CONNECTICUT SCIENCE & ENGINEERING FAIR

77th Annual Fair
March 3-15, 2025

Student Abstracts

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
229	LT	1001

Title: ARE OYSTERS FROM SOME PLACES SAFER THAN OTHERS.

Student Name(s): A. Garner, A. Millar

Abstract:

The experiment aimed to investigate microplastic levels in oysters from various geographic locations. Microplastics, which are tiny plastic particles that degrade from items like bottles and bags, are a growing environmental concern due to their impact on human health. By collecting oysters from different coastlines, we sought to compare the amounts of microplastics present in each sample and understand how pollution levels vary across regions.

To experiment, we carefully shucked and washed the oysters to remove any external contaminants. We then placed the cleaned oysters in mason jars with 2oz of hydrogen peroxide, allowing them to digest for 30 hours. This process helped to break down the oyster tissue and extract microplastics. After digestion, we filtered the remaining material and examined the filters under a microscope to identify and analyze the microplastics.

Our findings revealed that all oyster samples contained microplastics, with Darien oysters showing the highest concentration, followed by those from Prince Edward Island, Wellfleet, and Westport, which had the least. This confirmed our hypothesis that oysters from more polluted areas are likely to have higher microplastic levels.

Understanding the implications of microplastic pollution is essential, as it not only affects marine ecosystems but also poses health risks to humans who consume contaminated seafood. This research could inform policies aimed at reducing plastic waste and encourage environmentally responsible choices among the public, ultimately contributing to a healthier planet.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
161	LT	1002

Title: Does a Vegetarian Diet Affect Blood Pressure?

Student Name(s): W. Goodman, L. Vidal

Abstract:

The purpose of our experiment was to determine if a vegetarian diet affects your blood pressure. Our hypothesis was, because of the change of diet and not eating more vegetables which are high in potassium, it will lower your blood pressure. We tested 3 participants who went on a vegetarian diet for 4 weeks. We took their blood pressure every few days for 4 weeks on a MicroLife Automatic blood pressure machine. We found out participants had fluctuating blood pressure, but the trend over the weeks was blood pressure was lower most of the time. We kept a graph to see what their blood pressure looked like during the 4 weeks. The reason your blood pressure goes down when you are vegetarian is because it's less saturated fat and higher potassium. Many plant based foods and vegetables are also higher in antioxidants as they are better for cardiovascular health as they can reduce stress which is a risk of heart disease.

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

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

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☐ vertebrate animals ☐ controlled substances

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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
2025

Word Count	Fair Category	Project Number
214	LT	1003

Title: Compost vs. Fertilizer

Student Name(s): L. Molisani, G. Molisani

Abstract:

This experiment was designed to determine if compost or fertilizer creates nutrient rich soil. Fertilizer has caused many negative problems including large nitrogen loss through leaching, volatilization, and denitrification, causing concern for water quality, greenhouse gas emissions, and soil health among other concerns. (Sellars, 2012) Fertilizers, while promoting rapid plant growth can cause environmental and health problems. Compost offers a sustainable alternative, enriching soil while reducing waste. This experiment compared compost, fertilizer, and natural soil, measuring phosphorus, potassium, nitrogen, and pH levels, necessary for plant growth and development. It is believed that compost will create a more nutrient rich and ecologically safe soil base. Initial tests showed fertilizer's immediate nutrient release, while compost and natural soil had lower levels. Over time, compost demonstrated a gradual nutrient increase, notably in potassium and nitrogen. Conversely, fertilizer's potassium levels decreased, and both fertilizer and natural soil showed low levels of potassium. After three days, compost exhibited high potassium and nitrogen levels, moderate phosphorus, and a pH of 6.0. Fertilizer showed high nitrogen, medium phosphorus, low potassium, and a pH of 6.0. Natural soil consistently lacked potassium and phosphorus. The experiment proved the hypothesis: compost creates a more consistently nutrient-rich soil than fertilizer, demonstrating its long-term benefits over the immediate, but potentially detrimental, effects of fertilizers.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
112	LT	1004

Title: The Bioluminescent Dinoflagellates Fish Tank Light

Student Name(s): x. dejesus, g. medolli

Abstract:

The purpose of the experiment is to test if dinoflagellates can light up a fish tank.This topic was chosen because bioluminesce is one of the more interesting options out of all of the things that could be created and used. This research project is also intended to find an inexpensive light source for all those vivarium creators.The project will test how much light dinoflagellates create which will be measured using a light meter. In addition, the experiment will test how far the bioluminescent dinoflagellates spread their light in a water filled fish tank.This experiment presents the opportunity to find a more cost effective, natural way to light the housing of vivarium creators.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) CB 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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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
224	LT	1005

Title: Does heating or cooling a fruit/vegetable lower the amount of Brix?

Student Name(s): M. Rehan, G. Vallinayagam

Abstract:

The purpose of this project is to find out if heating or cooling a vegetable or fruit decreases its brix number. The brix number indicates the soluble solid content that refers to the sum of sucrose, nutrients, vitamins, and other minerals. The investigative question is: Does heating or cooling a fruit/vegetable lower the amount of Brix value compared to room temperature? The hypothesis is that heating will lower the brix number because some nutrients may escape into the water. To test this, carrots and apples were heated to 90oC, and 50oC, and cooled to 10oC. A garlic press was used to squeeze out the puree and a Optical Brix Refractometer was used to measure the Brix number. For apples, the cooling had the same brix number as the room temperature but heating caused a decrease. For carrots, cooling the carrots was the same and heating was a minor difference. This means the hypothesis for the apple was correct, but not for carrots. Other vegetables and fruits were tested at room temperature and after steaming to 90oC. The results show that fruit's brix numbers are lowered when heated, though the effect on vegetables is not as great as the fruits. This experiment helped us understand that eating fruits raw is better than eating them cooked because their nutritional value drops when you heat them.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
200	LT	1006

Title: Smart Sprouts- Precision Care for Plants

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

Abstract:

Smart Sprouts is an innovative irrigation system that enhances sustainable agriculture by using rainwater harvesting and advanced soil moisture sensors. This technology delivers precise watering tailored to the specific needs of plants throughout their growth cycles. By monitoring soil moisture levels, Smart Sprouts ensures that plants receive the optimal amount of water, promoting healthier growth and improved yields. One significant benefit is its ability to reduce reliance on external water sources. Traditional methods like flood irrigation can waste water, leading to soil erosion and nutrient depletion. In contrast, Smart Sprouts optimizes water use by directing it precisely where it's needed, improving resource efficiency and reducing the carbon footprint associated with transporting water. Additionally, rainwater harvesting decreases irrigation costs, allowing farmers to lower their water bills and minimize the economic impacts of droughts. Research shows that smart irrigation technologies can achieve water savings of up to 50% compared to conventional methods, making it an economical option for various agricultural applications. Overall, Smart Sprouts reflects the principles of sustainable agriculture, providing a scalable solution that benefits both the environment and farmers. As global water scarcity grows, innovations like Smart Sprouts offer promising pathways to more efficient water management and sustainable farming practices.

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

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

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
244	LT	1007

Title: How Do Varying Levels of Fertilizer Affect The Growth of Leafy Greens

In a Bucket Hydroponic System

Student Name(s): A. Banker, B. Lewis

Abstract:

In many places in the world, farming is inadequate due to land and water quality, which will worsen over time due to war and climate change. The bucket hydroponic system allows for plant growth without land and with significantly less water usage. We tested different concentrations of fertilizer in a bucket hydroponic system to examine the impact on the growth of leafy greens. The prediction for this experiment would be that the control bin, with the recommended concentration of fertilizer, would be the healthiest. The second bin, with half the concentration of fertilizer, would die first due to a lack of nutrients. The third bin, with double the concentration of fertilizer, would die next due to an excessive amount of fertilizer. The fertilizer used is a combination of nitrogen, phosphorus, and potassium, (NPK), and calcium nitrogen CaN. We tested electrical conductivity (EC) level and physical signs. After two weeks, the results showed that the hypothesis was correct. The control was the healthiest, although it showed some signs of wilting and an EC level of 1856. The low-concentration bin died the fastest out of the three from a lack of nutrients with an EC level of 976, followed by the high-concentration bin with an EC level of 3631. In conclusion, the data showed that the regular concentration of fertilizer is the most effective. This research helps solidify the correct amount of fertilizer in bucket hydroponics, which can help with combating hunger and starvation.

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

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☐ vertebrate animals ☒ controlled substances

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3. This project was conducted at a Registered Research Institution. ☐ Yes ☒ No
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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
249	LT	1008

Title: How do different water solutions affect dyeing roses green?

Student Name(s): P. Borowski, C. Guerrero Diaz

Abstract:

Our project was about how different water solutions affect dyeing roses green. Our water solutions were tap water, white distilled vinegar water, sugar water, and salt water. Our hypothesis was that tap water would be the best water solution for dyeing roses. How we tested our hypothesis is by doing our experiment multiple times and also making sure our results were correct. Some of our observations were that, after 12 hours, vase c started to show a little bit of green, and rose showed a little bit of green as well. Vase d started the process of dying and vase b was showing no signs of becoming green or dying; it was actually helping the rose to stay alive longer. After 24 hours, Rose C finally finished becoming green and the vase didn't change at all. Vase d died completely and vase b was still holding up well and had no changes similar to vase a. Our results from this experiment were that tap water worked the best and successfully dyed the rose green. The second-best water solution was the sugar water solution, which dyed the roses green only around the edges of the rose. The third-best water solution was vinegar, which did not dye the rose green but did keep it alive. Lastly, we have the salt water solution which did not dye the rose green and ended up killing the rose. Our hypothesis was correct. Overall, our project was a success and turned out great.

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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☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
245	LT	1009

Title: Creating and Testing Fruit Peel Extracts to Enhance Plant Growth

Student Name(s): G. Zakrzewski, S. Clark, C. Chawla

Abstract:

This project tested to see if fruit peel extracts can help carrot plants grow better than traditional fertilizers. This is important to test because it might help people who are struggling to grow plants and can also eliminate the need for traditional fertilizers that can pollute. Our hypothesis is that fruit peels will help plants grow more in both number and height than traditional fertilizer because they are a natural source of nutrients, and can promote growth without chemicals. We used bananas, apples, and oranges to make the extracts and then used the extracts to water carrot seeds in soil. We continued once the seeds germinated and grew into plants. We found that banana extract grew the tallest plants (average of 2.4 cm) but the height was not a large percentage more than plain tap water (average of 2.3 cm). The pots with plain tap water grew the greatest number of plants. All of the extracts except for orange grew larger than the fertilizer plants. Perhaps the plants with orange extract did not grow well because of its low pH (4.5). However, orange extract produced the greatest number of plants out of the extracts. The next lowest pH for the extracts was apple at 5.0 and there were fewer apple extract plants produced than any other control or variable. To conclude, banana extract produced the tallest plants but the tap water control produced the greatest number of plants. Testing using solid peels is currently underway.

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

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

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
229	LT	1010

Title: What Dish Soap Removes The Most Bacteria?

Student Name(s): M. LaMonica, L. LaChance

Abstract:

We are doing this project because we want to figure out what dish soap removes the most bacteria. I think that people who cannot afford a dishwasher, or if their house does not have a dishwasher should care because it shows which soap is the best to use. It would help because it shows which soap is the best. Our project solved which dish soap is the best. If Dawn is added to the process of washing dishes, then they will be cleaner, because I know from past experiences that Dawn cleans very well. First, we researched which soaps were the "best". We then started the experiment. We soaked all of the plates in water for the same amount of time. Then we swiped each once and it showed that Dawn did the best. We used the same amount of sauce, 120ml, and soap, 60ml. All of the dishes started with 270,000 Colony Forming Units (C.F.U.). Dawn removed the most bacteria, removing 262,980 C.F.U., 97.4% of the bacteria. Gain removed the second most bacteria, removing 249,750, 92.5% of the bacteria. Removing the least amount of bacteria was Palmolive, only removing 243,810 C.F. U., 90.3% of the bacteria. Our experiment proved that Dawn is the best dish soap. It contributes to the subject, which was life science, we worked in because it shows which dish soap is the best to use.

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

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

Word Count: 257

CSEF Official Abstract and Certification
2025

Fair Category: LT

Project Number: 1011

Title: Microneedles (MN) and Its Application in Diabetes Treatment

Student Name(s): T. Xie, Y. Zhao

Abstract:

Diabetes plagues millions worldwide; more than a tenth of the U.S. population is diagnosed with such disease. It occurs when the pancreas cannot produce insufficient insulin or the body cannot use insulin effectively, leading to high blood sugar levels. Over time, accumulation of blood sugar due to diabetes can instigate severe health issues, including heart disease, nerve damage, and vision loss. However, traditional insulin injections can be painful, inconvenient, and require frequent dosing, leading to poor patient compliance. Our research shows the use of microneedle (MN) technology as a comfortable and efficient method for delivering insulin and glucagon-like peptide-1 (GLP-1) (another substance that controls blood glucose level) through the skin. Microneedles provide a painless and relatively cost-effective alternative to common injections, improving drug absorption while reducing the frequency of injection. In this research, a bio-dissolvable microneedle patch was made with hyaluronic acid (HA), insulin, and GLP-1. Experimental results have shown that the microneedles penetrated pork rind skin samples, dissolved efficiently, and released the medication in a controlled dosage with sustained drug absorption, thus enhancing treatment effectiveness while minimizing potential side effects. Additionally, biocompatibility tests confirmed that the microneedles were safe for skin cell environments and showed no harmful side effects. Microneedle patches offer a more convenient and comfortable treatment option than traditional insulin injections. With further development, microneedle technology has the potential to change diabetes treatment by providing a simpler, more accessible, and more effective alternative.

Keywords: Diabetes, Microneedle (MN), Hyaluronic acid (HA), Drug delivery, Glucagon-like peptide-1 (GLP-1)

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

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- ☐ vertebrate animals
- ☐ controlled substances

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
237	LT	1012

Title: What Hydroponic Starter Works Best.

Student Name(s): M. Pappas, J. Swanson, L. Szwed

Abstract:

Our project is evaluating what soil works best for hydroponics starters. Hydroponics are a common and beneficial way to speed plant growth and successfully harvest plants. The starters that were used are: coconut husks, rockwool, and potting soil. The plants that were grown are spinach, lettuce, swiss chard, and cucumbers. The hypothesis was that rockwool would work best because it is a very common starter used in hydroponics. Instead, the coconut husks worked best due to the fact that they grew the most plants. The experiment also showed that coconut husks grew the plants faster and taller. The rockwool did not grow for us even after multiple attempts. The first we planted the seeds in the different starters, each type of plant was planted 12 times. They got watered and tracked daily. In total there were 48 pots used and each plant was planted 12 times. In the beginning of the experiment, the potting soil was growing the most plants and seemed to be the most successful one, they then quickly died out. The coconut husks took around ten to fifteen days to germinate, but once they were germinated they would take around a week to grow as tall as the potting soil would take to grow in two weeks. The coconut husks ended up being the most successful in the growth of the plants, making them the healthiest and tallest out of the three different starters.

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
2025

Word Count	Fair Category	Project Number
201	LT	1013

Title: The Effect of Silver Nanoparticles and Microplastics on the Reproductive Rate and Lifespan of Artemia Salina

Student Name(s): S. Iyer, S. Bellissimo

Abstract:

This project is about testing the effects of exposure of silver nanoparticles and microplastics on Artemia salina (brine shrimp) as it pertains to their lifespan and reproductive rate. We also want to educate the community on water quality and pollution. The brine shrimp were raised from cysts and placed in 3 tanks. The two variable tanks and the control tank were all kept at the same temperature and salinity and the brine shrimp were all fed the same diet. The independent variable was the pollutant added to each experimental tank, either microplastics or silver nanoparticles. The control tank had no added pollutant. We found that the addition of even a small quantity of silver nanoparticles or microplastics - at typical wastewater level concentrations - to a tank of brine shrimp significantly decreases their lifespan and reproductive rate. The silver nanoparticles had a more detrimental effect. We were able to confirm this by tracking lifespan and reproductive rates of shrimp exposed to nanoparticles and microplastics against a control group of shrimp which did not have these exposures over a five-week period. Future work involves testing the ability of both chitosan and activated charcoal to absorb these pollutants thus potentially mitigating their adverse impact.

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

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☒ Yes ☐ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
204	LT	1015

Title: Effect of Antibiotics on E-Coli and Lactobacillus

Student Name(s): B. Zhou, G. Pereira

Abstract:

Lactobacillus, is an important genus of bacteria that plays a crucial role in human health and various ecosystems. When your gut lacks lactobacillus, or has less of it than it should, then it can lead to stomach cramps, pain, bloating, and so many other uncomfortable symptoms. Our project is aimed to determine which antibiotic (Ampicillin or Kanamycin) will treat E. Coli best, and if this antibiotic negatively or positively impacts the probiotic, Lactobacillus. E. coli was plated on agar petri dishes in four groups: NT (no discs), NT + ddH2O, Ampicillin, and Kanamycin. The most effective antibiotic was used for further testing on Lactobacillus. Overall, Kanamycin gave the largest inhibition zones, than Ampicillin. Dishes without antibiotics were fully covered in bacteria showing no inhibited areas. Measurements showed Kanamycin inhibition zones ranged from a circumference of 2.5 to 4 cm in diameter, while Ampicillin ranged from 1 to 1.5 cm in diameter. When combined with Lactobacillus, Kanamycin did kill the E. Coli, but it didn't kill the Lactobacillus. In conclusion, Kanamycin was the most effective against E. coli, with Ampicillin being the second best. Kanamycin does not seem to impact gut bacteria, Lactobacillus, so it's suitable for use without any long-term effects to gut health.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
235	LT	1016

Title: The Sweet Trap

Student Name(s): H. Prewo, Z. Jasion

Abstract:

Have you ever drank soda before? Well, you might think it tastes good, but it is threatening your body and causing damage to your teeth. The purpose of doing the science experiment was to warn people about the dangers of sodas to your teeth and body and to investigate the health risks of soda. Problems this experiment solved was how bad sodas can be for someone's body and seeing how bad the acid/sugar can affect people's teeth later on. The hypothesis of the experiment was: If soda is bad for your teeth and organs, then it will cause damage to eggshells, because teeth and eggshells both have high calcium and minerals. The approach for this experiment was getting all the materials and preparing them. Then set up all the safety precautions. Lastly, search about how teeth are like eggshells because of their calcium and minerals. The most important variables were sugar, ph, and decay in teeth.

This experiment proves soda is not the best option for your daily consumption because it can damage teeth, which leads to cavities and negatively impacts health. The pH and sugar of each soda was Mountain Dew-3.22- 46g-per-360ml, Fanta-3.03-52g-per360ml,Gingerale-3.00-33g-per355ml,Dr pepper -2.9 39g-per355ml. In conclusion, the area we worked in was oral tooth decay and health. The objectives were met, such as finding ph/sugar which can affect teeth/health.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
231	LT	1017

Title: DO Coffee Grounds Work As A Natural Soil Enhancer ?

Student Name(s): I. Roy-Mahmood, E. Lizon, H. Lewis

Abstract:

Our group wanted to find out if used coffee grounds could be a natural soil enhancement. The reason why we chose to use coffee grounds is because it is a sustainable way to reuse seeing that 6 million tons of used coffee grounds are thrown into landfills every year. During our research we also saw that coffee grounds can be a good supplement because they give vital nitrogen to the plant. During our experiment we specifically used garden vegetables including cucumbers, lettuce and radish. When we conducted our experiment we took 30 plastic cups, 10 for the radish plants, 10 for the lettuce plants, and 10 for the cucumber plants. We planted 2 of each plant in specific coffee to sand ratios. They were 100 % coffee, 75 % coffee, 50 % coffee, 25% coffee and 100% sand. Our original hypothesis was that the plants growing in the addition of coffee were going to thrive. At the end of our experiment over 80% of the cucumber grew with coffee grounds, and 50% of both the radish plants and the lettuce grew with the coffee grounds. In conclusion our hypothesis was semi- correct with mixed results but overall the statement that garden vegetables will thrive in used coffee grounds is ultimately accurate. In the future this information could be used to help farmers find an affordable way to enhance their soil and reduce landfill usage

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
251	LT	1018

Title: Beyond Skin Deep: Examining Bacteria on Beauty Blenders

Student Name(s): A. DiDonato, S. Coppola

Abstract:

Background: More than half of the people who live in the U.S. use cosmetics. These people are often left with dirty beauty blenders to apply their makeup within the first few weeks of buying them. Bacteria build-up on these tools can leave someone susceptible to infection. We wondered how dirty the beauty blenders actually were and this led to our research question: Should beauty blenders be washed and if so, how often and with what cleaning products? We hypothesized that the unwashed beauty blenders would produce the most bacteria.

Methods: For two weeks, we applied one pump of makeup to each of our 9 beauty blenders and used them individually on the backside of our washed hands. Sponges were divided into three categories: 1. sponges remained unwashed; 2. sponges were washed with only cold water; 3. sponges were washed with hot water and dish soap. After two weeks, we swabbed samples from each sponge onto a petri dish. For five days, we evaluated and documented the bacteria growth of each labeled dish daily. We used petri dishes containing agar so the bacteria growth would be visible to the human eye without microscopes. All petri dishes were kept under a heat lamp at a consistent 85 degrees fahrenheit.

Results: Our results indicated that the sponges that weren't washed (Category one) grew the least amount of bacteria.

Conclusion: We concluded that washing beauty blenders does not decrease the amount of bacteria. Instead, replacing the beauty blender about every two weeks is recommended.

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
2025

Word Count	Fair Category	Project Number
209	LT	1020

Title: Does Plant Orientation Affect Growth?

Student Name(s): S. Yoo, C. Castilho

Abstract:

How does plant orientation affect the likelihood of a good crop, or a basic germination time expectancy? The purpose of this project is to examine if plant orientation has an effect on germination. It will also examine the possibility of growing larger crops by changing the orientation of plants and if this change can fulfill the demand considering the growing population. We did this by planting 3 groups of sugar snap pea seeds, leaving 2 plants in each group, resulting in a total of six plants. Each group was placed in one of 3 positions, lying horizontally, upside down, or as the control i.e. vertically standing. The plant's germination and growth was observed and recorded for 16 days. Our data's results showed that when in a position other than a natural growing position with soil downwards and light upwards gravity does indeed have an effect on plant germination and growth. This effect consists of slowing down a plants growth rate and reducing a seeds dormancy therefore reducing the time to germination. The reason behind the speed to germination and delay in growth may be due to gravity confusing the plants sensory systems because of the different plant orientations Consequently resulting in plant orientation affecting the plant germination and growth.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
201	LT	1021

Title: Determining an Inexpensive Growth Medium for Oyster Mushrooms

Student Name(s): S. Cardenales-Flamand, K. Donnelly, E. Bohonowicz

Abstract:

Mushroom farmers pay a premium for soil to grow mushrooms. We are looking at less expensive growth mediums. Our science fair project was comparing different materials to see which one grows oyster mushrooms (pleurotus ostreatus) mushrooms the best. Our materials were coffee grounds, toilet paper, and straw. Our hypothesis was that oyster mushrooms would grow the best in coffee grounds because mushrooms tend to grow in humid and damp areas. Coffee grounds maintain a high moisture content and contain many essential nutrients. From the beginning of the experiment there was little growth in the toilet paper, and straw but there was a large amount in the coffee grounds. Eventually there was much more growth in the toilet paper and the coffee grounds but there was little in the straw due to it not having a lot of damoness but the mushrooms in the coffee grounds grew the best consistently throughout the experiment. Our hypothesis was correct because the oyster mushrooms thrived in the coffee grounds. Growing mushrooms in coffee grounds is an efficient way to grow them without paying a lot of money. Starbucks and other coffee shops give out free coffee grounds that are able to be used to grow.

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
2025

Word Count	Fair Category	Project Number
218	LT	1022

Title: How Does The Type of Food Affect Garden Snail Activity?

Student Name(s): M. Urban, S. Gaudenzi

Abstract:

This project aims to measure snail movement after eating different types of food. Active snails are much healthier for the environment since they break down and decompose dead organisms. The research question of this project is how different types of foods given to garden snails affect how far they move and how much energy they have. This is vital to those caring for a snail's well-being. If strawberries are higher in nutrients and natural sugars than most fruits and vegetables, then the snail being fed strawberries is expected to have the most movement (energy) overall. Four snails were each fed a different type of food (apple + chalk, strawberry + chalk, lettuce + chalk, mix of all three variables) in terrariums and were fed and monitored once a day for seven days straight. After seven days, the snail being fed a mix of all three variables (control snail) had the most movement overall, which shows this snail had a lot of energy to move around. The three variable snails did not move as much, as they often slept or did not have as much movement/energy as the control snail. In conclusion, snails that ate lettuce, strawberries, apples, and chalk, had the most movement overall. This means they have more energy to move around compared to the other variable snails.

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
2025

Word Count	Fair Category	Project Number
173	LT	1024

Title: Static Electricity's Effect On The Cells Of A Ball Cactus

Student Name(s): C. Hudobenko, J. Maddox

Abstract:

This project focuses on how static electricity can affect house plant cells, using a ball cactus. The ball cactus was chosen because it was a readily available house plant. Ball cactus is also easy to experiment on and compare the differences when more than one is available. This research can be useful to others as it can be a way to compare if static electricity shock has an impact on plants and would it have the same effect in altering cell appearance. The goal is to investigate how static electricity impacts the lifespan of the cactus and the plants' growth. The prediction/hypothesis was that excess energy will overcharge about ¼ to ⅕ of the cells in the cactus because static electricity may damage the cactus cells. To measure impact of the static electricity the cells were looked at through a microscope before and after the static electricity is applied to the cells to determine impact on appearance. Visually the microscope showed no difference in the cactus cells with and without electric shock.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) CB 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
2025

Word Count	Fair Category	Project Number
222	LT	1025

Title: A study of the efficiency of ice melt substances and their environmental impact on roadside vegetation.

Student Name(s): A. Williams, E. Sikorski

Abstract:

The purpose of this experiment is to show substances that will melt ice efficiently and be safe for the environment. The procedure for this experiment is that trays get put into the freezer with 500 ML of water; after the trays are frozen the materials are tested. The materials sit on the ice for 30 minutes and then the amount of ice water is measured. In procedure phase 2, dirt is put into plant holders, grass seeds and clover seeds are spread evenly in the dirt, then they are placed to grow under the plant light stand and watered evenly each day. After they sprout, the seedlings are split into 7 different sections and labeled. In procedure phase 2 part 2, the fern was split into 7 different sections planted into styrofoam cups and labeled. Pine and cedar trees branches were labeled with different colored pipe cleaners to identify what substance to spray. The results were that chloride containing substances produced the most melted ice but did not work well environmentally on vegetation. Plant damage occurred on many of the plants except the trees. Beet juice and water were the substances that produced the least plant damage. In conclusion, beet juice should be the recommended substance for environmental safety that can melt ice but it is not efficient enough for highway use.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
240	LT	1026

Title: The Bone to Pick with Ocean Acidification: Bone Meal, a Substrate that Supports Phytoplankton growth and Helps Reduce Ocean Acidification

Student Name(s): A. Shiue, K. Rokkam

Abstract:

Ocean pH has declined by approximately 30%, from 8.2 to 8.05, over the past 150 years, driving ongoing ocean acidification that threatens marine ecosystems, particularly phytoplankton populations. The potential loss of phytoplankton could disrupt marine food webs, lead to significant biodiversity loss, and exacerbate environmental imbalances. This study examines the effects of varying pH levels on phytoplankton growth and investigates natural methods to restore pH balance. Using five water samples with pH levels ranging from 4.0 to 9.5, nannochloropsis plankton were cultured over several one-week periods. Growth rates were precisely measured with a hemocytometer, confirming the hypothesis that the optimal pH range for phytoplankton growth lies between 7.0 and 9.5, with increased acidity causing significant die-off (~27% at pH 4.0). A sustainable solution was identified: a mixture of bone meal (calcium phosphate) and eggshells (calcium carbonate) (BM/ES), which reacted with hydrogen ions in seawater to produce phosphates and bicarbonates, increasing water alkalinity by up to 50%. This BM/ES treatment improved phytoplankton growth, boosting populations by up to 30%, and supplied essential nutrients—calcium, potassium, nitrogen, and phosphorus—that further supported their development. The most notable finding was that BM/ES reduced phytoplankton die-off rates by 1.4% at pH 6.0 and 19.5% at pH 4.0. These results suggest that enhancing ocean alkalinity with natural substrates may mitigate the effects of ocean acidification and promote the resilience of phytoplankton populations in the face of shifting ocean chemistry.

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

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
245	LT	1027

Title: What mixture of compost and sand or compost and mulch grows grass the most effectively?

Student Name(s): G. Kelly, C. Young

Abstract:

For our science fair project we tested which mixture of sand and compost or mulch and sand would grow grass the best. The Ratios we tested were 100% mulch, 100% Sand, 100% Compost, 75% Sand 25% Mulch, 75% Sand 25% Compost, 50% Sand 50% Compost, 50% Sand 50% Mulch, 25% Sand 75% Mulch, and 25% Sand 75% Compost. We did this to see what mixture would grow our grass the fastest and most effectively. We grew the plants for a total of 15 days and watered them every day with about half a cup of water. What mixture of compost and sand or compost and mulch grows grass the most effectively? 100% Mulch was the most effective for growing grass. If you are going to plant grass it would grow fastest in mulch. The 100% mulch grew a total of 19 cm in 15 days because the mulch holds water in and has nutrients, while others only grew to about 15 centimeters or only 5-10 centimeters. The mulch has many nutrients from the tree it came from, as well as being able to retain water. While sand just soaks up the water and percolates so its beyond the reach of grass roots. First we measured our our sand, compost and mulch into bins then put about 15 seeds in each. After that water them with about a half cup of water each day for fifteen days, each day record data on growth speed and height.

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
2025

Word Count	Fair Category	Project Number
246	LT	1028

Title: How does the amount of glycerin affect the torson, tensile strength, and flexure of sustainable seaweed fabric?

Student Name(s): C. Hayden, E. Buck

Abstract:

The purpose of this project was to see if there are safer and more sustainable fabrics for the environment. The investigative question was: "How does the amount of glycerin affect the torsion, tensile strength, and flexure of sustainable seaweed fabric?" The hypothesis was that adding more glycerin would make the fabric stronger.

To test this, three mixtures were prepared using 200mL of water, 4g of sodium alginate, and different amounts of glycerin (0g, 4g, and 8g) and poured into each of the cups and mixed with the immersion blender. Then, the mixtures were poured into bowls and put into the refrigerator. After a couple of hours in the refrigerator the bubbles were removed. Afterward, they were poured into embroidery hoops pre-treated with a 10% calcium chloride solution to help solidify the fabric. A light mist of Calcium Chloride was sprayed on top of the sample to limit mold growth. The samples were left for a couple of days to let them dry. Once the samples were dry, they were tested for torsion, flexure, and tensile strength.

The results showed that the sample with 0g of glycerin was the strongest, though it was brittle and hard. The 4g glycerin sample had moderate flexibility but was not very strong, while the 8g glycerin sample was the most flexible and durable but lacked strength. In conclusion, the hypothesis was incorrect. The sample without glycerin was the strongest, demonstrating that while glycerin increases flexibility, it does not improve strength.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
250	LT	1029

Title: The Effect of the Ratio of Pomegranate Peels to Psyllium Husk on the Final Strength and Effectiveness of a Bioplastic

Student Name(s): M. McBreen, A. Knox

Abstract:

This project tested the effectiveness of using pomegranate peels and psyllium husk as alternatives to traditional plastic. We chose this topic because we learned that 100 million tons of plastic bags end up in the Atlantic ocean each year. Bioplastics made from fruit are safer than traditional plastic as they are better for the environment because they biodegrade quickly. To create the bioplastics we created 3 mixtures, one with pomegranate peel only as the starch, one with psyllium husk only, and one with a mix of the 2 starches. The additives that were constant for all the mixtures were vinegar, water, glycerin, and arrowroot powder. We put each mixture on a heater while consistently stirring the mixture. We prepared a mold lined with parchment paper and once our mixtures became a liquid consistency, we poured them in the mold and let them dry for 12 hours. Once dry, we tested how they compare to a traditional plastic wrap in terms of thermal resistance, how much they could stretch, the number of twists they could withstand, and how much time it took for an apple to rot in the wrap. We found that the psyllium husk bioplastic could stretch the most and after traditional plastic, it had the best thermal stability and could endure the most twisting. It took the same amount of time for the apple to rot in the psyllium husk bioplastic as the traditional plastic. This demonstrates that the psyllium bioplastic can successfully be used as a wrap.

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

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
214	L7	2001

Title: Would You Like Plastic With That?

Student Name(s): R. Shah

Abstract:

Do water filters really live up to their claims of improving water quality? While many filters can remove visible debris, their effectiveness in filtering out microplastics remains uncertain. The PURPOSE of this experiment was to determine whether a low-cost, homemade water filter could remove more microplastics from tap water than commercial filters, while also demonstrating its practicality as an effective and affordable filtration option. This knowledge helps consumers make informed decisions about water filtration. The PROBLEM investigated was: which water filter, homemade or commercial, is the most effective at filtering microplastics? The PROCEDURE involved (1) constructing a homemade filter using gravel, sand, activated carbon, and filter paper, (2) testing it alongside three commercial filters (PUR, Vortopt, and Waterdrop), and (3) measuring microplastic levels before and after filtration using methylene blue dye and a digital microscope. The RESULTS showed the homemade filter removed 98.9% of microplastics, outperforming the PUR filter (91.7%), Vortopt filter (78.4%), and Waterdrop filter (73.9%). The unfiltered control sample removed 0%. The CONCLUSION is that the homemade water filter was the most effective, proving that low-cost, natural materials can provide better filtration. This research shows that low-cost water filters can effectively reduce microplastics in drinking water and offer a practical option for people without access to expensive filtration systems.

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

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
244	L7	2002

Title: Inulin: A Better Food Source for Yeast?

Student Name(s): M. Cooper

Abstract:

The purpose of this experiment was to test if inulin, a polysaccharide made of several fructose molecules, was a better food source for yeast, a single-celled fungus, than sucrose, which is more commonly used. This was hypothesized because as inulin has several molecules and is a polysaccharide, while sucrose is a disaccharide and only has two molecules, inulin should release more carbon dioxide. Warm water was measured into fourteen different bottles, and yeast was poured in after. Next, inulin was added to seven of the cups, and sucrose was added to the other seven. Color-coded balloons were fit over each cup. After fifteen minutes of the yeast rising, results were recorded. Of the seven samples of yeast containing sucrose, three balloons had risen. The lowest height of the yeast inside a bottle was 2.5 centimeters, and the greatest was 5.5 centimeters. Of the seven samples of yeast containing inulin, no balloons rose. For those, the lowest height was 2.0 centimeters, and the greatest was 2.4 centimeters. These results show that while inulin can be used as a food starter for yeast, it won't make the bread rise as much as if sucrose is used. The final conclusion is that though inulin can be used as a food starter for yeast, it prefers sucrose. The hypothesis of whether inulin is best for yeast was not supported; however, this is still helpful to the overall purpose of this experiment (finding food sources for yeast).

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
250	L7	2003

Title: Flower Lifespan

Student Name(s): A. De Leon

Abstract:

The purpose of this project was focused on flowers, a part that is everyday life for people with an interest in plants. I wanted to see what additives could be used to extend the life of a flower.

The materials used were pennies, an aspirin tablet, bleach, lemon lime soda, apple cider vinegar, sugar, water, flower food, a denture cleaner tablet, an energy drink, labels, and vases.

First, after the materials are gathered, we'd prepare them. Then, the additives are added into the vases along with water. After, I would place them in an area away from extreme conditions to try and avoid inaccurate results. Then, I'd document all my findings each day.

During the two week observation of the samples, I used the water vase as the control sample.

Most of the samples began to decay near the end of the first week. The only samples that weren't decaying were the penny, lemon lime soda, energy drink, sugar, and the control samples. At the end of the observation, the only two samples in the best conditions were the control sample and the penny sample.

In conclusion, pennies are one of the best additives to extend the lifespan of flowers. Research after the end of the observation revealed that the copper in pennies had antibacterial and fungicidal properties that prevented the stem of the flower from being blocked. The water which came from the city pipes was also bleached and had minerals in it that provided the flower with nutrition.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
249	L7	2004

Title: Petri Dish Experiments Exploring Bacteria Growth in Soil Samples With and Without Nitrogen-Fixing Bacteria

Student Name(s): P. Clark

Abstract:

Some plants have roots that contain nitrogen-fixing bacteria. These plants covert nitrogen from the air into useable nitrogen in the soil. This experiment compared the quantity of bacteria in the soil of plants containing nitrogen-fixing bacteria to control soil. This experiment compared the bacteria growth of different soil samples: outdoor vetch soil and unplanted native outdoor lawn soil, as well as pea plant soil and unplanted identical soil. Vetch and pea plants are nitrogen-fixing plants. This experiment used sterile swabs and petri dishes to collect the samples, and grow bacteria for 48 hours. A control with no soil was used as well, which grew no bacteria. To be sure this experiment was accurate, two samples of each soil were used. After 24 hours, there were no bacteria colonies in any of the samples. After 48 hours, there were a lot of white small circular bacteria colonies in all of the soil samples. There were approximately 24.3 colonies per square inch in the pea plant petri dish, 48.7 colonies per square inch in the plain unplanted soil, and 12.1 colonies per square inch in the unplanted organic lawn soil. The bacteria colonies in this sample were noticeably bigger than the bacteria colonies in the pea plant samples. The colonies in the vetch soil were 15.2 colonies per square inch. This experiment showed that there is bacteria in all soil, nitrogen-fixing or not. In this experiment, the indoor soil had more bacteria than the winterized outdoor soil.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
138	L7	2006

Title: How Environment and Genetics Change the Chances of Getting Cancer

Student Name(s): M. Kotau

Abstract:

This project explores how both genetics (traits we inherit from our family) and environmental factors (like smoking, pollution, and diet) affect a person's chances of getting cancer. Using the Scratch app, I created an interactive program that lets users see how these two factors work together. In the program, users can change different settings, such as whether someone is exposed to smoke or has a family history of cancer, and watch how those changes impact the risk of getting cancer. The program also explains how some risks can be reduced by making healthier choices, like eating well and avoiding smoking. This project helps people understand how their choices and family history can affect their health. It also encourages learning about how to lower cancer risks and shows how science and technology can make health information easier to understand.

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

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

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

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

☒ Yes ☐ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
239	L7	2008

Title: How Will Different Levels Of U.V. Light Affect Bacterial Growth?

Student Name(s): M. Wallis

Abstract:

Escherichia coli (E. coli) is a harmful bacteria that can make many people sick, and ultra violet (U.V.) disinfection is a common way to kill this bacteria. But the right protocol has to be used for it to be effective. The purpose of this project is to determine how different levels of U.V. Light affects the growth of bacteria. To do this, E. coli was grown on Petri dishes and divided into four groups: bacteria not exposed to any UV light, one group exposed to 100% U. V. light, one group exposed at level one and another group exposed at level three. Dishes were exposed daily with a 395 nanometer L.E.D. U.V. light for exactly twenty minutes. My hypothesis is: if the bacteria is exposed to less U.V. (level three), then you would have more growth because it has more protection from the U.V. light. The data shows that exposing U.V. light to bacteria will stunt its growth, and reducing the level of exposure to U.V. light did increase the amount of bacteria that grows. However, All groups showed a plateau or slowing down of their growth, until they eventually all reached the same point. In conclusion, changing the amount of U.V. light exposed to bacteria will affect how much bacteria will grow, but no matter what the growth will slow down before coming to a stop. This leads to the question: can you stop the growth of bacteria altogether?

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
217	L7	2009

Title: The effects of dish soap on plants

Student Name(s): C. Moreen

Abstract:

In certain areas of the world, such as California, people are encouraged to use their water for multiple purposes. For example, you could use the water you use to wash your dishes to water your plants. My experiment tests this hypothesis. Will a certain amount of dish soap in the water allow the plants to grow, or will it kill them?

For this experiment, ten radish seeds were planted in each of five containers and watered with different concentrations of dish soap for about ten days. The growth of the tallest plant from each group was measured over that period.

The results of the experiment were satisfactory and consistent with the hypothesis. The pot receiving only water (the control group) grew much better than the plants with any amount of soap in their mixture. They looked tall, healthy, and more robust than the other groups. The pot watered with a 2% concentration of dish soap saw most of its plants die at the end of the experiment, resulting in few, short plants.

Science tells us that the composition of the water is very important. If the water has other chemicals and additions, it may not be good for plants. Water used to wash dishes can be used to grow plants, but only in a very diluted form.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
245	L7	2012

Title: 1 Pollutant: 4 Filtering Methods

Student Name(s): D. Bhavsar

Abstract:

Do different filtration methods remove pollutants from fast moving river water? Do they truly remove pollutants, specifically, can they remove Nitrate from river water to prevent the risk of Methemoglobinemia, Nitrate poisoning, in a scenario without clean water? The PURPOSE of this experiment is to find out how to filter nitrates from river water so less people will get poisoned. The PROBLEM that was investigated is to find the best method to filter river water. The PROCEDURE is to: (1) Collect a gallon of river water to use in the experiment. (2) Use the test strips to test river water without any filtration and compare the changing colors to the chart given by the company that also made the test strips. (3) Use the four different methods of filtering on the rest of the water and collect it. (4) Use the test strips on the filtered water and use the chart given by the manufacturer to compare the results. The RESULTS show that the control had the Nitrate parts per million,(ppm) at 50. The water filtered by steam and the Charcoal, Gravel, and Sand Filter were the most efficient. The Cotton Filter came next and then the Boiled Water and then the control. In CONCLUSION, the CGS. Filter and collecting steam are the best ways to filter out Nitrate. The results prove the hypothesis that the CGS. Filter works best. This Experiment helped in studying Natural water and how to filter water for thirst.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
247	L7	2013

Title: Do we link certain colors to certain emotions?

Student Name(s): S. Mandalika

Abstract:

My objective is to explore the link between colors and emotions. My hypothesis is that people will associate certain colors with certain emotions. This phenomenon occurs because the human brain subconsciously absorbs information from the environment and the experiences one has throughout their life. In terms of the procedure, fourteen people were interviewed. They were asked to listen to three music tracks and press one of the three colored buttons they thought would best associate with that song. Each participant had three trials. Finally, they were instructed to type the emotion they were feeling. The results showed that most people associated blue with the low beat song, but interestingly the results were split between tranquility (46.2%) and sadness (53.8%). For the upbeat song, most people chose green with 93% of them feeling happy when the song was played. Finally, most people associated red with the scary song and almost everyone reported feeling anxious or scared (93%). While some of the results matched my hypothesis, such as blue being calm, most of the results were different from the standard research being done on colors and emotions. These findings suggest that while people often relate colors to emotions in predictable ways, personal experiences and age also play a role. The 11–17 age group I tested had stronger emotional connections, perhaps due to social media and life experiences, influencing their color-emotion links. This supports the idea that color-emotion associations are both universal and shaped by individual experiences.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
178	L7	2014

Title: Investigating the best water for flowering annuals

Student Name(s): T. Baltrukonis

Abstract:

There are a lot of different opinions on what type of water helps plants grow faster and healthier. I hypothesized that tap water would be the best because of my gardening experience. Some expert gardeners would recommend tap water or rain water while others suggest supplementing your water with chemical or natural fertilizers. This is important because while everyone wants healthy plants different types of water have different environmental impacts; and also may vary in cost. So sometimes the cost or impact may not be worth the benefit in the plant's health. My project focused on investigating the effect of different water types on the germination, growth rate, and flowering of 3 different annuals. I used 5 types of waters, and 3 types of annuals starting as seeds as they grew over a span of 70 days. I also measured growth, and germination over that 70 days. I determined that tap water resulted in the best growth, and flowering rates compared to the other types of water. My hypothesis was proven correct after the events of this project.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
149	L7	2015

Title: how can we use seed paper to make growing vegetables and flowers more available.

Student Name(s): L. Loc

Abstract:

This project aims to create a product to reduce paper waste and grow more vegetables instead of buying them. The project explores alternatives to single-use plastic and promotes the growth of plants, vegetables, and trees. The project focuses on three beneficial plants: butterflies and hummingbird wildflower mix, bleeding hearts, and balsam fir. Wildflowers are low-maintenance, grow quickly, produce oxygen, and add pops of color to the garden. Bleeding hearts add color and attract pollinators, while balsam fir is an evergreen that excels at oxygen production and seed dispersion. Through this experiment, it was found that the thickness of seed paper impacts seed growth. Thicker paper delays root development, whereas thinner paper allows roots to reach the soil more quickly. The results of the project can be observed. While any seeds can be used, it is recommended to choose those native to the region for the best outcome.

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

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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
2025

Word Count	Fair Category	Project Number
254	L7	2016

Title: Studying Muscle Memory in Planaria to Understand Neurodegenerative Diseases

Student Name(s): J. Park

Abstract:

Planaria are freshwater flatworms with the ability to regenerate lost body parts. This study tests the hypothesis that memory can be stored in non-brain tissues, like muscles. Previous studies showed that regenerated planaria can remember familiar environments they encountered prior to injury.

In this study, planaria were trained for long-term memory using food and light stimuli over 14 days. After training, the planaria were cut into head and tail parts and allowed to regenerate. Once regenerated, the planaria were tested again to see if they remembered what they had learned. The results showed that planaria retained learned behaviors even after regeneration, including those regenerated from the tail. This suggests that muscles might play a role in storing memory.

In addition, this study tested whether daily supplements could help with muscle memory recovery. Omega-3 (supporting brain function) and L-Glutamine (supporting muscle function) supplements were given during regeneration. Notably, L-Glutamine (1nM) helped the planaria remember faster, while higher concentrations of Omega-3 (0.1nM) appeared to cause stress, slowing their ability to find food.

In conclusion, this study suggests that memory may not only be stored in the brain but also in other tissues like muscles. This finding could have significant implications for patients with neurodegenerative diseases, such as Alzheimer's and Parkinson's. Focusing on muscle memory recovery may play a key role in improving motor function. By enhancing muscle recovery, we could help these patients regain movement, which would greatly improve their quality of life, in addition to focusing on brain regeneration.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
251	L7	2017

Title: Sprouting Seeds: Fresh vs. Store-Bought

Student Name(s): Y. Ostrovsky

Abstract:

The purpose of this experiment was to compare the germination time of store-bought seeds to seeds taken from fresh cantaloupes and bell peppers. It was hypothesized that seeds taken from fresh fruits and vegetables would sprout faster than store-bought dry seeds. Seeds were germinated by placing 20 of each type of seed on a wet paper towel, putting the towels into sealed plastic bags, and putting the bags inside a dark cupboard. Every day, for 7 days, the seeds were checked to see if a seed had sprouted, and data was recorded and graphed. In this experiment, fresh seeds sprouted faster and more efficiently than store-bought seeds, for both peppers and canteloupe. For example, on the fifth day 20 out of 20 of the fresh pepper seeds had sprouted, but only 2 of the packaged pepper seeds had sprouted. By the end of the experiment, 20 of the fresh pepper seeds had sprouted, but only 7 of the packaged seeds had sprouted. Similarly, by day 7, 17 of the fresh cantaloupe seeds had sprouted, compared to 11 of the store-bought seeds. The difference is significant. The fresh seeds in both cases were faster and more efficient. These results support the conclusion that indeed one does not have to buy seeds. Instead, one can just take seeds fresh from a plant, which will sprout even faster than the seeds one buys. If people can grow healthy fruits and vegetables in their houses from regular groceries, then why not!?

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
124	L7	2018

Title: Mouth Bacteria Experiment

Student Name(s): J. Arriaza

Abstract:

The aim of my research was to determine which food type promotes the most significant bacterial growth. To accomplish this, I began by taking a sample from the inside of my cheek and inoculating an agar medium in a petri dish to monitor bacterial development. I started with a thorough oral hygiene routine, brushing my teeth and rinsing my mouth with water. After this, I swabbed my cheek and transferred the sample onto a petri dish, establishing a baseline control. I then proceeded to eat a variety of foods, swabbing my cheek after each meal while ensuring I maintained oral cleanliness by brushing and rinsing between different food types. The findings revealed that gummy candies were linked to the highest levels of bacterial growth.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
255	L8	2501

Title: Identification of the Optimal Wastewater Algae for Production of Degradable Bioplastics from PHB

Student Name(s): L. Foell

Abstract:

Plastic made from fossil fuels can take up to 1,000 years to decompose, and is a main contributor to pollution around the world. This is why scientists have developed bioplastics that can decompose much faster than traditional plastics. Algae is a prominent source for bioplastics as it is plentifully available, however these production costs are much more expensive than traditional plastic. This research identifies the optimal algae species and environment that contains the highest concentration of polyhydroxybutyrate (PHB), a key factor in bioplastic as biodegradable and a non-toxic polymer, through the use of Nile Red and Bodipy. First, three different types of algae called Chlorella, Chlamydomonas, and Cyclotella were placed in food wastewater, food waste with river water, and river water, to determine which algae and environment combination created the best visual algae growth. Next, Nile Red dye and BODIPY dye were separately added to detect and quantify PHB in algae for fluorescent analysis. The calibration graphs were created to find the relationship of dye concentration and fluorescent intensity. Algae was counted to determine algae intensity and then PHB amount was estimated based on the dye calibration using the fluorescence intensity of algae and each dye. Finally, the PHB ratio was calculated based on PHB over algae intensity. Findings suggest that Chlorella in food-waste river water was the most prominent-growing algae for bioplastic production with the highest PHB-Production-Rating of 3.23µM-BODIPY-PHB/Algae. It was also determined that BODIPY is the dye that is more sensitive for detection of PHB.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
246	L8	2502

Title: Using Microwave Radiation to Effectively Kill Weeds in Soil

Student Name(s): L. Bonito

Abstract:

Weeds are detrimental to the agricultural community, and as they begin to develop tolerances to chemical herbicides, it is important to find other ways to prevent weed growth. My hypothesis was that plants grown from dandelion seeds exposed to microwave radiation would have a reduced growth rate because the radiation would rupture the plant cell wall. I separated my dandelion seeds into 3 groups; there were three individual pots for each group to ensure the validity of the experiment. I placed 10 dandelion seeds in each microwave-safe container. I microwaved the seeds for 0 seconds (Control), 10 seconds (Group 1), and 30 seconds (Group 2). I then planted them according to their microwave times in either a green pot (30 seconds), a purple/white pot (10 seconds) or a pink pot (0 seconds). After 12 days, the results showed that the microwaved groups, Groups 1 and 2, had reduced growth rates during the first 5 days before an increase in growth on days 6 and 7. Instead of behaving like the control, which grew steadily and plateaued, the experimental group would have drastic increases in growth over short periods of time. Microwave radiation has the potential to be an effective and more environmentally friendly alternative to traditional herbicides. It is still in the experimental stage, but I have confidence that it is a strong alternative. I will test microwaving the seeds for longer, microwaving the soil, and microwaving the plant and seed multiple times next.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
249	L8	2504

Title: The Determination of Sunscreen Consumer Products Effectiveness in Protecting Against UVA and UVB Light Exposure

Student Name(s): A. Davis

Abstract:

This investigation started when I noticed that there were a lot of people who would tell me about their sun burns from being out in the sun even when having sunscreen applied. First, I researched to see what SPF meant. SPF (sun protection factor) is the percentage of coverage that protects the skin from unwanted UV (ultra violet) rays. Another thing I researched was what UVA and UVB rays were. UVA rays go deep into your skin and reflect off your dermis. With a lot of exposure time and time again will result in skin aging and also skin cancer. UVB reflexes off your DNA which is above your dermis. Enough exposure can cause sunburn and also a risk of skin cancer. After finding out the UV's I purchased five UV cards to be the dependent variable and three different neutrogena sunscreens ranging from 30, 55, and 70 SPF to be the independent variable. I put a dime size amount of sunscreen on three cards per SPF. Then I put the cards under a 160 watt light for five minutes. The results range from 0-50 rays. This got me thinking. If the SPF is working then what is still letting UV rays in? For future research I would test other ways that the UV may be getting in. Is it the heat that is resulting in the sunscreen to dissolve or is the sunscreen having some type of reaction on our skin resulting in the SPF not to work?

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
248	L8	2505

Title: Development of a Thyme Oil-in-Hydromed Wearable Anklet for the Natural, Effective Repellent of Ticks

Student Name(s): C. Cahill

Abstract:

Lyme disease, brought about by tick bites, is problematic, with ~30,000 people diagnosed with it each year in Connecticut alone. While there are many tick deterrent products currently available, their success rate is limited, and they often require continued application of hazardous chemical reagents (i.e. DEET) to the skin. In this research, a safe, essential oil based repellent coated anklet was designed, to continually emit the four major components of thyme oil, as a wearable tick-deterrent. 4% thyme oil and 20% HydroMed-D solution in ethanol was applied to the top of a typical concert-goers wristband. Once dried, 0.33g polymer/essential oil mixture remained, which emitted 13.4µg of thymol, 34.3µg of carvacrol, 26.6µg of α-terpineol, and 3.1µg of endo-borneol, verified by GC-FID analyses. Starting with a total thyme oil scent profile of 77.4µg, the bracelet was found to maintain this level of gas-output for three days after opening its sealed-packaging. The scent output of the wristband is 4-times the 20µg LD90 for thyme oil for a typical 2mg tick, yet it is well under what is menacing to humans, with a NOAEL of 0.22g/day, well under 17g/day for a 150lb person. The intended use would be on the ankles, where ticks often attach to hosts, or as a wristband. With the 77.4µg thyme oil scent output for 3 days, and 31.6µg on day-7, the bracelet can be worn during an outdoor event or a weekend camping trip.

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
287	L8	2506

Title: Fabrication of a Biodegradable, Nutrient-Rich, Orange Peel-Loaded Hydrogel for

Student Name(s): R. Choudhary

Abstract:

Nearly 70% of the world's freshwater is consumed by agriculture. Agricultural use of water supply must become more efficient to account for the increase in crop production for a growing population. This research introduces a unique Orange-Peel-Hydrogel (OP-HG) soil-additive, that time-releases water into the soil, decreasing crop watering frequency and maintaining crop soil moisture during arid conditions. Initial analysis of OPs highlighted an 88% water content, the highest amongst common peels. SEM, EDS, and ATR-FTIR analyses of OPs revealed a highly porous surface which promotes water transfer to soil while releasing its many inherent soil nutrients. Purposeful rehydration of dried OPs demonstrated that they can absorb twice their original weight, for eventual re-release. The newly-designed OP-HGs containing 1.2%-OP was blended into 15.5% moisture soil at 1g-OP-HG per 150ml of soil. Measured against control infusions of OP, HG, and no-additive soil, the soils were permitted to dry under sunlight for 80 hours, without further watering, with %-moisture recorded throughout. The %-moisture of OP-HG-infused soil decreased from 15.5% to 11.10%, while the control soil decreased to 7.2%. Comparing total water loss, the OP-HG soil lost 28.4% of its water, while the control and HG-infused soils lost 53.3% and 41.1%. Considering the mass of water donated "per gram" of each soil-infusion-additive tested, OP-HG provided 5.85g-H2O/g-OP-HG, compared to hydrogel-only, with 2.72g-H2O/g-HG. This >2-fold increase in water release for OP-HG is attributed to inclusion of 1.2%-OPs and represents a first-in-literature demonstration of such a timed-water-release, soil-infusion model, to decrease crop watering-frequency, and promote crop growth.

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
183	L8	2507

Title: How Bacterial Resistance is Affected When Repeatedly Exposed To Disinfectants

Student Name(s): A. Aldo

Abstract:

Disinfectants are a commonly used substance used to keep bacteria from growing. Since disinfectants are used at a higher rate, my experiment tries to find out how bacteria is affected by repeated exposure to disinfectants and if resistance is developed. My hypothesis is that if the same disinfectant is used against bacteria over generations of the bacteria's growth, then the disinfectants will kill less bacteria, causing a decrease in the Zone of Inhibition, because the bacterias will develop a way to resist the disinfectants. The procedure I used for this experiment was treating the bacteria, then extracting bacteria near the zone of inhibition. This was replated and retreated using the same process. Over the course of this experiment, the data I collected showed that in the second round of exposure to disinfectants, the bacteria's zone of inhibition visibly shrank. I found that over time, the bacteria grows more resistant to disinfectants with more bacteria surviving after the 2nd round of being exposed. This research could be used to try to find a way around bacteria resistance or how to prevent it from happening.

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

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CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
205	L8	2508

Title: Music's Impact on Memory

Student Name(s): B. Lounsbury

Abstract:

My project is focused on better understanding how music could potentially affect our ability to remember and recall information. This project was partially inspired by my grandma, who is suffering from short term memory loss. Personally, playing music at low volumes helps me study. This made me very interested if listening to music may be helping or harming me while I study. The key question is "Does music have an effect on an individual's ability to recall a group of words presented verbally?" My hypothesis for this project is that music will negatively affect people's ability to recall information presented verbally. In order to test my hypothesis, I created 3 sets of 10 words that followed similar criteria. I chose a heavy metal and classical song, then invited 4 groups of people at various ages to participate in my study. I had the participants recall the words both with and without music. I then recorded the results and analyzed them to determine the outcome. The results helped prove my original hypothesis correct. My findings were that most age groups had best recall results with no music playing. The data also indicated that music, of any kind, negatively affected their ability to recall information presented verbally.

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
2025

Word Count	Fair Category	Project Number
251	L8	2509

Title: Testing the Effectiveness of Green and Black Tea and Coffee as a Plant Nutrient

Student Name(s): P. Creegan

Abstract:

In order for plants to grow, they require water, sunlight, carbon dioxide, and nutrients. There are specific nutrients in plant food, but I wondered what else can be added to a plant to provide nutrients. Tea and coffee became my focus because they contain essential nutrients like nitrogen, phosphorus, and potassium. My project tested whether plants can grow healthier and taller in the presence of tea or coffee. My hypothesis was that both ground and liquid forms of tea and coffee will provide nutrients that will stimulate plant growth. Ground tea and coffee may act as a slow-release fertilizer, while liquid forms might deliver immediate benefits. In the first phase of experimentation, I focused on tea and separated the plants into 3 groups, the control group and 2 experimental groups using Earl Grey tea and green tea. Each plant began with 5 radish seeds. Fifty milliliters of water or tea were used to water the plants 4 days a week. For this phase of testing, my hypothesis was not supported because my control plant grew taller on average than any tea plant. Phase 2 involved testing both solid tea and coffee. I used English Breakfast tea and coffees with varying caffeine levels. This phase supported my hypothesis because the English Breakfast tea plants grew the most by a large margin. The English Breakfast tea in Phase 2 likely outperformed the Earl Grey tea in Phase 1 because Earl Grey tea has oil of bergamot, a citrus oil that lowers pH.

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

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
179	L8	2510

Title: How do different cleaners affect plant growth?

Student Name(s): N. Peaper

Abstract:

This project investigates how different cleaning products affect the growth of grass. By spraying pots with grass in it with different cleaning solutions, 2 plant based and 2 non plant based, I aim to find out if plant based cleaning products affect the plants growth, overall health, and the environment. The cleaning products I used in my experiment include a Clorox bleach cleaning solution, Lysol, Meyers, and Method all purpose cleaners, and as a control, I used Water. Over the course of 8 days I watered the plants as needed and sprayed each of them with their designated cleaning product. Every other day I would take photos of the grass and measure their height. The results of my experiment showed that the cleaning product which contained bleach significantly stunted the growth of plants. The Lysol (all purpose cleaner) also had more of a negative impact on the grass compared to the Method and Meyers cleaners, and of course water. This shows how non plant based cleaners do impact plants and negatively affect them compared to plant based cleaning products.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
211	L8	2512

Title: The Energy from Above

Student Name(s): J. Scott

Abstract:

Solar power is one of the world's most captivating and intriguing energy sources. My project aimed to evaluate how a solar panel converts energy into light. I hypothesized that solar panels contain specific components or elements that harness the sun's light for energy. My procedure consisted of 17 steps. The first 16 steps involved the building process, while the 17th step involved connecting light bulbs to their connectors. A question I asked myself was, how does a solar panel function? I discovered that it operates with two elements—silicon and phosphorus—that combine to form N-type silicon. I used two different connectors to attach the light bulbs to the electrical wiring. With the first connector, I tested three different light bulbs, but all three failed. For the next connector, I used a specific LED light bulb, which also did not work. I tested the solar panel both outside and under a heat lamp. I learned that I may have used the wrong type of CD. In conclusion, this project requires effort and time to complete, as well as the correct materials. Next time, I will switch the CDs to Blu-ray DVDs because that's where the project went wrong; I want to switch because Blu-ray DVDs contain more silicon.

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

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

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☐ vertebrate animals ☐ controlled substances

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

☒ Yes ☐ No

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
219	L8	2513

Title: Pupation Behaviors in Manduca sexta: Substrate Choices and Pupation Success

Student Name(s): A. Samat

Abstract:

This study examines the pupation substrate preferences of Manduca sexta (Tobacco Hornworm Caterpillars) to determine the best material for successful pupation. If Tobacco Hornworm Caterpillars are placed in a choice chamber with different substrates to pupate in, then they will choose the soil. This is because of its natural resemblance to the caterpillar's environment and its ability to retain moisture. To test this hypothesis, caterpillars were provided with four substrate choices: potting soil, sawdust, shredded paper, and paper towels. Each caterpillar's behavior and pupation success was monitored.

Results indicated that while most caterpillars gravitated towards sawdust, soil proved to be the most suitable substrate for successful pupation. Three caterpillars pupated successfully in soil, while substrates such as shredded paper and paper towels showed no successful pupation. Sawdust resulted in incomplete or unsuccessful pupation for the majority of caterpillars. The findings suggest that soil's moisture retention and texture create optimal conditions for pupation, while other materials lack this quality.

This study fills a gap in the scientific literature on the environmental requirements of Manduca sexta during pupation. In addition, it has practical applications for researchers and educators who are interested in these types of caterpillars. Future studies into this topic could investigate other variables such as humidity levels, soil type, and temperature to refine our understanding of optimal pupation conditions.

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

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

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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
2025

Word Count	Fair Category	Project Number
253	L8	2514

Title: Using Bamboo with Natural Additives to Create a Strong, Durable, and Flexible Bioplastic

Student Name(s): O. Hastings

Abstract:

Using bamboo fibers, glycerin, and additives, I have attempted to make a bioplastic that is able to biodegrade while having similar characteristics to plastic. Bamboo grows 32 inches a day making it a good alternative to keep up with the current demand for plastic. Using bamboo fibers as a matrix, I started by adding water and glycerin and letting it dry for several days. The results of this first test created a chalk-like texture that crumpled easily and had no similar features to plastic. By adding more glycerin I thought it would create a better plastic texture due to it having the similar characteristics to a gel. Without increasing the powder as well, the plastic did not dry making it unable to be used as a plastic. I increased the bamboo powder to balance the added glycerin, but the result was still not favorable. I then added psyllium husk powder for strength along with the increased amount of glycerin. This combination created a gel-like material that had the most stretch. I then tried guar gum powder, which had the most strength and a similar amount of stretch to psyllium husk powder. This was the most practical result. I have concluded that guar gum is needed to add strength and the appropriate texture to the bioplastic. I am going to continue to vary the recipe using bamboo, guar gum, glycerin, and water to see which formulation makes the best bioplastic. Testing will continue until the optimal bamboo-based bioplastic has been created.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
263	L8	2516

Title: Investigating the Effect of Natural Remedies on Reducing Pine Tree and Bee Pollen Antigens to Combat Allergic Reactions

Student Name(s): W. Chen

Abstract:

Allergies affects people globally, with nearly a third of adults in the United States suffering from symptoms. Triggered by reaction to allergens that are contained within the pollen spores, our immune system releases histamine, which leads to allergic symptoms. In this research, the ability of natural remedies to alter the chemical composition of allergens, and thus render them unrecognizable by our immune system, was investigated. Water-soluble extracts from nine natural materials, including honey, quercetin, stinging needle, wolfberry, butterbur, basil, and cilantro, were prepared. These extracts were then applied to purified Honey Bee (HB) and Pine Tree (PT) pollen allergens, so that changes in chemical structure could be investigated. ATR-FTIR analysis of the many separate combinations of pollen and natural remedies suggest that stinging needle, wolfberry, and honey, due to absence of an amide-bond (1530cm-1) that was present in the HB allergen spectrum, and addition of amide and ester fatty-acid bonds (1315 and 1744cm-1) to the PT-allergen spectrum. Separately, pollen allergens exhibit native fluorescence, whose change would indicate chemical change. With a 355nm excitation, HB-pollen allergens fluoresce at 425nm and 535nm, while PT-pollen allergens fluoresce at 440nm. After the addition of natural remedies, the 425nm emission of HB-allergens were red-shifted by stinging nettle, cilantro, wolfberry, honey, and quercetin extracts. Conversely, the 440nm emission for PT-pollen allergen was blue-shifted by stinging nettle, cilantro, honey, basil, and butterbur. Collectively, FL and ATR-FTIR analyses suggest that the addition of cilantro, honey, or stinging nettle show the most promise for natural treatment of allergens.

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

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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
2025

Word Count	Fair Category	Project Number
236	L8	2518

Title: Sugar's Effect on Teeth

Student Name(s): E. Martinez-Quintero

Abstract:

From what I have learned, the prolonged consumption of sugary foods and drinks can cause tooth decay. I think that the darker liquids will change the color of the eggshell, the acidic liquids will dissolve the eggshell and the liquids with the most sugar will slightly change the color of it.

The independent variables are the liquids and sweeteners. The dependent variables are the color and texture of the eggshell. The constants are the amount of sweetener, amount of liquid, the boiled egg and the liquid temperature. The control is a boiled egg submerged in drinking water.

I put an egg in 18 liquids, syrups and sweetener mixtures for 3 days. Each day I recorded what happened to the eggshell and the pH of the liquid. At the end of the 3 days I picked at each egg, looked at a piece of the eggshell under a microscope and brushed each egg with toothpaste.

The white sweeteners had the least effect on the eggshell, the acidic and dark liquids had the greatest effect and the syrups left a film on the eggshell.

In the end, most of my hypothesis was proven correct. The darkest liquids changed the color of the eggshell, the acidic liquids dissolved it and the liquids with the most sugar changed the color of the eggshell. The most sugary liquids also made the shell easier to break; something that I hadn't considered before.

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

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

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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
2025

Word Count	Fair Category	Project Number
247	L8	2519

Title: The Effects Of Biochar as a Soil Conditioner to Enhance Plant Growth

Student Name(s): N. Friedman

Abstract:

This project studies how adding biochar to soil can help improve plant growth. This study is important because it will determine specifically how much and what type of biochar can be used to improve soil health. Biochar can help balance soil pH levels, control nutrient delivery, and loosen the soil to make sure it is not too compact. Biochar can also remove toxins in soil. Biochar limits the amount of greenhouse gases emitted into the atmosphere due to carbon being removed in the process of biochar being produced. I tested different percentages of biochar and different types of biochar to see how these variables affect the growth of radishes. My hypothesis is that if I add 20 percent by volume of biochar to soil, then plants will grow the most compared to 10 percent and 0 percent (the control). I also hypothesized that wood biochar will help plants grow better compared to coconut biochar. I used triplicate pots of each control and experimental variable, and each pot had five radish seeds. At the end of week three, the 20 percent biochar plants had the highest average height at 8.8 centimeters compared to 10 percent at 8.4 centimeters and 6.8 centimeters for zero percent biochar. This means that adding biochar helps compared to the control but the 20 percent results are likely not significant over the 10 percent as it is only a 5 percent improvement in growth. The wood versus coconut biochar data is currently being collected.

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

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

CSEF Official Abstract and Certification
2025

Word Count	Fair Category	Project Number
246	L8	2520

Title: Crossed Up!

Student Name(s): B. Crabbe

Abstract:

Basketball games can often be decided by the precision of final shots, especially free throws. It's a skill where some excel and others struggle. Hand/eye coordination is probably most important in shooting because the player must align their shot with their dominant line of vision in order to shoot the ball for highest accuracy.

The purpose of this experiment was to further investigate if crossed hand/eye dominance affects shooting percentage in basketball. This experiment investigated the impact of crossed vs. uncrossed hand/eye dominance on basketball free throw accuracy in 10-14 year old athletes. Participants from my school's basketball teams completed a survey on hand dominance, including number of years of playing experience. Then each participant's eye dominance was determined using the triangle method. Each participant shot 15 free throws, with results recorded. The participants were divided into 2 groups- crossed and uncrossed dominance. The average free throw percentages and standard deviations were calculated for each group. The standard deviation assessed consistency within each group's shooting accuracy. Finally, the data was analyzed to compare the free throw performance between the two groups, testing the hypothesis regarding dominance and accuracy. In conclusion, uncrossed hand/eye dominance correlated with higher free-throw accuracy (47.9% w. SD- 2.44 , SD without outlier- 1.54) vs. crossed hand/eye dominance (36.7% w. SD- 1.80). This supports the hypothesis that uncrossed dominance enhances focus and control, improving precision, although outliers and uncontrolled variables like experience and technique may have influenced results.

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

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

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2. Student independently performed all procedures as outlined in 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
2025

Word Count	Fair Category	Project Number
253	L8	2521

Title: Unraveling Weather-Pollen Interactions – Machine Learning for Allergy Forecasting

Student Name(s): S. Nimmagadda

Abstract:

Pollen allergies affect millions of people, yet most forecasting tools provide only broad estimates without considering how environmental, climatic, and urbanization factors influence pollen levels. Many models lack real-time accuracy, failing to capture the complex interactions between weather and pollen activity. This project applies machine learning to improve pollen forecasting and provide more precise, data-driven predictions. A key challenge was data gathering and curation, as pollen data is often limited and inconsistently formatted across sources. Historical tree pollen data was obtained from the National Allergy Bureau (NAB) and other sources, while meteorological data, including temperature, humidity, precipitation, wind speed, and pressure, was collected from NOAA's Climate Data Online (CDO) portal. After extensive data cleaning and processing, a dataset of 5,000 daily values from 2020-2024 across six cities was compiled. A Random Forest Regression model was then trained using an 85% training and 15% testing split, chosen for its ability to handle complex relationships between variables while reducing overfitting. Hyperparameter tuning with GridSearchCV improved predictive accuracy, achieving an R^2 score of 0.55. To make this research accessible, the trained model was deployed as an interactive Streamlit-based web app, allowing users to input real-time weather conditions and receive pollen forecasts. Future work will expand to grass and weed pollen and incorporate additional environmental, climate, and urbanization variables, along with personalized allergy risk factors. By refining the model with broader datasets, this tool could greatly enhance pollen forecasting, providing more accurate, localized, and personalized insights to help allergy sufferers manage exposure effectively.

Technical Disciplines Selected by the Student (Listed in order of relevance to the project) ME CS 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
2025

Word Count	Fair Category	Project Number
252	L8	2522

Title: Kidney Chronicles: Genes at Work.

Student Name(s): S. Balaji

Abstract:

Background:

More than 100,000 Americans are waiting for a kidney transplant, and millions of people suffer from kidney disease. Unfortunately, the shortage of organs results in the loss of 17 lives every day. Advances in regenerative medicine may result from a better understanding of kidney cell growth and repair.

Methods:

In this study, kidney cells from mice in embryonic and adult stages are compared using single-cell RNA sequencing data. RStudio and Seurat tools were used to analyze data from a public genetic database, normalizing gene expression and identifying variable genes. I clustered cells using Principal Component Analysis (PCA) to find similarities between them. These clusters were mapped using UMAP visualization, and Genecard was used to determine the top ten genes in each group that were differentially expressed. Gene Ontology was used to identify the gene functions, which were then examined in context of kidney function and repair.

Results:

The results suggest that while adult kidney cells exhibit genes linked to maintenance and limited repair, embryonic kidney cells express genes linked to growth and regeneration. Knowing these distinctions may help develop regenerative therapies that could repair damaged kidneys without the need for kidney transplants.

In conclusion, this research could be expanded upon in the future to create gene-based treatments, which could reduce the need for organ donation in the future and enhance patient outcomes. These findings could lead to life-saving regenerative medicine and give thousands of nephrology patients around the world hope by deepening our understanding of kidney cell behavior.

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

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