment 1 all plants grew at the same rate (25 mm/day), including the one without light. Based on this result, contamination of outside light was reduced and the light duration was decreased to 3 hours. In experiment 2, plants with orange and no light grew for 3 days, then stopped growing. Plants with white and green light grew the most and continued to grow over all 9 days at 12 mm/day. The other colors fell between white and no light.

In conclusion, with a lot of light (12 hrs/day) all plants grew rapidly regardless of the light color. Plants that grew in the dark showed that light pollution was a problem. On the other hand, having only 3 hours of light showed how the change in light color can affect plant growth.

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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CSEF Official Abstract and Certification
2023

Word Count	Fair Category	Project Number
244	L8	2533

Title: D.E.R.M.A.

Student Name(s): T. Bhattacharya

Abstract:

The goal of this project was to build a machine that is able to process an image of a surface-level skin disease such as acne, eczema, rosacea etc. and diagnose it. The first part of the project is actually capturing the images which is done with the Raspberry Pi Camera Module 3. It was selected due to its autofocus capabilities that have been used to ensure the images are recorded consistently. The camera is mounted on a 3D printed enclosure which ensures a durable yet affordable structure. The second part of the project is processing the images to determine a diagnosis and present it to the user. This is done with a deep learning model, exported onto a Raspberry Pi Zero 2. The model uses data from an online service, called Kaggle, which divides a total of 19,500 images into train and test subsets. The train data is then fed through multiple layers, using an architecture based on VGG16 to process the images, and help the algorithm understand which characteristics of the image make it belong to the class as designated. Novel techniques such as data augmentation and autotune have also been used to optimize accuracy. I have achieved an accuracy of 70% with the algorithm, making D. E.R.M.A. a reliable resource. This project provides a faster and more economical solution than a doctor's visit, and also is more secure than at-home test kits, providing an overall more efficient solution for dermatologic diagnosis.

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
2023

Word Count	Fair Category	Project Number
263	L8	2534

Title: Design and Implementation of a Novel Machine-Learning-Based System Utilizing Feature Extraction for Precise Cervical Cancer Detection via Biopsy Sample

Student Name(s): E. Joseph

Abstract:

Current cervical cancer detection methods, whether traditional or AI-driven, have limitations in accessibility and accuracy. The widely used pap-smear test is not feasible in many parts of the world due to lengthy lab processing times and necessitates the use of AI. AI-based pap-smear processing methods often lack accuracy and require substantial computing resources, rendering them largely ineffective. Inaccuracies in many AI-based systems stem from their reliance on biopsy images, which can yield unexpected results due to variations in testing conditions and make them computationally expensive and inaccessible.

This project aims to create an accessible, computationally-efficient machine-learning-based system to detect and classify cervical cancer from a biopsy sample. An algorithm based on the OpenCV computer vision library was created to extract cellular features, such as cell area and perimeter, from biopsy images. Utilizing these features for training reduces exposure of non-cell material to the model, thereby improving accuracy as compared to training the model on the entire biopsy image. The extracted features were then used to train and evaluate a regression-based neural network. Another neural network, based on the VGG-16 network architecture, was developed and trained on biopsy images to serve as a baseline.

When evaluating the models, it was observed that the neural network trained upon numerical features extracted from biopsy images had significantly higher accuracy and less resource usage, expanding the use case of such a model to low-powered devices such as the Arduino microcontroller. This project hopes to provide accessible and instantaneous cervical cancer testing in third-world countries.

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