CONNECTICUT SCIENCE & ENGINEERING FAIR

78th Annual Fair
March 2-14, 2026

Student Abstracts

Fair Categories

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

Special Categories

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

Special Category Composites

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
130	LT	1001

Title: The Effect of Different Music Genres on Time It Takes Ants to Travel

Student Name(s): F. Olea, Z. Guaman, J. Ramirez

Abstract:

By investigating how music genres affect the time it takes for ants to travel, this project aims to provide information about myrmecology, sounds, and vibrations on ants. The research question of this project is “How do different genres of music affect ants' time it takes to travel”. The hypothesis was if the genre of music changed while the ants were traveling, it would impact their travel time. For this investigation, different music genres were played (Rock, Rap, Indie. Silence) as ants traveled 1 foot. The result proved ants traveled way faster when there was no music being played and slower when any genre was played. In conclusion, different genres of music not only slowed them down as stated in the hypothesis, it completely disrupted their travel time compared to silence.

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

2026

Word Count	Fair Category	Project Number
186	LT	1002

Title: Impact of Varying Wavelengths of Light and Controlled Environmental Conditions on the Degredation of Vitamin C Potency in Fruits

Student Name(s): A. O'Connor, A. Campbell

Abstract:

This study investigates the impact of various environmental conditions and light wavelengths on the degradation of vitamin C potency in fruit, with implications for cancer nutrition research. The experiment examined five distinct fruits subjected to different exposures: open and closed air environments, sunlight, LED light, and heat from radiators. Vitamin C degradation was quantified using redox titration, revealing that open-air exposure to sunlight and LED light induced the greatest reduction in vitamin C, with a mean degradation of 73% in open air and 54.5% in closed environments. The results indicate that environmental factors such as light intensity, heat, and the resultant oxidation processes significantly accelerate vitamin C breakdown, further influencing melanin production due to the generation of quinones. These findings underscore the critical importance of preserving vitamin C integrity, particularly for cancer patients, for whom high-dose vitamin C has been shown to augment the efficacy of immunotherapies such as chemotherapy. The data suggest a need for revised dietary guidelines that account for environmental conditions affecting vitamin C levels, and advocate for further exploration into the effects of vitamin C degradation on cancer cell dynamics.

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

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
250	LT	1003

Title: The Impact of Ice Melting Substances On Unicellular Organisms In Pond Water

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

Abstract:

The project is "The Impact of Ice Melting Substances On Unicellular Organisms In Pond Water". When roads are icy, towns put salts and other ice melting materials on the roads; these substances can get into local water bodies. Microscopic freshwater organisms may be negatively impacted by substances put onto roads. This project investigates salt levels in different locations and fresh water bodies in Bozrah and the impact these substances have on the number and behavior of common microorganisms.

The hypotheses are that organisms will respond to increased salt levels with changes in movements, color, or osmoregulation responses. Based on last year's work with salts and plants, the prediction is that magnesium salts and beet juice won't impact organisms as greatly as other ice melts. Dilution trials containing higher amounts of ice melts will show greater impacts than trials with lower amounts. Based on local observations of salt use, organisms in water bodies with state road or business parking lot catch basins will be at greater risk of behavior changes due to heavier salt use in these areas.

In this study only the prediction that greater levels of salts would have more impact was supported. Some trials showed MgCl actually had a greater impact than predicted. Parking lots did show the highest salinity results but town roads actually had a higher average than state roads. Other than these general conclusions, this work shows the need for more trials and different equipment and techniques to more accurately measure salt impact on protists.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
252	LT	1005

Title: The Effect of Location on Water Quality of the Upper Saugatuck River Watershed Using Macroinvertebrate Metrics

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

Abstract:

Location, on account of geographical terrain and land use can have a significant impact on the water quality of a watershed. The Saugatuck River is a local body of water that starts adjacent to Route 7 in Danbury, Connecticut, a high volume roadway, and makes its way through Redding, Connecticut, passing through many marshes and wetlands, as other tributaries funnel into its path, which ends at the Saugatuck Reservoir. This study was designed to use macroinvertebrate metrics, water quality tests and observations to identify water quality differences throughout four locations, and to determine how proximity to natural, physical, and man-made elements may affect the water quality throughout the Upper Saugatuck River Watershed. Macroinvertebrates are small water dwelling creatures which hold specific characteristics and features that allow them to tolerate pollution at different levels. During this survey period a total of 77 macroinvertebrates were collected and 17 species were identified. The species richness index, EPT index, and Shannon-Wiener index exhibited nonlinear positive correlations of an increased distance from the origin of the river at Sugar Hollow Pond Danbury with an improvement in water quality. There was a positive correlation between the presence of an upstream marsh and the water quality assessment downstream from the marshes. There was a positive nonlinear correlation between water quality and the number of tributaries that flowed into the Upper Saugatuck River. This study can provide scientific reference for the management of the Upper Saugatuck River, adjacent wetlands, and land use surrounding the river and its tributaries.

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
199	LT	1006

Title: The effect of acid rain on plants from certain climates

Student Name(s): M. Anderson, B. Cyphers

Abstract:

The purpose of the project is to understand the effect that acid rain is having around the world, and understand whether it is positive or negative. This study investigates the question of how acid rain affects growth around the world? The hypothesis was that the plants more exposed to acid rain would not die as fast as the plants not commonly or never exposed to acid rain. Acid rain was made in this experiment by mixing vinegar and water. The plants were all watered with the same amount of acid rain. The plants were watered three times throughout the week. By the end of the experiment, three of the four plants either died or were negatively affected. Only the palm plant was thriving, showing that this species is more adaptable to acid rain. In conclusion the experiment supported the hypothesis. A result that was a surprise was the cactus was not as affected as the other plants even though in nature it has no exposure to acid rain. It is likely that the cactus was not fully dead because it takes so long for a cacti to react to changes because it absorbs the water it uses until needed.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
250	LT	1008

Title: What is the Best Way To Preserve Strawberries?

Student Name(s): C. Cortinhas, E. Randall, J. Micolovich

Abstract:

The purpose of our project was to determine the best way to preserve strawberries. We tested five different products that claim to be able to preserve fruits like strawberries. These products were mixes of natural remedies and man-made formulas. Before our research we hypothesized that Ms Wages Fruit Preserver would perform the best, after research we thought that Veggie Wash would do the best. Both times we thought that hot water would do the worst. To do our experiment we separated the strawberries into six groups. We used five different products and one control group. After cleaning each group with its designated product, we stored all of the strawberries in a household fridge and tracked when they molded or rotted. Our independent variable for this project was the amount of days we tracked the strawberries, our dependent variable was the amount of mold that grew. We also had multiple constant variables such as the environment we kept the berries in, when the pictures were taken, and when the strawberries were bought. After two weeks, all of the berries molded. The first group to grow mold was lemon juice, and the last groups to mold were baking soda, Ms Wages, and Veggie Wash, which all molded on the same day. We also had three groups that rotted, which were baking soda, Ms Wages, and hot water. From these results, we can conclude that the best product to use if you want to preserve fruits such as strawberries is Veggie Wash

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
157	LT	1010

Title: Germ Geography: Mapping Microbes Around Our School

Student Name(s): L. St. Germaine, B. Devoe

Abstract:

ACES Chase Academy is a clean school, but how clean is it? This project aims to investigate how clean different areas of the school actually are by comparing the amount of bacterial growth present in Camp Hall, Upper school, and optionally the Theater and Goss Gymnasium. The research question asks how germ levels differ between these locations. It is hypothesized that Camp Hall will have the most germs. They think this because the students of Camp Hall are younger, and therefore more prone to leaving messes. They will use sterile Q-Tips, rotate a sterile Q-tips on the surface they want to collect, then rub that in an agar filled petri dish. They will then leave it on the science lab classroom windowsill for 5 days. On a regular basis the petri dishes will be observed and photos taken. The observation of the amount of bacteria growth will be the measurement used to validate the hypothesis.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
208	LT	1011

Title: Grounds for Growth

Student Name(s): K. Lazzara, M. McKinney

Abstract:

What type of brewed coffee grounds, either Chock full o'Nuts or Nespresso coffee pods, will help indoor petite French/dwarf marigolds grow the tallest over seven weeks? If brewed Chock full o'Nuts brand coffee grounds is used, then it will help indoor petite French/dwarf marigolds grow the tallest over seven weeks. The purpose of this experiment is to determine what type of ground work is the best for making indoor petite French/dwarf marigolds grow the tallest, making it useful knowledge for gardeners to have. Once a week, use your ruler to measure all the plants. Since there are two seeds in the pot,measure the taller one only. Seven weeks after you planted your seeds, you must measure the plants for the final height in centimeters. Calculate the average and determine which group has the tallest average. The hypothesis was supported, as Group A had the tallest average, with a height: 7.14 cm. The Group that had Nespresso grounds (Group B) did not grow as tall, and Group C (receiving nothing) was taller than Group B. Group B's average height was 6.12 cm, and Group C's was 6.68 cm. Coffee grounds can be very good for plants, but are not the best for seedlings and sprouts.

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

2026

Word Count	Fair Category	Project Number
250	LT	1012

Title: Photoprotection of Yeast, Fact or Fiction: Studying the Effect of Ultraviolet Ray C on The Proliferation of Saccharomyces Cerevisiae via Analysis in Vitro Cultivation

Student Name(s): S. Hassan, T. Khan, S. Hassan

Abstract:

The purpose of the experiment is to explore a possible solution for therapeutic intervention for conditions such as Candidiasis. Candidiasis is a condition where the body produces excess yeast, causing extreme skin irritation, affecting quality of life and potentially leading to burning rashes, breathing difficulties, and trouble swallowing. When excess yeast enters the bloodstream, life threatening effects are possible. Existing treatments for candidiasis, like fluconazole can have side effects such as nausea, indigestion and diarrhea. Our proposition is to explore whether the use of ultraviolet light C, which is known for killing bacteria, can kill off yeast that would grow on the skin of a person with Candidiasis. In our experiment, we exposed yeast to ultraviolet light C from a range of distances. Our experiment involved pouring agar plates, cultivating yeast, and testing our hypothesis using different experimental and control groups. Photos of each plate were taken before and after exposure to ultraviolet light C. The plate images were then analyzed using Oculyze, an online software for counting and analyzing colonies. Once this was done we calculated the averages of each group of plates before and after and then subtracted to see the difference. Our results showed that exposure to ultraviolet light C led to reduced yeast growth, with the closest distance resulting in the greatest reduction in yeast growth. Based on our experiment, ultraviolet light C may be a potential viable treatment for conditions such as Candidiasis due to its ability to reduce yeast colonies, especially at closer distances.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in 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

2026

Word Count	Fair Category	Project Number
238	LT	1013

Title: Evaluating the Effectiveness of Phytoremediation in Removing Heavy Metals from Contaminated Soil

Student Name(s): R. Yadav, A. Popuri

Abstract:

By testing how different plants can extract different heavy metals from soil, the results that are produced can help decipher which plants are suitable for decontaminating without having to dig up the soil. This research aims to answer the question: How do different plants remove different heavy metals from soil? If spider plants are used to take copper out of soil, then it will show the biggest effects in phytoremediation or taking the heavy metals out of soil, in the pH (potential of Hydrogen) of the soil. Studies show that spider plants exhibit high tolerance to copper, and they can effectively take up the heavy metal in their plant tissue. The plants (Spider Plant, Neanthe Bella Palm, Polka Dot Plant) were planted in soil with different heavy metals (Iron, Nickel, Copper, Zinc, Magnesium) tainted in it. The acidity of the soil was measured every 7 days using pH strips. Many of the tests remained unchanged, but after analyzing the data, the polka dot plant seemed to have the best results when trying to filter out iron. In conclusion, the hypothesis was not supported by the data as previously thought. The results in this study show that polka dot plants were better at extracting heavy metals from the ground. The effect of knowing that polka dot plants are best at taking iron out of soil could be helpful to know which plants to plant when wanting to filter soil.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in 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

2026

Word Count	Fair Category	Project Number
252	LT	1017

Title: Galleria Melonella Larvae as Plastic Eaters: Myth or Fact?

Student Name(s): M. Mercado, J. Deo

Abstract:

This project investigated whether waxworms (Galleria mellonella) have the potential to reduce microplastic pollution by consuming polyethylene plastics. Waxworms are known for their unusual ability to break down low-density polyethylene (LDPE) and high-density polyethylene (HDPE), materials that are difficult to chemically decompose due to their durable molecular chains and are harmful to the environment because they absorb toxic substances. The goal of this study was to determine whether waxworms could be a viable solution for reducing polyethylene-based plastic waste. The hypothesis was that waxworms would consume small portions of polyethylene within 20–24 hours but would not fully decompose a plastic bag. This prediction was based on prior research showing that approximately 2,000 waxworms were required to fully break down one plastic bag, while only 150 waxworms were available for this experiment. To test this hypothesis, waxworms were placed in two containers containing pre-weighed plastic bags with the handles removed. Each bag weighed 3.10 grams. Approximately 50 waxworms were placed in each container with woodchip bedding, and the bags were exposed for 12 and 24 hours. A second trial used smaller plastic squares exposed for 24 hours. Results showed minimal evidence of plastic consumption. Any observed damage was minor and may have been caused by preexisting wear or environmental factors rather than feeding. When bedding was removed, no additional plastic damage occurred. Overall, this study suggests that waxworms are highly selective and may not consume all types of plastic, indicating limitations to their effectiveness in reducing microplastic pollution.

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

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

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2. Student independently performed all procedures as outlined in 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

2026

Word Count	Fair Category	Project Number
244	LT	1019

Title: Restoring Dead Zones: The Role of High-Oxygen-Producing Vegetation in Assisting to Reduce Aquatic Hypoxia.

Student Name(s): E. Mohammed, N. Abdulkadir, M. Bhuiyan

Abstract:

Our experiment is investigating potential ways to reduce aquatic hypoxia, which has become a common occurrence in recent years. Dead zones are bodies of water with extremely low levels of oxygen. These hypoxic zones cause imbalances in aquatic ecosystems, with serious ramifications for a variety of industries and communities.

We chose to investigate this issue by immersing several species of vegetation known as "good oxygenators" into hypoxic zones. We simulated dead zones with near hypoxic water and then inserted Lysimachia nummularia (Moneywort) and Ceratophyllum demersum (Hornwort). Afterwards, we measured oxygen levels and made daily observations of the water and plant appearance for 7 days. At the end of the experiment period, dissolved oxygen (DO) levels for the hornwort increased by 11 mg/L, and for moneywort, by 8.5 mg/L. Hornwort was thus a better oxygenator, possibly due to its superior adaptability and tolerance for harsh conditions. We noticed significant spikes in the oxygen levels after the plants were given time to acclimate to conditions, potentially suggesting that exposing plants to hypoxic conditions prior to inserting them into dead zones could improve oxygenation capabilities. We also observed that other factors assisted in raising oxygen levels, such as better water circulation, and more light in hypoxic zones.

The results of this project suggest that aquatic vegetation helps significantly diminish hypoxia, with differing levels of improvement for each species. Our findings could potentially inform future methods and/or initiatives for reducing hypoxia in bodies of water.

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
215	LT	1020

Title: Living Organisms on the Rate of Food Decomposition

Student Name(s): R. Melendez, S. Cardenas

Abstract:

In this project, food scraps thrown away were used as compost, which then the compost could be used to grow crops making more food for people in need. The experiment conducted was how organisms affected the rate of compost decomposition. The experiment conducted was how organisms affected the rate of compost decomposition. In the course of three weeks in centimeters, it was measured how much the compost decreased in size with the organisms in it. If three different organisms (earthworms,mushrooms,and leaves) are added to three different compost bins, and the compost bins each have the same amount of food scraps added in each one of them. Then at the end of three weeks we will check for which organism decomposed to food scrapes at the most significant rate (measured by which decomposition bin is at the shortest length). We believe that the worms will decompose the compost the most significantly. The organisms used to decompose the compost where, leaves, mushrooms, and earthworms. We also had one control, meaning one compost bin had no organisms in them. We measured in centimeters, and used compost bins to store the food scraps/compost and the organisms were inside of them. The results showed that the leaves were the organisms that decomposed the compost the fastest rate.

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

2026

Word Count	Fair Category	Project Number
143	LT	1021

Title: What's the dirtiest public restrooms

Student Name(s): C. Goncalves, S. Basile

Abstract:

Our project for the science fair was to determine what the dirtiest public bathroom was. We chose the following 6 locations for this experiment because they are popular locations used by the general public: Mcdonalds, Taco Bell, Walmart, SIS, Mall, and Gas Station. We predicted the results would be Taco Bell or Gas station, however, the results showed that Taco Bell was the dirtiest with 1 large swarm culture.

To successfully complete this project, we mixed agar powder with hot water to create the petri dish gel solution. We collected the bacterial swabs at all 6 locations using q-tips. We counted the amount of bacterial cultures present on each petri dish every day for 7 days. One thing we found interesting about this project was that the Taco Bell bathroom appeared to be the most clean but had the largest bacterial presence.

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

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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

2026

Word Count	Fair Category	Project Number
141	LT	1022

Title: More than just Water

Student Name(s): G. Dickson, C. Sather

Abstract:

This experiment investigated how different cleaning methods affect bacterial growth in commonly used water bottles. The goal was to determine whether washing habits: dishwashing, rinsing, or leaving a bottle unwashed, change the amount of bacteria that develops over seven days. Three types of bottles (Gatorade, Stanley, and plastic) were tested, each cleaned using one of the three methods and then swabbed and cultured in Petri dishes. The results showed that plastic bottles left unwashed grew the most bacteria, while Gatorade bottles that were dishwashed had the least. Although the hypothesis predicted that dishwashed Stanley bottles would be the cleanest, the dishwashed Gatorade bottle showed slightly better results. Overall, the experiment demonstrated that regular, thorough washing, especially using a dishwasher, significantly reduces bacterial growth. These findings highlight the importance of proper bottle hygiene to help prevent the spread of germs and illness.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
240	LT	1023

Title: How pH Affects Seed Germination

Student Name(s): D. Keen, Z. Ahmadi, n. n/a

Abstract:

Have you ever been growing seeds inside of your house before and after a while you realized that it just wasn't working no matter what you put it in, or how much you water it? We hypothesized that this is because of the pH of the water, not because of the quantity, and more neutral water would be best. In our experiment, we used four samples of water with different pHs, with two of which being tap water and bottled water, and the other two being tap water with baking soda, and tap water with white vinegar. Instead of using soil, we made makeshift hydroponic cups for the bean seeds used. To make these, we used four plain plastic cups for the base, made paper towels into cylinders and put them into the cups. We then added the samples of water to each of the cups, one per cup. Those cups sat on the windowsill for about 21 days, with the normal bottled cup growing about a foot tall, the acidic cup started to grow mold, but still started to grow very slowly around day 19. Once done with the experiment, we concluded that our hypothesis was correct, but we still had one wonder left. We had realized there was a factor that we might have not taken into perspective; the different iron levels of the tap water, as it was city water that was used for the tap water.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
124	LT	1024

Title: From Food Waste to Water Bottles: Testing Avocado (Persea americana) Skins as a Sustainable Material

Student Name(s): E. Lemos, C. Ruiz-Ribeirio

Abstract:

This project is about making a water bottle out of avocado skins. Usually, people throw away avocado skins after eating the fruit, but instead of wasting them, they can be used to make something useful. Using avocado skins could help the environment by reducing waste. Beeswax was added to the avocado skins to make them stronger and waterproof. The experiment tested if the avocado skin bottle can hold water without leaking or breaking. If it works, it would show that food waste like avocado skins can be turned into sustainable materials. This could also help reduce the number of plastic bottles used, which create pollution and hurt nature. Finding new ways to reuse food waste is important for keeping the Earth cleaner and healthier.

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

2026

Word Count	Fair Category	Project Number
237	LT	1025

Title: The Effect of Sound and Music Genres on Heart Rate (Measured in Beats per Minute)

Student Name(s): T. Pfeiffer, M. Gaidos

Abstract:

For our project, we sought to find out if human heart rate changes with listening to different genres of music or sounds. We tested heavy metal, classical, country, and hip-hop, along with white noise and nature sounds. Our hypothesis is that heavy metal music will make the heart rate rise the most and white noise will make the heart rate drop the most. We started the testing after the subject's heart rate was stable, as the baseline. We next played the music or sound for one minute and recorded the heart rate changes. After we recorded all of the data, we made a graph and bar chart with the average fall and rise from each genre of music and sound, of all the subjects' heart rate from the baseline. This made the results clear to read. The average from all the subjects' heart rates results were that heavy metal made your heart rate rise the most. It rose an average of 7.83 beats per minute (BPM) and fell an average of 1.33 BPM. Classical music caused an average rise of 2.83 BPM and fall of 4.17. Country music caused a rise of 5.17 BPM and a fall of 2.33. White noise had the greatest fall of 4.33 BPM and a rise of 4.83 BPM. Nature sounds rose 7.17 BPM and fell 3.5 BPM. Hip-hop rose 5.5 BPM and fell 2.67 BPM. Our hypothesis was supported.

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

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

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

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

☐ Yes ☒ No

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
228	LT	1026

Title: How does pH affect plant growth?

Student Name(s): A. Dibouliya, J. Zubarev

Abstract:

The purpose of our study was to determine which soil pH level is suitable for perennial ryegrass growth and overall health. It was hypothesized that perennial ryegrass would grow best in neutral soil conditions. To test this hypothesis, potting soil was adjusted to create acidic, neutral, and alkaline environments using common household materials. Acidic soils were prepared by mixing soil separately with lime juice, vinegar, and coffee grounds. Alkaline soil was created using wood ash, a small amount of baking soda and a huge amount of water, while untreated soil served as the neutral control group. Grass seeds were planted in labeled containers, watered equally, and placed in the same location to ensure consistent sunlight exposure. Soil pH levels were measured before planting in the middle of our research and in the end, and grass growth was observed over a five-week period. Plant health was evaluated based on height, color, and overall appearance. Results showed that grass grown in acidic soil had the healthiest overall appearance and strong growth. However, grass grown in neutral soil also performed well and showed similar height and color. In contrast, grass grown in alkaline soil showed slower growth and discoloration. These results partially supported the original hypothesis, suggesting that neutral soil is ideal for perennial ryegrass, although slightly acidic soil can also promote healthy growth, while alkaline conditions negatively affect development.

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

2026

Word Count	Fair Category	Project Number
175	LT	1027

Title: Keeping It Cool & Damp

Student Name(s): M. Roxo, S. Fernandes, M. Rowe

Abstract:

The purpose of this project was to see which soil cover will do the best on keeping soil moist for a long period of time. This study answers the investigative question of which soil cover keeps soil the moistest. The hypothesis is that the mulch will do the best in keeping the soil the moistest. For the procedure, the materials needed are 4-12 plants (along with pots, unless being grown outdoors), a soil moisture meter, and water. 20 ml of water were added every other day for 2 days and the moisture was measured with a moisture meter 1 hour after watering, and once on the other days. The results of the project was that mulch did the best on keeping the soil moistest. And, the sand allowed for the most soil evaporation. The hypothesis was supported because the data shows how mulch kept the soil moist and that's what was predicted. When the data was being tracked, the mulch was noticed to keep the soil the moistest even the days it was not watered.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
155	LT	1028

Title: Analyzing the Impact of Urban Expansion on Deforestation Before and After COVID-19 Using Satellite Imagery

Student Name(s): J. Cross, R. Prestol

Abstract:

This project investigated how urban expansion contributed to deforestation before and after the COVID-19 pandemic using satellite imagery from 2001–2024. The pandemic, which began in 2020, influenced population movement toward suburban and rural areas, raising questions about its impact on forest loss.

Satellite images from the Landsat program were analyzed to compare land-cover patterns from 2001–2019 (pre-pandemic) and 2020–2024 (post-pandemic). Vegetation was measured using the Normalized Difference Vegetation Index (NDVI), and land-cover classification identified expanding urban areas.

Results showed steady urban growth from 2001–2019, with accelerated expansion after 2020 in several regions. Many newly developed areas were previously forested, especially along city edges where land was cleared for housing and infrastructure. Forest loss was greater after the pandemic than in prior years.

These findings demonstrate how satellite imagery can track human-driven environmental change and suggest that COVID-19-related urban expansion contributed to increased deforestation.

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

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

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☐ vertebrate animals ☐ controlled substances

2. Student independently performed all procedures as outlined in 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

2026

Word Count	Fair Category	Project Number
256	LT	1031

Title: Human Versus Machine: Can Two Kids Use a Quantum Computer to Beat an MTG Pro?

Student Name(s): A. Schay, J. Richardson

Abstract:

Purpose: This study investigated whether data-driven quantum optimization could construct a competitive Magic: The Gathering (MTG) hand comparable to one built by an expert human player. Deck construction in "Sealed" card MTG requires selecting roughly 23 non-land cards from an 85-90 card pool, a task involving approximately 3.6×10^{22} combinations, far beyond the practical capability of classical computers. We hypothesized that an optimized deck generated using a Quadratic Unconstrained Binary Optimization (QUBO) model could beat a tournament medalist. Procedure: An expert benchmark was established using a publicly documented pool of cards from a winning tournament player. For the computer optimization we converted card evaluations into a mathematical scoring function composed of a "power score" and "synergy bonuses" (both derived from crowd-sourced rankings), as well as "penalties" enforcing mana curve targets, deck size, and a two-color limit. The model was translated into Python and solved with a hybrid quantum sampler to select 22 cards, supplemented by fixed artifacts and lands. Results: Deck performance was evaluated using the "Forge" simulator through 1,000 AI-versus-AI matches. The professional deck defeated a randomly generated deck by 214 games. When the quantum deck competed against the expert, the quantum-deck won by 4 games, a difference within the measured 5% randomness of identical-deck trials.

Conclusions: We conclude that quantum-style optimization can produce decks equivalent to those built through years of human experience, though not demonstrably superior. Future work will incorporate artifacts, advanced lands, and automated curve discovery, as well as human-plus-machine collaboration.

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

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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
107	LT	1032

Title: Human Ability to Detect AI Generated Images: A Comparative Image Survey

Student Name(s): C. Joyce, K. Torres

Abstract:

This project investigates if humans can identify AI generated images versus non AI images. This topic is being explored to determine if people are mislead by fake images as AI continues to advance. The hypothesis is that women will be better at distinguishing between AI generated images and non AI images than men. It is also believed that women between the ages of 18 and 25 will be more likely to correctly identify the images than any other group surveyed. To test this, participants of different ages, genders, and educational levels will be survey to determine if they can differentiate between AI generated images and real images.

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

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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

2026

Word Count	Fair Category	Project Number
235	L7	2001

Title: Operation Brine Shrimp: Optimizing Life Conditiona

Student Name(s): N. Krishnamurthy

Abstract:

Brine shrimp are a declining population. A big habitat, the Great Salt Lake in Utah, is shrinking due to climate change. This species is also a big supplier to industries around the US. If these species were to go extinct, there would be major economic change as well as a loss of one of our beloved species. Even though the brine shrimp population is large, it is at risk of worsening conditions to come as time moves on. This experiment tests their hatching rates in the possible conditions of acidification and continued climate change. My simulations included a control, one with high salinity, one with regular salinity and vinegar, and one with high salinity and vinegar. My hypothesis was that the simulations with vinegar would not fare well, but the one with high salinity and vinegar would do very badly. This hypothesis was correct. The ones with no vinegar did much better than the ones with vinegar. There are many future experiments to be done as an expansion to this experiment. For instance, more work as to how much salinity can brine shrimp handle and other work testing their extreme living conditions can be done. My findings can add to future work by giving prior information and background to proceed with more precise and intricate results. This experiment, overall, helped give a base understanding of what brine shrimp are facing in the years to come.

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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☐ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
173	L7	2002

Title: Starch Wars

Student Name(s): A. Palacios

Abstract:

Abstract

This experiment investigated how different types of spaghetti influence blood glucose levels after being turned into resistant starch through refrigeration and reheating. Resistant starch is known for digesting more slowly than regular starch, which can help reduce sharp increases in blood glucose. The testable question asked: What is the effect of resistant starch on blood glucose? Six types of spaghetti were cooked, portioned, refrigerated for 12 hours, reheated, and then consumed before breakfast, lunch, and dinner. Blood glucose levels were measured using a continuous glucose monitor 20–40 minutes after eating. The results showed that DeCecco whole wheat spaghetti produced the lowest glucose spike (134.67 mg/dL), while Banza gluten□free spaghetti produced the highest (170 mg/dL). In many cases, pasta that was simply cooled performed better than the resistant starch version. Overall, the data did not support the hypothesis that resistant starch would always lower blood glucose more than cooled or freshly boiled pasta. Future improvements include increasing the number of trials and controlling food intake between tests to reduce variability.

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

2026

Word Count	Fair Category	Project Number
207	L7	2003

Title: Using Eggshells to Model the Protective Effect of Brushing Against Enamel Damage from Acidic and Non-Acidic Beverages

Student Name(s): K. Hanson

Abstract:

Acidic beverages can weaken tooth enamel and contribute to dental erosion. This project investigated how brushing teeth and beverage choice affect enamel damage using eggs as a model for human teeth, since eggshells contain calcium compounds similar to tooth enamel. Clean eggs were exposed to different drinks, including soda, coffee, Gatorade, and water, over a controlled period of time. Some eggs were brushed after exposure to determine whether brushing reduced damage.

The results showed that soda and coffee caused the greatest surface damage to the eggshells, indicating a higher level of acidic erosion. Brushing after exposure reduced visible damage in these samples. Gatorade caused noticeable color changes on the eggshells but resulted in less structural damage compared to soda and coffee. Water produced the least amount of damage and did not cause noticeable changes to the eggshell surface. Eggs that were brushed consistently showed less erosion than those that were not brushed.

These findings suggest that both the type of beverage consumed and oral hygiene practices significantly influence enamel health. Brushing teeth can reduce damage caused by acidic drinks, while choosing less acidic beverages such as water may help prevent enamel erosion. This study demonstrates the importance of dental care and beverage choices in maintaining healthy teeth.

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

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
241	L7	2004

Title: Does your choice of footwear have a significant impact on your jumping ability?

Student Name(s): E. Bauco

Abstract:

For my Science Fair assignment this year, I am studying which types of footwear could greatly impact your vertical jump. I will select eight different pairs of footwear, and four volunteers will measure their vertical leap with each pair. I was compelled to do this project because, as an athlete, I jump every solitary day. I have always been interested in how certain shoes could strengthen my jumping ability. I have several pairs of shoes that have increased my vertical jump in the past. My project aims to prove these theories.

The many muscle groups that allow athletes to jump are located in the hips, knees, and ankles. Strength training workouts that involve the use of joints and plyometric exercises are said to develop these muscle categories and increase one's vertical leap. These workouts include squats, lunges, deadlifts, bounds, and box jumps. Gregory Abbott, a Mass General Brigham athletic trainer, states that these exercises will help prevent injury and have a great effect on jumping ability.

In a sports-related study, a basketball player was performing several types of jumps. The athlete tested their jump with eight types of footwear, as well as no shoes. The researchers concluded that the barefoot condition obtained the highest vertical leap. Those who studied this project stated that the shoes with the largest mass reduced the use of motion in the lower limb joints, and that footwear lowered the horizontal jump of the basketball player

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
237	L7	2005

Title: Sensory Triggers of Defensive Behavior in Manduca sexta

Student Name(s): S. Hsiao

Abstract:

Research of Manduca sexta, or the tobacco hornworm, has been extensive, especially with its defensive behavior, but the sensory trigger that causes the reaction to occur has not been as prevalent. This experiment sought to understand which sensory trigger (auditory, visual, or tactile) would have the greatest impact on triggering the defensive reaction of Manduca sexta. Caterpillars were placed in individual containers and tested when exposed to stimuli similar to those of the Black-capped chickadee. Sounds of the bird, a visual video of the bird, and gentle strikes by tweezers were tested after ensuring the caterpillars were in their natural state. After review, the reaction was then given a "ranking" based on a chart with decreasing levels of normal hornworm defensive behavior. The results demonstrated spread-out rankings throughout the three senses, but visual tests presented the lowest overall. However, all the rankings were low on average, likely due to the lack of a natural state in the hornworms, requiring additional factors to be considered if the experiment were repeated. Future implications pose additional challenges for hornworm research, especially regarding animal behavioral control. To prevent Manduca sexta from being eaten and ultimately increase beneficial moth populations, it is essential to understand and incorporate multiple sensory cues that influence their defensive responses in order to better protect them from predators. Decreasing moth populations are concerning, as they are considered essential pollinators to the benefit of the environment.

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
249	L7	2007

Title: Sweet Science: How Sugars fuel yeast vs. Humans

Student Name(s): A. Chapman-Roberts

Abstract:

Scientists have used many organisms as models of the cellular processes of the human body. I wanted to find out if bread yeast would be a good model since they have many common characteristics, primarily that they are both Eukaryotic cells. I think that this project can help people in general and more specifically those with diabetes to know which sugars are better for them and which are more harmful to their health.

My hypothesis stated that once the correct mixture of sugar and yeast is established, it will prove how different types of sugars will react similarly to how they affect the body. Using glass bottles and adding yeast to each one along with a different type of sugar such as Maple syrup, Honey, Corn syrup, Organic sugar, White sugar, and Equal. Finally, add warm filtered water and a balloon on each bottle.

Nearly ten minutes in, the corn syrup started rising and its balloon started blowing up far more than the others. The white sugars also inflated, with not much difference between the regular and the organic. Meanwhile, Maple Syrup and Equal inflated their balloons the least. Honey taking the longest to inflate. The visual reaction of the corn syrup in the bottle was extremely more active than the rest, expanding four times its size; proving it is the worst for the human body. Even though my experiment was successful; I would try different sugars and various temperatures of water next time to compare the different variables.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
123	L7	2009

Title: Does Chocolate Improve Memory?

Student Name(s): J. Zilliox

Abstract:

I chose to develop my hypothesis because I was unsure what the results would be. I had never thought that memory worked with chocolate. I think my results will help for future studies about your memory on chocolate. My results showed that dark chocolate helped but milk chocolate did not. There are three types of memory sensory, long term, and the one I tested was short term. Short term memory is easy to remember but only a few things for a short time. I tried to test if chocolate expands the amount or time your short term memory would work. Chocolate has flavonals in it. Some experiments have proven flavanols to improve your memory. My experiment showed more evidence that chocolate improves memory.

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
249	L8	2501

Title: The Effect of Soda Acidity, sugar level, and caffeine concentration on Daphnia Magna's Physiological Responses

Student Name(s): J. Cabral

Abstract:

The purpose of this experiment was to investigate how soda concentration, acidity (pH), and sugar content affect the physiological responses of Daphnia magna. The problem studied was whether increasing soda concentration and chemical composition would increase stress in Daphnia, measured through changes in heart rate. It was hypothesized that if Daphnia magna were exposed to more acidic soda (lower pH), their heart rate would increase, their activity level would decrease, and their recovery time would be longer because acidic solutions can stress their cardiovascular system. To test this, Daphnia magna were exposed to multiple soda types and a water control group at two concentrations: 25% and 75%. Heart rate was measured immediately after removal from the solution and again after 60 seconds, and recovery time was recorded. Three trials were conducted for each treatment, and averages were calculated to compare responses between soda types and concentrations. Results showed that higher soda concentration caused higher immediate heart rates and longer recovery times. The average immediate heart rate increased from approximately 273.6 BPM at 25% to about 314.7 BPM at 75%. Sodas with higher sugar content including Coke and Dr. Pepper often created a large increase in heart rate and longest recovery periods. Additionally, sodas with more caffeine, typically had a higher heart rate. The water control showed minimal change, confirming that the effects were caused by soda treatments. In conclusion, soda concentration and composition significantly affected Daphnia magna physiological responses, suggesting dissolved substances in contaminated water can impact aquatic organisms.

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

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

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☒ vertebrate animals ☐ controlled substances

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

☐ Yes ☒ No

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
258	L8	2502

Title: Can Dietary Anti-Oxidant Pre-treatment Control the Hyperphosphorylation of Tau Protein, Reducing the Chance of Alzheimer's Disease and Tauopathies

Student Name(s): N. Mikkilineni

Abstract:

Neuronal oxidative stress promotes tau protein hyperphosphorylation leading to microtubule instability, transport defects, neuronal death, and neurofibrillary tangles found in Alzheimer's and multiple tauopathies. The goal of this research is to identify if pre-treatment with dietary antioxidants Vitamin E (Alpa-tocopherol) and green tea extract (EGCG) can protect from or control the hyperphosphorylation of tau protein due to oxidative stress. Baker's Yeast (Saccharomyces cerevisiae) was used as the model organism for the molecular mechanisms of neurodegenerative diseases. 1ml, 2ml, and 3ml volumes of Alpa-tocopherol, EGCG, and a 50/50 combination were tested. Yeast culture prepared in YPD broth was pre-treated with measured antioxidant dosings for 3 days. Absorbance at 600nm was measured to calculate Colony Forming Units/ml and compare vs. controls YPD broth (C1) and yeast culture in YPD broth (C2) under conditions of no oxidative stress and oxidative stress (after adding 40mcL of 3% hydrogen peroxide for 30 minutes). Antioxidant pre-treatment resulted in higher cell growth vs. control-(C2) in 89% of the measurements, indicating improved chances of protecting from and managing Alzheimer's and tauopathies. 1ml pre-treatment was most effective, averaging +51% cell growth vs. control-(C2) vs. +30% and +17% for the 2ml and 3ml pre-treatments, indicating a pro-oxidant effect at higher volumes. With oxidative stress simulation the 1ml 50/50 combination antioxidant was most effective with +53% growth of the yeast model for neuronal cells vs. control-(C2). Future work could be on neuronal cells to refine dosing levels below 1ml, and study pre-treatment vs. post-treatment effects.

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

2026

Word Count	Fair Category	Project Number
203	L8	2503

Title: Natural Degradation of Cyanotoxins in Water by L. acidophilus with Concurrent Stimulation of the Aquatic Ecosystem

Student Name(s): C. Maldonado

Abstract:

The contamination freshwater lakes, ponds, and streams by cyanobacteria and theircyanotoxins persists, without a simple means for their effective removal in situ. In response to this need, this research has demonstrated that the addition of Lactobacillus acidophilus (L.a.) to C. anabaena cyanobacteria-contaminated water can bioremediate the cyanotoxins, likely through a digestion of these fluorescent, organic molecules. This was highlighted by fluorescence microscopy, that revealed the sudden fluorescent properties of the L.a. once it has degraded as much as 1.11x10-5µg of cyanotoxin per CFU of L.a. To apply this new finding in a real-world setting, a floatable and tethered L.a.-Permeable-Sack was designed, to allow cyanotoxins to enter a semi-permeable membrane, where they are degraded by L.a. This same sack does not permit used L.a (which now contains portions of the fluorescent toxin) from entering the stream or lake, thus localizing the toxin-contaminant. In laboratory trials, this new approach was able to remediate up to 96% of the toxins in only 3 days. When the L.a. -Permeable-Sack is fully used or expired, it can be removed from the stream or lake, so that the toxin remnants are fully removed from the stream, where they can be discarded appropriately.

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

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☐ vertebrate animals ☒ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
246	L8	2504

Title: A Cognitive Analysis of Social Media Engagement and Multitasking Behaviors in Adult Attention and Focus Endurance

Student Name(s): K. Raptis

Abstract:

This confirmatory study builds on the previous year's pilot, which examined the correlation between social media use and visual and spatial memory in adults, hypothesizing that frequent social media use may impair memory by reducing attention span and promoting multitasking. This study instead examines the correlation between multitasking habits and social media use and their relationship with adults' ability to maintain focus and attention. The study hypothesized that increased multitasking and social media use would negatively correlate with performance on an online attention and focus assessment. Multitasking frequency and social media use were independent variables, whereas attention and focus scores were dependent variables. Participants completed a cognitive assessment designed to measure long-term focus, specifically using Total Brain's focus assessment (Focus Test Online - How Strong Is Your Focus? | Total Brain, 2022). Data were collected via a Google Form, in which participants self-reported their scores, answered demographic questions, and provided both quantitative and qualitative responses regarding their social media and multitasking habits, as well as their beliefs about how multitasking affects them. All participants were de-identified after the study concluded. Correlation analysis was used to examine trends between reported behaviors and test performance. Data was analyzed to determine the most reliable results and the direction of the correlation. Results show a negative relationship between negative beliefs and test performance in a 52-participant sample. This study contributes to a clearer understanding of the correspondence between social media in tandem with multitasking behaviors and cognitive abilities.

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

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

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☐ vertebrate animals ☐ controlled substances

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

2026

Word Count	Fair Category	Project Number
113	L8	2505

Title: Comparison of CO2 Uptake During Photosynthesis by Chlorella, Nannochloropsis, and Chlamydomonas

Student Name(s): G. Pereira

Abstract:

Since the Industrial Revolution, atmospheric carbon dioxide (CO2) emissions have increased substantially, contributing to global warming through the greenhouse effect. This study investigated which algal species, (Chlorella, Nannochloropsis, or Chlamydomonas) absorbs the greatest amount of CO2 during photosynthesis. It was hypothesized that Chlorella would exhibit the highest CO2 absorption due to its rapid growth rate. CO2 reduction was measured over two weeks using Bromothymol Blue Indicator and pH strips. Results indicated that Nannochloropsis demonstrated the greatest overall photosynthetic efficiency, producing the most distinct color change in Bromothymol Blue. pH strips showed minimal variation, suggesting lower sensitivity. These findings indicated that Nannochloropsis may be the most effective species for carbon absorption under controlled conditions.

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

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☐ vertebrate animals ☐ controlled substances

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

2026

Word Count	Fair Category	Project Number
194	L8	2506

Title: Homemade Water Filtration

Student Name(s): R. Maravilla

Abstract:

The purpose of my experiment was to see if I could make Candlewood Lake water as clean as well water. For my experiment I got water from 2 different places at Candlewood Lake in Danbury, CT. I got water from the dock (clear looking water) and from the beach (contaminated dirty water). Then I made a homemade water filter using a 2-liter bottle, cotton, sand, charcoal, pebbles, and rocks. I filtered the different waters collected and tested the hardness, chlorine, alkalinity, pH, nitrite, nitrate, copper, and iron effects of each water. I also tested the effects of well water from my home.

My hypothesis was that Candlewood Lake water will not be as clean as well water, but it should show an improvement compared to well water (unfiltered). My hypothesis was proven to be wrong in cleanliness. The beach water (contaminated and dirty) did get a lot cleaner and showed improvements in testing. The water from the dock was the same after we put it through the filter. The water from the dock was as clean as the well water and showed improvements. In conclusion, my hypothesis was proven to be somewhat wrong.

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
249	L8	2507

Title: To Swim or Not to Swim

Student Name(s): C. Thomas

Abstract:

For my science fair project I tested pond water in eastern CT to see where the safest place to swim was. I did this because it is important to know if where you are swimming is safe. It can be harmful to swim in the wrong place. You can get sick from bacteria in the water. My hypothesis was that; If the pond is far away from any major roads then it will be the safest to swim in. I did this experiment by first, buying test kits for nitrites, ammonia, pH, phosphates, and bacteria. Then, I chose 5 different ponds in eastern CT and collected a water sample from each. Lastly, I tested my samples and recorded my results. My result was that Day Pond was the least safest pond to swim in because it had a lot of bacteria which is dangerous. The safest place to swim was Gardner Lake because it had no bacteria and good to satisfactory levels of ammonia, nitrites, pH, and phosphates. The other three locations are acceptable places to swim. In conclusion my hypothesis was not exactly correct because Day Pond was not the closest to a major road and Gardner lake was not the furthest away from a major road. My project was successful and everything went according to plan. The only thing I would change is to test the ponds in the summer because the amount of animals around the pond can affect how safe it is to swim in.

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

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☐ vertebrate animals ☐ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
254	L8	2508

Title: Investigating the Inclusion of Hair Extracted Keratin Nanostructures for Increased Strength and Flexibility for the Construction of an Artificial Anterior Cruciate Ligament

Student Name(s): J. Prezioso

Abstract:

Anterior Cruciate Ligament (ACL) injuries affect approximately 100,000–200,000 individuals annually in the United States, and 5–20% of reconstruction grafts fail or retear, particularly in young, active patients. Current reconstruction options—including autografts, allografts, and synthetic ligaments—often fail to replicate the native ACL's balance of tensile strength, elasticity, and organized fibrous architecture, contributing to reinjury and prolonged recovery. This research investigated the feasibility of a sustainable, biomimetic ligament scaffold using keratin extracted from waste dog hair as a reinforcing material. Keratin was isolated using acid–base solubilization and characterized through ATR-FTIR spectroscopy and scanning electron microscopy to confirm the preservation of key protein functional groups and its fibrous morphology. Scaffold constructs were fabricated using PDMS molds with aligned channel geometries and compared across three configurations: keratin nanostructure-reinforced scaffolds, plain PDMS slabs, and hollow-channel controls. Mechanical testing demonstrated a consistent hierarchy of structural performance, with keratin-containing scaffolds exhibiting the greatest resistance to deformation, followed by plain PDMS, and hollow-channel controls. Moreover, inclusion of keratin nanostructures in PDMS produced nearly 30% increase in stretchability, while simultaneously increasing the strength of the artificial ACL by 12%. Pre- and post-stretch SEM analysis revealed no observable microstructural damage in keratin-reinforced samples after tensile loading. These findings indicate that keratin incorporation enhances structural strength and stability relative to non-reinforced models. This investigation demonstrates that waste-derived keratin can serve as a reinforcing biomaterial in synthetic ligament constructs, highlighting the potential of sustainable, biomimetic materials to enhance future ACL reconstruction strategies.

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
256	L8	2509

Title: Machine Learning-Based Analysis of Smartphone Behavioral Data for Detection of Depression in High School and College Students

Student Name(s): S. Mysore

Abstract:

Depression is a prevalent problem in college students, with ~30% experiencing depressive symptoms during their academic career. Current methods of identifying depression in students are limited by reliance on self-reported assessments such as the PHQ-9 (Patient Health Questionnaire). These often contain bias, and are therefore unsatisfactory. A study (Eisenberg et al. 2009) found that students with depression are twice as likely to drop out. This proves that accurate diagnosis of depression is becoming crucial, as prolonged depression can lead to more severe outcomes. This research develops a detection method by using machine learning to analyze smartphone data. The approach is supported by research that correlates heavy social media use to depression and suicidal ideation (Sultan Lab, n.d.). Factors included average daily app usage, mean PHQ-9 scores, total app usage, number of distinct apps, average grade, number of courses, number of deadlines, and number of piazza posts (a Q&A platform). This data was from an open-source dataset provided by Dartmouth, the StudentLife study, and was used to train neural network, random forest, and logistic regression models. Accuracy, F1-Score, and ROC-AUC were used to evaluate model performance. Given the limited sample size of 25, Logistic Regression had the most stable predictive behavior. ROC-AUC for Logistic regression was 0.58, which is a modest predictive signal given the constraints of the dataset. This research establishes a framework for using sensing to detect depression. Future extensions of this model could incorporate the RADAR-MDD study, which contains longitudinal data to enhance predictive accuracy.

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

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☐ Yes ☒ No

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
215	L8	2510

Title: Decomposition of PET plastic by fungi and the influence of UV radiation

Student Name(s): E. Gammans

Abstract:

Background: Plastic in landfills is harmful to the environment and takes hundreds of years to decompose. Certain fungi decompose plastic in short periods of time in lab environments. Transferring fungi to landfills in a cost effective way could reduce carbon emissions and the environmental impact of plastic waste without relying on consumers' ability to recycle.

Hypothesis: If A. niger and P. microspora are used to decompose plastic PET samples, then P. microspora will decompose the plastic exposed to UV radiation the fastest because of its fast performance in lab environments.

Procedure: Equal pieces of plastic water bottles - half exposed to UV radiation - were placed into tubs with soil and each fungi. Each tub had a sensored heating mat underneath and was given 160mL of water every 4-5 days. Temperature and humidity was monitored.

Results: After 4 weeks, P microspora grew faster than A. niger in the samples. No significant degradation occurred, and no data was collected. As predicted, P. microspora grew faster, but the degrading efficiency is unknown.

Conclusion: It is possible to grow plastic degrading fungi in controlled environments outside the lab, but the efficiency of these fungi decomposing plastic is unknown. Significantly degrading plastic samples in ideal conditions created in a school environment with a limited budget was not possible in this experiment.

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
245	L8	2511

Title: Novel & Portable Cards For Detection of Common Food Allergens

Student Name(s): R. Shah

Abstract:

Is there a low-cost and accurate way to detect food allergens? Many people rely on reading ingredient labels to avoid food allergens, which is inconvenient and risky. The PURPOSE was to determine whether a portable food allergen detection card could accurately detect common food allergens (egg and milk) using visible biochemical reactions. The PROCEDURE involved (1) constructing cards for experimentation, (2) testing two egg detection methods (Protease Inhibition and Biotin–Avidin Binding) and two milk detection methods (Rennet and Lemon Acid) on respective positive and negative foods across 3 trials per food sample, and (3) analyzing each reaction, averaging the scores, and calculating sensitivity, specificity, and accuracy to determine the most reliable method for each allergen. The RESULTS showed that the Protease Inhibition method correctly identified all egg-positive and egg-negative foods (100% sensitivity, 100% specificity, and 100% accuracy); the egg Biotin–Avidin Binding method produced one false negative, resulting in 66.7% sensitivity, 100% specificity, and 83.3% accuracy; for milk, the Rennet method produced 66.7% sensitivity, 66.7% specificity, and 66.7% accuracy, and the Lemon Acid method produced 100% sensitivity, 33.3% specificity, and 66.7% accuracy. The CONCLUSION is that the Protease Inhibition method was more accurate for egg detection. For milk detection, the Rennet method was more specific while the Lemon Acid method was more sensitive, with the same accuracy. This research shows that biochemical reactions can be translated into a portable allergen detection method, offering a practical option for people with food allergies.

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

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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

2026

Word Count	Fair Category	Project Number
229	L8	2513

Title: To Drink or Not To Drink: How safe is your water

Student Name(s): C. Caputo

Abstract:

The purpose of this experiment was to find out which type of water has the highest quality based on measurable characteristics. Bottled, filtered, tap, sterile, and snow was tested to find the differences in pH, total dissolved solids (TDS), turbidity, and bacteria.

The hypothesis was that filtered/purified bottled water would have the best overall quality because filtration removes impurities.

Samples of New York tap water, Connecticut tap water, filtered water, purified bottled water, spring water, medical-grade sterile water, fresh fallen snow, and snow that had been on the ground for seven days were collected. Each sample was tested three times for accuracy. The pH was measured using pH strips, TDS was measured with a TDS meter, turbidity was tested using a turbidity tube, and bacteria tests were performed using a water testing kit.

The results showed that all drinkable water samples had a neutral pH of 7. Sterile water and fresh snow measured a pH of 6. The biggest difference was in TDS levels. Purified bottled water measured 0 ppm, spring water measured 26 ppm, and tap water ranged from 194 to 233 ppm. None of the drinkable water samples tested positive for bacteria, but snow left on the ground for one week tested positive.

In conclusion, all drinking water samples tested were safe and met basic safety standards, but mineral content varied by source and treatment.

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

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

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
238	L8	2516

Title: Not All Acidic Drinks Are Equal: The Impact of Titratable Acidity on Enamel Erosion

Student Name(s): A. Kim

Abstract:

Frequent consumption of acidic beverages has been associated with dental enamel erosion; however, acidity alone may not fully explain the extent of enamel damage observed among commonly consumed drinks. This experiment investigates the relative impact of pH and titratable acidity (TA) on calcium demineralization to better understand factors contributing to tooth enamel erosion.

The pH and TA of ten widely consumed beverages; Cola, Red bull, Orange juice, Gatorade, Monster, Sprite, Vitamin water, Powerade, Body armor, and Apple juice were measured using standardized titration with 0.1M NaOH. To assess calcium binding and demineralization potential, a calcium release assay kit (Elabscience®) was used on an eggshell to measure the calcium release.

Although several beverages exhibited similarly low pH values(pH 2.8-3.8) Monster and Red Bull demonstrated the highest titratable acidity by consuming around 128ml of NaOH. These same beverages produced the most intense blue coloration in the calcium binding assay, indicating significantly greater calcium interaction and demineralization potential compared to beverages with lower TA. Notably, drinks with the pH value of 2.8-3.8 but lower TA resulted in substantially weaker calcium binding responses.

These findings suggest that titratable acidity plays a more critical role than pH alone in predicting the enamel damaging potential of beverages. Evaluating TA alongside pH provides a more accurate assessment of dental erosion risk and highlights the importance of beverage composition in protecting oral health, particularly for children and adolescents who frequently consume sports and energy drinks.

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

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

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☐ vertebrate animals ☒ controlled substances

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

CSEF Official Abstract and Certification

2026

Word Count	Fair Category	Project Number
251	L8	2517

Title: An Artificial Intelligence Application for Identifying Medical Conditions Affecting the Human Eye

Student Name(s): A. Bandebo-Cambra

Abstract:

Millions of people worldwide have medical conditions they are often unaware of or unable to easily identify, which results in many suffering harm that could be prevented. This could be greatly changed if there existed easily available solutions that can identify potential health issues to encourage people to visit medical professionals before conditions worsen or become irreversible. In my research, I was surprised that there're no available solutions that do this for diseases of the eye. My goal for this project was to develop a free, accessible application that can identify diseases which have visible symptoms in the eye, provide relevant information about those conditions, and encourage users to seek a healthcare professional for proper diagnosis.

To accomplish this, I applied a Convolutional Neural Network (CNN) to create an eye-disease identifier. To train the models, I compiled a dataset with over 4,000 images of the anterior (outside) of the eye with four common diseases: cataracts, uveitis, conjunctivitis, and eyelid drooping, along with images of normal eyes. From these, I built a model and a web application that allows users to take a picture of their eye using a phone camera and analyze it with better than 95% accuracy. In conclusion, the remarkable accuracy of my models and the ease of use of the application demonstrate that it is possible to design solutions to support identification of diseases affecting the eye and other diseases with visible symptoms. This innovation represents a significant step forward in proactive, accessible, and digital global healthcare.

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

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

2026

Word Count	Fair Category	Project Number
249	L8	2519

Title: Smart Bandages for Dogs,

A novel approach to using the halochromic properties of RCAs to test for infections.

Student Name(s): O. O'Dea

Abstract:

The purpose of this project was to develop a working prototype for an infection-detecting bandage using natural compounds. My hypothesis was that I could use anthocyanins, a halochromic flavonoid, paired with a hydrogel to create a wound cover that detects infection. To do this, I completed three experiments. In Experiment 1, I extracted anthocyanins from red cabbage and tested their color-changing reactivity to different pHs. The best option was to use 95 grams of cabbage to 750 milliliters of distilled water, boiled for 12 minutes. In Experiment 2, I created sodium alginate based hydrogels, encapsulated them using calcium chloride, and tested both their consistency and their porosity. I tested chemical proportions to decide on the ideal rations. I selected a balance of 3 grams of sodium alginate to 120 milliliters of distilled water, as it created a gel with an ideal consistency. For my calcium chloride solution, a ratio of 1 teaspoon of calcium chloride to one cup of distilled water created a thick but porous membrane. I used a circular mold, poured in 10 grams of my sodium alginate gel, then poured on 7.5 milliliters of the calcium chloride solution. In Experiment 3, I re-created the hydrogels using an anthocyanin base, and tested their reactivity when placed on simulated wounds, created using sodium bicarbonate, which has a pH similar to that of infected dog wounds. The tests were successful, leading to the conclusion that an anthocyanin based bandage is a viable technology for sensing infections.

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

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