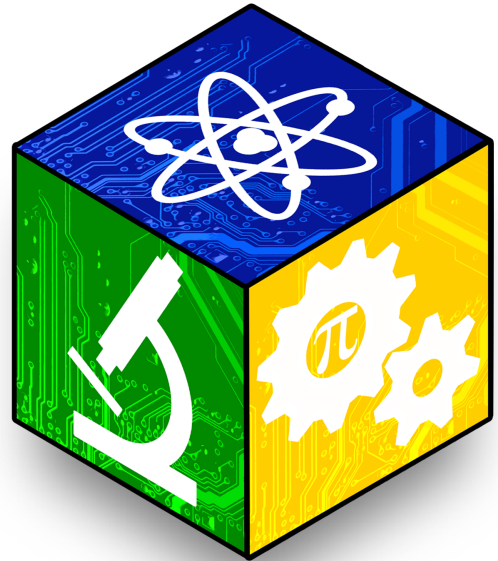


CONNECTICUT
SCIENCE &
ENGINEERING
— FAIR —



74th Annual Fair
March 7-19, 2022

Student Abstracts

Fair Categories

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

Special Categories

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

Special Category Composites

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

CSEF Official Abstract and Certification

Word Count

205

Fair Category

LT

Project
Number

1001

Title: Do Essential Oils Promote the Growth of Yeast Cells?

Student Name(s): J. Donnelly, J. Periera

Abstract:

Many essential oil manufacturers' advertisements suggest that they improve health. These are often falsifications and have led to injuries and even death. This made us investigate the impact of essential oils on the growth of yeast cells. We disagree with the benefits, as not many benefits have been seen in our experiment. We chose brewer's yeast since they are eukaryotic cells similar to the ones of humans. We took flasks and put water, honey, and brewer's yeast into each of them. The brewer's yeast consumed the water and the oxygen and released sugar and carbon dioxide. This filled up a balloon on the mouth of the flask. We added essential oils to all but one to see how it affected the amount of carbon being produced. We found that the mint and mango essential oils prohibited the growth of the brewer's yeast. The other balloons with essential oils in them were no bigger than the control or produced no carbon dioxide at all, which proves our hypothesis correct. In conclusion, essential oils do not promote cell growth and are advertised falsely. Hopefully, this experiment will be taken further and can be further tested to see if its essential oils are as safe as companies claim.

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

CB BI MI

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

230

Fair Category

LT

Project Number

1002

Title: Optimum Composting For Eisenia Fetida

Student Name(s): s. pierce , C. Wilcox

Abstract:

With a current increase in raising backyard chickens, there is also an interest in how to compost their chicken manure working with worms. Composted chicken manure is very nutrient dense and is used extensively in gardens. However, fresh manure contains extremely high levels of nitrogen in the form of ammonia, which makes it too poisonous for garden use. The goal of this experiment was to find out the best environment for red wigglers to decompose raw chicken manure. For our first trial, we used chicken manure and wood shavings from our shed's fresh waste pile. This resulted in all the worms dying, most likely the result of high ammonia content. On subsequent trials, we added increasing percentages of dirt. We put 75% dirt and 25% chicken manure in a plastic shoe box. In the second box, we put 50% dirt and 50% chicken manure, and in the last box, we put 25% dirt and 75% chicken manure. As a result, we found out that if you have less than a 50:50 ratio, the worms will have a higher chance of dying. This is because there are high amounts of ammonia in the chicken manure which is toxic to the worms. In the future we hope this will help our school turn the chicken manure and wood shavings into compost and we will be able to use it in our garden.

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

AS EA

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

244

Fair Category

LT

Project Number

1003

Title: Hydroponics vs. Potting Soil: Which is Better for Growing Kale in the Winter?

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

Abstract:

The objective of our experiment is to see if kale will thrive better in hydroponics or in potting soil. In the first 7 weeks in which the experiment was conducted, we documented the growth rate each week to see how quickly the kale would grow. Early on, we discovered that the potted kale was not growing as well as the hydroponics, which had already reached about 2 inches. At the end of the first experiment, only one of the potted kale had germinated, weighing about 0.1 ounces, unlike the hydroponically grown kale, which weighed approximately 4.8 ounces. In the second half, we wanted to see if the plants needed the plant food to thrive in the hydroponic device. Comparing the first three weeks with and without plant food, more of the seeds had grown without it, showing that it is not needed for them to thrive at first. Using hydroponics at home can also help the earth because it saves water and reduces the carbon footprint by not supporting businesses that are not completely carbon neutral. We hope that this experiment will help reduce the carbon footprint by growing kale and other vegetables at home and not relying on deliveries. It could also reduce farmland space up to 20%, making it possible for more things to be grown, and reduce the time spent growing. It could also be helpful to farmers in desert areas such as California and Arizona, to grow more successful crops.

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

PS EA

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

152

Fair Category

LT

Project Number

1004

Title: Sun vs. Moon

Student Name(s): B. Dunkle , N. Dicello, S. DaSilva

Abstract:

The purpose of this project is to see how much sunlight and moonlight really affect a plant's growth. So for the experiment zinnias were used as the independent variable and the question we asked for it is how much does moonlight affect a plants growth?. Once the question was asked the procedure for it was to get 9 pots fill them with dirt, plant five seeds in each pot, then divide equally among the three group members, after that is done water the plants with two tablespoons of water everyday, each group member will switch two of the three plants out everyday so they only either get only sunlight or only moonlight, leave the third plant by the window at all times, do this for four weeks but once every week measure the growth, and record data. The results were that moonlight grew more than sunlight so the hypothesis was proven false.

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

PS EA

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

LT

Project Number

1005

Title: Investigating the Effectiveness of Flocculants to Mitigate Harmful Algal Blooms (HABs)

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

Abstract:

Harmful Algal Blooms (HABs) found in water can be toxic and cause many problems in the water, such as making the water toxic and emitting a horrible stench. HABs can cause death to animals that intake the algae and even kill humans with harmful toxins. This is a massive problem because harmful algal blooms are more prominent in bodies of water as time passes. We hypothesize that if Aluminum Chloride is used for algae clarification, it will yield better mitigation of algal blooms than Ferrous Sulfate and Sodium Hydroxide because it can inhibit the growth of the algae. To perform this experiment, we grew 40mL of *C. Vulgaris* algae solution in stable conditions for 7 days to model HABs. This culture is intended to model HABs, but there is an experimental limitation as *C. Vulgaris* is not a potent species. Different flocculants were used to aggregate the algae into disposable clumps. The flocculants used were Sodium Hydroxide, Aluminum Chloride, and Ferrous Sulfate. A flocculant causes the algae to clump together and become denser, leading it to sink to the bottom of the water. This mitigated algae was then analyzed for turbidity and used to determine the clarity of the solution in order to determine the chemical's efficiency. Although all three chemicals independently caused the algae to aggregate, Sodium Hydroxide was most effective and most promising for industrial usage. This was unexpected because Aluminum Chloride is more widely used. Our experiment can conclude that flocculants can efficiently mitigate HABs in water.

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

EM EV CH

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

195

Fair Category

LT

Project Number

1006

Title: Bean maze

Student Name(s): T. Brennan, T. Lott, M. Delacruz

Abstract:

The project we are doing is about plants and what kind of color plastic helps a plant grow or grow faster. The plastic will change the color of the light. We are testing red plastic, transparent plastic, and green plastic. It is important to use transparent plastic because we want to see how a plant grows in normal light.

For this project we built 3 plant mazes out of card board. They are all the same. The only difference is the plastic on the top. We placed these boxes in sunlight in a greenhouse during February. Bean plants were placed in the bottom of each box maze. We grew the bean plants from seed. We chose beans based on the recommendation of our teacher and our parents. We learned that beans are strong and firm and grow quickly.

We hope to see the plants find their way through the maze reaching the top. Our prediction is that at least one of them will grow, the transparent one. We think that the red one will not grow because red is a dark color and won't boost the light, therefore affecting the photosynthesis of the plant below.

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

PS EA EV

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

236

Fair Category

LT

Project
Number

1007

Title: Ready, Set, Grow!

Student Name(s): C. Lutz, N. Barone, L. Mannello

Abstract:

Our project is to test the benefits of planting arugula micro seeds with different ratios of composted cardboard pizza boxes to soil. These ratios include, 100% soil, 100% cardboard, 50% soil and 50% cardboard, 75% soil and 25% cardboard, and finally 75% cardboard and 25% soil. All ratios are placed into tupperware tubs that are 11 in. width, 5 in. length. Our hypothesis is that cardboard compost promotes plant growth. The hypothesis was formed from our guiding question. What are the plant sizes under various soil compositions? Before we could plant any micro seeds in the cardboard, we had to cut it up and break it down into a soupy-like mixture so that the roots wouldn't be cut off. For this project, the independent variable is the cardboard in the soil, and the dependent variable is the growth rate. The 100% cardboard did not promote plant growth. The 100% soil had the best growth rate, with 4 inches of growth. The ratio that grew best was from the soil with no shredded cardboard. We determined that different ratios of cardboard to soil works better than just cardboard and that more soil was better. We are just disappointed that the cardboard mixture did not help plant growth, because we had hoped that if it did, more people would have a good reason to use cardboard compost instead of just throwing their pizza boxes in the trash.

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

PS EA EV

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LT

Project Number

1008

Title: How music affects pillbug behavior

Student Name(s): A. Burnham, H. Buttrey

Abstract:

Music has an effect on every living thing, overall the effect that most music has is calming you down, helping with anxiety, slowing your heart rate, and more. (Psych Central) Although in some situations, music can increase stress and make you start to panic. It shouldn't be assumed that music will have a good impact on everything for every situation on anyone.

It's said that animals do react to different sounds, but it might be different for pill bugs. Our hypothesis is that they will not react to the more calming music but they might get scared by louder more intense styles like Rock.

Pillbugs are nocturnal isopods (terrestrial crustaceans living on land) found in dark, humid places such as under fallen leaves, or logs. Pillbugs cannot hear but can sense vibration with antennas.

We are going to track the following behaviors of the pillbugs: Content, undecided meaning it didn't do anything, and, scared. What we did was we put them in a bin and tried playing various types of music. We kept them all at the same level of sound.

In conclusion, our hypothesis was correct. They were scared by rock music and had a positive reaction to calming music. The way you could put this in a real world situation is you could compare this to humans. How could this affect the world? When stores have background music it's usually calming. This may be a technique to make customers in stores happy and maybe want to come back.

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

AS BE

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LT

Project Number

1009

Title: Best Plants for Short Term Growth

Student Name(s): E. Nerenberg, S. Heyman

Abstract:

This experiment was used for the purpose of helping other people decide on what plant to use for short and effective growth. The scientists grew seventy-two seedlings, twelve for each six different types of plants. The seedlings were observed and measured for fifteen total days, and the results were astonishing. We used six types of plants: Phaseolus vulgaris, Lepidium sativum L., Brassica rapa, Lathyrus odoratus, Zea mays, and lastly Festuca glauca. This includes two types of seedlings from three different families, Brassicaceae, Faboideae, and the Poaceae. None of these plants hit their expected height over the fifteen days they were measured. Possibly the most interesting part of the project was the lack of growth in the Mustard, Cress, and Fescue. The Fescue didn't grow at all, which may be because the germination takes a while. This shows that the seeds need to be chosen correctly, as Fescue was probably not the right seedling to choose for a short term experiment. On the other hand, both Mustard and Cress didnt grow much at all. They did sprout over the soil level, but never got to their predicted height. This probably happened because the scientists did not plant the seedlings deep enough or they didn receive enough sunlight. The Bush Bean grew the highest, proving to have had the most successful growth. This experiment can help farmers with recommending cover crops or other students who want to know the best plant to grow for a science project just like this one.

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

Word Count

159

Fair Category

LT

Project Number

1011

Title: Moon Madness

Student Name(s): K. Dela Rosa, E. Abo-alaial

Abstract:

Our project is about whether the full moon causes more erratic behavior. We recorded data for both full moon and regular moon days. We got this information from the Shelton Police Department, and some research that goes with it. We recorded the number of calls in data tables, each year being a trial (2018, 2019, 2020, and 2021). Some of the full moon calls were more than the regular moon calls, and some were the opposite. Then, we compared the averages for each year (full and regular moon separate). Most of the full moon averages were more than the regular moon averages. We compared the overall averages for both full and regular moon dates (for all years). The full moon average was more than the regular moon average. The full moon overall average was 38.15 calls, while the regular moon overall average was 37.9 calls. So, our hypothesis was not supported by data (did not get what we expected).

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

BE PH

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

LT

Project
Number

1012

Title: A novel way to solve coral bleaching

Student Name(s): P. Vijay , T. Prabhu

Abstract:

The objective of our experiment and prototype was to take preventative measures against the growing number of coral bleachings. Out of 1036 reefs surveyed during the 2020 mass bleaching, around 60% of the corals had moderate to severe bleaching. Bleaching being the largest cause of death for these corals. Which lead us to our hypothesis of if we were to use a thermoelectric chip combined with a CPU fan and heatsink, and connected it to a 12 volt power bank, it would enable us to create a water coolant technique that runs on hydro energy, therefore cooling down the reefs more efficiently than methods that are being pondered.

The concept behind our prototype was inspired by the process of thermal equilibrium. In addition a key part of our project resides within a peltier module. The chip is an implementation of the peltier effect which is the cooling of one junction and the heating of another when a current is passed. This allowed for our prototype to cool below ambient temperature and meet goals of cooling down the water.

In order to find out how to accurately compare our prototype to other methods, the experiment was conducted in a 1 gallon tank. Water heated to 85°F. We compared both water cooling techniques and after 10 minutes, took the temperature of the water during trials to see which cooled down more. Due to the idea of thermal equilibrium, our prototype proved much more effective by the even distribution of cooler water.

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

EM EN EV

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

144

Fair Category

LT

Project Number

1013

Title: The volcano eruption

Student Name(s): S. persaud, A. haynes , K. woodson

Abstract:

The topic of the project we are doing has to do with citric acid. We are testing lemon juice against vinegar in an acid-base reaction. Eventually we think it would be fun to use our results to make a paper mache volcano erupt. We are testing the height of the bubbles created by the reaction and heat from the reaction. The best reaction will be chosen and used in our volcano model. We think the vinegar is going to react most, and the highest. We are using the same ingredients for both of the reactions except the vinegar and lemon juice will be traded out.. We will stir the baking soda in the water until it dissolves fully and then we will add vinegar or lemon juice in it. We will measure the height of the bubbles for both reactions and the temperature.

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

EA CH

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

242

Fair Category

LT

Project
Number

1014

Title: Sodium Bicarbonate As a Cost Effective Way To Raise the pH of Soil

Student Name(s): L. Czerwiec, O. Keise, B. Kelly

Abstract:

Around the world, the growing of crops is more difficult because soils are increasingly more acidic due to an abundance of ammonium from fertilizers and other issues. The typical solution is to add lime to soils. However, it can be expensive, causing us to want to find another way to raise the pH of soils more cost effectively. Sodium bicarbonate costs \$4.50 per kilogram, while lime costs \$6.00 per kilogram. Sodium bicarbonate is a base which forms an alkaline solution when added to water and should raise the pH of soil. To test if it will raise the pH of soils, we added a solution composed of sodium bicarbonate and water to bean and snap pea plants, planted in acidic soil. Half of the plants were given the sodium bicarbonate solution once, and the others were given it daily. We also had plants in acidic soil not treated with the sodium bicarbonate solution. Finally, we had plants in neutral soil as our control. There were no physical differences between the three conditions of the plants; however, the plants in the acidic environment grew slower. The pH of the soil of the plants that were treated with the sodium bicarbonate solution every day rose from 6.2-6.6 to almost 8 over a couple days. The plants treated once rose from 6.2-6.6 to about 7. Overall, sodium bicarbonate is a practical way to raise the pH of soil than lime and could be implemented globally.

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

PS BI EM

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

224

Fair Category

LT

Project Number

1016

Title: Improving Composting in the Winter Months

Student Name(s): D. Pappas, S. Plaz, M. Agrafojo

Abstract:

Keeping a compost pile active in the winter season can be challenging with colder temperatures and weather threatening to freeze the compost. We chose to do our experiment on composting to prove we could keep it active for spring planting.

We made two piles, the Constant Pile and the Variable Pile. For the Constant, we set aside a wheelbarrow full of compostable material but did nothing to it. We then added a tarp over the Variable Pile and formed a brick wall around 3 sides of the pile (north, east, and west sides), leaving the south side exposed to get maximum exposure to the sun. We turned, watered, and added food scraps to the Variable Pile throughout the experiment. Two to three times a week, we took the air temperature and internal temperature of both piles to compare them. The first few weeks the Variable Pile was creating more heat than the Constant Pile, indicating a greater amount of biological activity. As winter progressed, the two piles became the same temperature.

Even though both the piles eventually froze we expect the Variable Pile to resume decomposing earlier in the spring than the Constant Pile. When these techniques are applied, more material can be composted in colder climates throughout the year. Next year we will investigate methods to keep the compost active throughout the year.

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

EV EA CB

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

249

Fair Category

LT

Project Number

1017

Title: How do fears change with age?

Student Name(s): S. Gutierrez, A. Cruz

Abstract:

Our goal for this project is to understand if common fears we have had as teens can carry on into our adulthood. To do this we will create a survey asking about different fears and send it to different age groups. The outcome of the survey will help us to prove that common fears leave us as we grow older. After researching we have found data that will help us in our project. We learned that our pre-frontal cortex is still in development when we are kids. (The functions of the prefrontal cortex include suppressing negative emotions and helping us with making social decisions.) The prefrontal cortex is the last thing to develop in a brain and therefore adults deal with the stress of fear differently than children. This is important to note because it tells us how much the pre-frontal cortex needs to work during the fear extinction process and if the process is successful. We also learned that adults produce less adrenaline than children. (Adrenaline causes a racing heart and/or dizziness.) This is important because it tells us that without feeling those strong effects of adrenaline, adults do not experience much of such severe fears. In conclusion, our research proved to be true by our experiment. For example, the ratio of kids to adults that fear paranormal activity is 19:12 and the ratio of kids to adults that fear monsters is 7:4. This proves that common fears usually go away as we enter adulthood.

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

BE

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

125

Fair Category

LT

Project Number

1018

Title: Hand soap vs Hand sanitizer

Student Name(s): A. Foster , J. Valiente

Abstract:

This experiment explores which hand-cleaning product is more helpful when getting rid of germs. In this experiment we will start off by applying glo germ gel(lotion) to our hands and using a UV light to see how dirty our hands will be. Afterwards, we will test which hand cleaning product is more effective. To see which product is more effective we will apply the same amount of hand soap to one set of hands and hand sanitizer to another set of hands. For the hand soap we will wash for 20 secs, for the hand sanitizer we will rub in for 20 secs. After washing, rubbing, and drying we will use the UV light to see which hand-cleaning product removed more germs.

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

CH CB MI

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

244

Fair Category

L7

Project Number

2001

Title: The Effects of Run-off Pollutants on the Harmful Algal Bloom model *C. Vulgaris*

Student Name(s): A. Variar

Abstract:

Harmful Algal Blooms (HABs) cause worldwide problems that can pollute water bodies, and harm aquatic life as well as humans and animals nearby. HABs consume oxygen and block sunlight at an increasingly fast rate, and release toxins that can cause respiratory or neurological issues, and organ dysfunction. One disaster in August 2014 resulted in half a million citizens in Ohio having an extremely toxic water supply when HABs overtook Lake Erie, whose severity index has increased to a dangerous 6.0 since 2021. The purpose of this project is to replicate a real life scenario of how different pollutants would affect the growth of HABs in the water, with the limitations of not including other living organisms and using a non-toxic algal bloom type. It was hypothesized that the growth of the fertilizer and compost groups would be greater than that of the control group, while the detergent group would grow less than all three. The experiment lasted over a span of 12 days and a 670 nm spectrophotometer measured the algae's light absorbance (Au), which was later converted into concentrations (mg/L). It was found that the growth of the algae from the fertilizer group was faster than the algae in the control group, while the compost and detergent groups stopped growing at a normal rate after 6 days. I plan to continue this project for another year by modeling this situation with the HAB *Anabaena inaequalis*, and comparing the results between both.

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

EM EV

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

184

Fair Category

L7

Project
Number

2002

Title: Fertilizer Frenzy

Student Name(s): C. McMahon

Abstract:

I got the idea of this experiment from the gardening I do. I wanted to see which fertilizer is better than the other one. The purpose of this experiment is to see which fertilizer makes the dill get taller and be more productive, Brand A is Jack's All Purpose fertilizer, or, Brand B Dr. Joe All Purpose Tablets. This experiment is important because I want to know which fertilizer best positively affects dill, and also makes them mature quickly! I am also using two plant lamps for warmth of the plants. My hypothesis for this experiment is, If the same amount of fertilizer is used then Jack's All Purpose Fertilizer (Brand A) will make the Dill grow taller and be more productive. For my results in this experiment I measured each plant in each group, I averaged all the plants for, (Brand A), (Brand B), and the Control, individually and then I made a graph to show the results. I have concluded that my hypothesis was incorrect and neither of the fertilizers were as effective as the control which just had water in it.

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

PS

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4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

195

Fair Category

L7

Project
Number

2003

Title: Amounts of bacteria on Organic and Non-Organic fruits and vegetables

Student Name(s): I. Mezheritskiy

Abstract:

The purpose of this project was to find out what is healthier to eat organic or non-organic fruits or vegetables based on the number of bacteria it has. Bacteria is very dangerous to eat because it can make you very sick. "Organic" bacteria is the bacteria that comes with the fruit and vegetable that you can not wash off. In order to do this experiment, I had to conduct a lot of research in order to find out what other factors add bacteria to the fruits and vegetables. Then I swabbed everything and checked on the bacteria every day but I only recorded the information on certain days. I also took pictures to show the difference from day today. To collect information I counted the bacterial colonies and measured the size of the bacteria if it was 1mm or larger. Then I found the average size of the colonies. The conclusion I came to was that both organic and non-organic fruits and vegetables both collect bacteria from different places, and the best thing to do is to wash your fruits and vegetables in order to get rid of the bacteria that it collects.

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

MI CB ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

232

Fair Category

L7

Project
Number

2004

Title: How Does Water Temperature Affect Yeast Fermentation and Pizza Dough Growth?

Student Name(s): A. Bruno

Abstract:

I wanted to do a science project related to pizza because it is my favorite food. The best and most important part of pizza is the dough. Yeast is what is used to make the dough rise. Yeast is an active live culture, which means that it is living. "Fermentation is the process of using yeast for a chemical process to transform the product in some way. Technically speaking, the yeast digests carbohydrates to convert them into alcohol and carbon dioxide." This is what makes the dough rise. The purpose of this project is to see how yeast reacts with different water temperatures and what effect it will have on making the pizza dough rise. I made four different batches of dough using four different temperatures of water, ice cold water, room temperature water, warm water, and hot water. I measured the dough every ten minutes for an hour. The data was analyzed, and the conclusion was drawn that the pizza dough rose the most with warm water.

The question which started this experiment is: "How does water temperature affect yeast fermentation in making pizza dough rise?" The hypothesis is: "If warm water is combined with the yeast to make pizza dough, then the warm water will make the dough rise the most than the other water temperatures." Yeast thrives in warm water, sleeps in cold water, and dies in hot water.

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

BI CB

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

166

Fair Category

L7

Project Number

2005

Title: Light Position and Plant Growth

Student Name(s): L. Gayer

Abstract:

The purpose for conducting this experiment was to investigate whether or not the same plants, with the same growing conditions, though placed differently, would grow towards the same light source. My hypothesis was that no matter where the plants were placed, they would always grow towards the light source. To test this hypothesis, I set up a growth light sixteen inches above my three plants. My first plant, Plant A, was placed sixteen inches to the left of the light source. My second plant, Plant B, was placed directly under the light source. My third plant, Plant C, was placed sixteen inches to the right of the light source. I watered them daily with one tablespoon of water. Gradually, you could see changes in the plant's position of growth. At the end of this ten-day experiment, I came to the conclusion that the plants will always grow toward the light. All three plants adapted to curve towards the light, and they all grew significantly taller.

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

PS

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- Yes No

CSEF Official Abstract and Certification

Word Count

246

Fair Category

L7

Project Number

2006

Title: Catalace: A novel method to detect cervical cancer

Student Name(s): E. Joseph

Abstract:

Currently, artificial intelligence algorithms used for cancer detection are limited in their accuracy and usability. AI cancer detection software is still less accurate than radiologists. Part of this inaccuracy is due to the limited data that AI algorithms receive. Conventional AI software relies solely upon the biopsy image to make decisions. Oncologists typically need much more than just the biopsy image to make a cancer determination; they often utilize patient history, unique patient characteristics, blood panels, and genomic screens. Thus, the current AI cancer detection landscape is quite limited in the scope of health that can be derived from just a biopsy image.

Catalace is a user-friendly platform that combines conventional AI-cancer diagnostic imaging technology with specific patient characteristic information in order to accurately diagnose cancer. Catalace bridges the knowledge gap by allowing for various types of data inputs to increase the amount of information the algorithms synthesize. This project aims to make cervical cancer testing faster and more accessible by utilizing machine learning algorithms to accurately predict and classify cervical cancer from histopathological images taken from a pap smear test.

During experimentation, many different network configurations were tested such as the GoogLENet Convolutional Neural Network Architecture, but a custom configuration ended up yielding the highest accuracy of approximately 94%. A computer vision algorithm to crop histopathological images to areas of interest as well as segment images was implemented to increase prediction accuracy. Catalace will revolutionize the cancer diagnostics landscape and improve patient health.

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

CS ME EN

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

193

Fair Category

L7

Project
Number

2007

Title: What Solution Keeps Apples From Browning?

Student Name(s): L. Nyberg

Abstract:

I chose to investigate whether there was any possible way to delay and/or stop the browning of apples. I hypothesized that if apples are left in an acidic substance, then they will not brown as quickly because the acidic substance will prevent oxygen from entering the apple. The investigation was conducted by slicing up four different types of apples and placing them in five various substances ranging in acidity. The apples sat in each solution for a total of six hours and were then examined to see how brown they had become. Upon examination, the apples that were placed in lemon juice, the most acidic substance, browned the least, while the ones put in vinegar, the least acidic substance, browned the most. From this, I can conclude that strong acidic substances such as lemon juice can help keep apples from significantly browning by preventing oxygen from entering the apple's cells and reacting with other substances that typically cause the apple to brown. This investigation could prove useful to people everywhere who typically throw away apples everyday because they go brown by offering them an alternative to help preserve the apple's freshness longer.

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

EA

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

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 vertebrate animals controlled substances

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

192

Fair Category

L7

Project Number

2008

Title: Extracting DNA from strawberries

Student Name(s): D. Hernandez Reynoso

Abstract:

The purpose of my project was to determine whether it was easier to extract DNA from under-ripe, ripe, or overripe strawberries. The first step was to make the DNA extraction liquid by mixing dish detergent, salt, and water together. The next step was to smash all the three different types of strawberries into separate bags and add the extraction liquid to each. Once the extraction liquid and smashed strawberries were mixed together, the mixtures were then filtered with coffee filters into cups. The filters were taken off and cold rubbing alcohol was poured into the mixtures in the cups allowing the strawberry DNA to float. According to my data and observations, the strawberries had all different amounts of DNA. My results showed that the overripe strawberries had more DNA than the under-ripe and ripen strawberries. From all the information gathered, I was able to make a conclusion that the overripe had more DNA than the ripped and the under-ripe strawberries. My hypothesis was also proven correct because I said that if I added more rubbing alcohol to the overripe strawberries there would be more DNA and I was correct.

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

CB

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 vertebrate animals controlled substances

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4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

87

Fair Category

L7

Project Number

2009

Title: Salt Effect on Plant Growth of Raphanus sativus

Student Name(s): S. Palker

Abstract:

Raphanus sativus is known to be a very salt sensitive crop. The goal of this experiment was to see just how much salt R. sativus could tolerate. To conduct this experiment, four salt mixtures were made and then used to water the plants. Each day, the plants were measured and observed to see how much salt stress affected them. In order for plants to grow, they need to use photosynthesis. When there's too much salt in the water they use for photosynthesis, it slows down this process.

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

PS

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 vertebrate animals controlled substances

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

189

Fair Category

L7

Project Number

2010

Title: Mealybug Management 101

A Study of Houseplant Pest Treatment Options

Student Name(s): A. Manish

Abstract:

Mealybugs are a common enemy of the indoor houseplant and greenhouse managers. They are not only visibly unattractive but they also suck out the phloem, or sap, from the plant, causing it to die. The reason I decided to investigate the best treatment for mealybugs was because I saw how many had infested the plants around my school. I wanted to know how to treat them in a safe, effective and efficient way. I decided to investigate two popular treatment options: horticultural oil and alcohol swabs. Over six weeks, every Monday I treated selected areas with either horticultural oil or alcohol, leaving one additional area without treatment as a control. Then every Thursday I evaluated the mealybug infestation by determining the total area of randomly selected leaves in which mealy bugs were present. After six weeks, alcohol had the lowest average level of infestation out of the two treatment methods. However, the alcohol swabbing consumed more time to apply the treatment. Given the devastating impact of a mealybug infestation, this time-costly treatment is well worth it, as it has a very quick and lasting impact on mealybug populations.

Technical Disciplines Selected by the Student
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PS EM EV

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4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

128

Fair Category

L7

Project Number

2011

Title: Sugar Content of Fruit using a Refractometer

Student Name(s): M. Dragunat

Abstract:

In this project the sugar content of fruit was investigated. It was hypothesized that the sugar content of each sample fruit would increase as it ripened over the study period. The fruit samples examined were bananas, strawberries, red grapes, and green grapes. A refractometer was used to measure the sugar content of each sample fruit throughout the experiment. Results showed that the sugar content of each sample fruit did increase as the fruit samples ripened over a five day period.

Understanding the ripening process helps farmers know when to pick

different fruits and grocery stores understand the shelf life of their fruit. Scientists can also use sugar content information when developing new kinds of foods. Knowing what is in our foods helps each of us make healthy decisions.

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

CB PS ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

L7

Project Number

2012

Title: American Horseshoe Crab Aquaculture

Effects of water temperature and food on the survival and growth

Student Name(s): G. Giovanelli

Abstract:

The purpose of this project is to help the decreasing population of the American horseshoe crab by investigating water temperatures and food intake to help them reach their juvenile stage of life. Horseshoe crabs are not only important to our ecosystem, but they are also important to the medical and pharmaceutical industries. The question I am trying to answer is: Does food intake and water temperature levels influence the growth rate of the American horseshoe crab? My hypothesis is if the water temperature is warmer and the food is a mixture of shrimp and lobster pellets, then the horseshoe crabs will grow healthier and make it through their juvenile life cycle stage. I partnered with MaryEllen Mateleska, Director of Education and Conservation, at the Mystic Aquarium in Mystic, CT. As part of my experiment, I had two controlled groups, Group A and Group B and each had 20 horseshoe crabs. Group A and Group B were both set at different water temperatures. From my research, I learned if you put American horseshoe crabs at a warmer temperature such as 74°F and provide them the food source that is a mixture of shrimp and lobster pellets, then the American horseshoe crab will survive its juvenile state longer. After several repeated experiments, my hypothesis was supported, if the water temperature is warmer and the food mixture is shrimp and lobster pellets, then the horseshoe crabs will grow healthier and reach their juvenile life-cycle stage.

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

AS

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

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

4. Is this project a continuation? Yes No

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

Yes No

CSEF Official Abstract and Certification

Word Count

212

Fair Category

L7

Project
Number

2013

Title: The Affects of Antacid Tablets on Acidity

Student Name(s): F. Carr

Abstract:

Abstract

This experiment was about the Effect of Antacid Tablets on Acidity. This experiment because it tells the human species what type of antacid tablet brand is the most effective and most efficient. This experiment matters because it helps people to make the right choice to pick the best type of antacid brand to heal indigestion. The problem in this specific experiment was "Which type of antacid product most quickly and efficiently removes acidity the most?". My approach for this problem was to grab 4 types of antacid brands and test which type gets the acidity back to neutral level. I would take cups of vinegar and test this by putting the tablets in the vinegar. The product for measuring the acidity (pH) was a pH pool mesurer. The best one according to the following research was Pepcid Complete. It was the closest to neutral level (7) at 5.6 to 6.2. And at 30 seconds it had reached 5.6. It was the most effective and efficient. This project contributes to the area worked in by telling everybody what kind of antacid is the most efficient and reducing indigestion the most quickly and efficiently. Objectives were not met because none of the selected brands did not meet expectations of pH level or 7.

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

BI ME

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- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

L7

Project Number

2014

Title: How Do Small Amounts of Sodium Chloride Affect the Growth of Brassica Rapa (Mustard Plants)

Student Name(s): J. Schwartz

Abstract:

Tap water contains small amounts of salt. If someone uses tap water instead of rain or desalinated water to water their plants, does that hinder the growth of the plants?

The procedure of the experiment was to create three solutions; one of distilled water, one of 1/8 teaspoon of salt per gallon of water, and one of 1/4 teaspoon of salt per gallon of water. Then, plant six Brassica Rapa seeds, and make three groups of two plants each. Water each plant with the corresponding label to the solution with 1/3 of a cup of the solution and measure the heights daily.

The results of the study were that the control and 1/8 salt per gallon groups ended up very similar, but the 1/4 salt per gallon group ended up slightly shorter.

The results of the study show that the salt present in tap water that is not in distilled water (which is very close to rainwater, because both are very pure) does not make a big difference in the final growth of plants.

Technical Disciplines Selected by the Student
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PS EM

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- Yes No

CSEF Official Abstract and Certification

Word Count

250

Fair Category

L7

Project
Number

2016

Title: Are You "Bready" for Some Mold?

Student Name(s): M. Triantafyllos

Abstract:

My project was to make my own bread and study:

How yeast and gluten impact dough.

How temperature, moisture, and time influence mold growth.

I made 3 containers of dough. The first contained flour, yeast, salt, and sugar. The second contained flour, yeast, and salt. The third contained only flour and salt. I added the same amount of water to all 3 containers, mixed the ingredients, and let the dough rest. I then placed gloves over each container and observed which inflated the fastest. For the second part of my experiment I put slices of bread into 4 ziploc bags. Bag 1 I placed in the freezer. Bag 2 I in the refrigerator. I stored Bag 3 at room temperature and Bag 4 at room temperature but added water. I then observed the mold growth on each piece of bread for 10 days. I came up to the conclusion that the glove placed over the first container of dough inflated the fastest. This was because the yeast interacted with the sugar and glucose was converted into carbon dioxide which caused the bread to rise. I also learned that gluten is formed when water is added to flour. Kneading the dough strengthens the gluten network and gives bread a chewy texture. Part two of my experiment showed 2 things:

Warmer temperatures cause faster mold growth, refrigeration slows down mold growth, and freezing prevents mold from growing at all.

Wet bread molds faster than dry bread because mold thrives in damp environments.

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

MI

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

252

Fair Category

L7

Project Number

2018

Title: Increasing well-being in middle schoolers using intervention strategies

Student Name(s): N. Panigrahi

Abstract:

In the past decade mental health in children has been on a decline, especially because of the recent pandemic, so I tested whether journaling and breathing increased well-being in middle schoolers. My independent variables were the journaling and breathing, and my dependent variable was the survey results. The variables that I kept controlled throughout this experiment were the journals, the surveys, the instructions, and my tone of voice. When I told the test subjects the instructions with the same tone of voice, it allowed the information to be perceived the same way by the test subjects. My research indicated that the well-being in these subjects would increase if the proper effort was to be put into the project. This information was exactly correct. I came to this conclusion by giving self-designed journals to the test subjects, and I asked them to journal every night. Along with this, I asked them to do a breathing exercise called square breathing. This is when you inhale for five counts, hold that breath for five counts, exhale for five counts, and then stay empty for five counts. In order to get actual results, I sent a daily survey which asked the subjects to reflect on their journaling and breathing experience from the night before. At the end of the week, I sent a larger survey which included more in depth questions to sum up their experience. Through these tests, I concluded that breathing and journaling can, and does increase middle schoolers' well-being.

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

BE ME AT

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

239

Fair Category

L7

Project Number

2019

Title: How Ocean Acidification Affects Shelled Marine Life

Student Name(s): R. Doshi

Abstract:

Carbon dioxide released into the atmosphere does not remain in the air alone but ends up in our oceans. Now, scientists have learned that this dissolved carbon dioxide decreases pH levels of seawater, making the ocean water more acidic, hence the name "Ocean Acidification."

The objective of the experiment was to understand the effect of ocean acidification on shelled marine life—specifically, the impact of decreased pH levels on its structural integrity.

Carbon dioxide was infused into the water during phase one to simulate the ocean acidic environment. The pH levels and structure of the shells were studied using one control shell and three additional shells. Before adding the shells to each beaker, they were weighed. Carbonation tablets of varying weights were added to each beaker. In beakers containing 3 gm, 6 mg, and 9 gm dissolved carbon tablets, pH levels decreased by 24%, 30% & 33%, respectively.

Phase 2 examined the impact on the weight and structural integrity of the shells. The weight of the shells, Sample control 1, Sample 2, Sample 3, and Sample 4, decreased by 0.17%, 3.9%, 4.4%, and 15%, respectively. Shells observed under electron microscopy showed visible

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

EA AS EV

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

155

Fair Category

L8

Project Number

2502

Title: The Effect of Different Types of Chewing Gum on Bacterial Growth

Student Name(s): S. Morris

Abstract:

The purpose of this project was to determine how different natural essential oils in gum affected the growth of bacteria. What gum types have an effect on bacterial growth? If the gum flavors (Wintergreen, Cinnamon, Peppermint, and Spearmint) are effective in preventing bacterial growth, it will be shown in the measurements of the zone of inhibition. To test this, E Coli. was spread on Lennox Broth Agar plates and sat overnight to grow. After the growing of the E Coli, a piece of each flavor of gum was put in 5ml of Lennox Broth. Then, a filter paper disk was dipped in each gum solution and put onto the plates to sit overnight. The results of this experiment show that the gum actually fed the bacteria rather than prevented it. The gum was expected to prevent the growth of bacteria rather than enhance the growth but the complete opposite happened. These results were not expected.

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

MI ME

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

253

Fair Category

L8

Project Number

2503

Title: Applications of Machine Learning in the Prediction and Clustering of COVID-19 Deaths

Student Name(s): V. Slepinin

Abstract:

Machine learning has become a promising technique for evaluating and understanding the properties of COVID-19, particularly in patient diagnoses and infection rate predictions. This project begins to examine the applications of simple algorithms in analyzing COVID-19 deaths. It was initially hypothesized that there would be a correlation between the provided data, but there were no assumptions regarding the performance of the models. The first model developed was for clustering, using the k-Means algorithm and international COVID-19 fatalities categorized by country, over time. This resulted in a scatter plot with three clusters, each corresponding to the onset or decline of COVID-19 waves. A second model with K-NeighborsClassifier was built, using relevant statistics and parameters to predict whether COVID-19 deaths will rise, remain the same, or fall, one day in advance. The clustering model successfully identified trends in the international COVID-19 data by placing centroids at the dates July 16th, 2020, March 13th, 2021, and July 8th, 2021. However, its implementation in identifying virus waves is theoretical and cannot be proven with this experiment. Despite making predictions with a median accuracy of 66.6 percent and implying that there is a relationship between the data, the second model is also impractical. Using predictive models to forecast COVID-19 has shown to be convoluted due to issues of data quality and ineffective algorithms. Both models performed at an logical standard and could serve as a guide for future research, but they are currently unsuitable for constructively examining the pandemic.

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

CS ME

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

164

Fair Category

L8

Project Number

2504

Title: The Power of Teeth Whitening

Student Name(s): R. Vartelas

Abstract:

In my experiment, I use eggshells as a replacement for actual teeth. I had found that eggs have many similarities to teeth which make it a good substitution. Eggshells are similar to the enamel of a tooth. Both enamel and eggshells are quite thin but contain rich calcium-based compounds for their structure. Calcium carbonate for eggs and calcium phosphate for enamel. They both share the same coloring, ranging from a light yellow to white. In addition, the eggshell protects the egg from breaking, just as tooth enamel protects the tooth from decaying. The peroxide amounts in the products is a huge part of the results. Carbamide peroxide is $\frac{1}{3}$ the strength of hydrogen so 30% carbamide= 10 % hydrogen. The 3d Crest Whitening Strips have 10% hydrogen . The Smile Titan Teeth Whitening Kit has 44% carbamide peroxide. Aotto Teeth Whitening Coconut Activated Charcoal Powder has no peroxide. Out of these 3 products, the Smile Titan Teeth Whitening Kit has the highest concentration of peroxide.

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

BI

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- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

191

Fair Category

L8

Project Number

2505

Title: Single-Use Plastic Substitute

Student Name(s): S. Leahy

Abstract:

Plastic has been both a blessing and a curse. Plastic is a blessing because it's helped make things more sanitary in grocery stores; however, plastic has also destroyed a lot of animals' lives and the environment. Now we need to strive to replace it with something either currently existing or safer. Some ideas for suitable replacements are glass, bioplastics, steel, bamboo, paper, silicone, edible replacements, or cardboard. The goal of this experiment was to find a valid easily recyclable or biodegradable alternative to plastic. The research showed that the best alternative would be bamboo because it is easily biodegradable without releasing anything harmful and can possibly be recyclable. This experiment did support the hypothesis because I imagined the best alternative would be bamboo. I chose to do this science fair research project because I love our planet and solving plastic pollution will help prevent our environment from being harmed, protect animals' habitats and all of our lives from being harmed too. I want to protect our planet and do as much research on this topic and other planet destroying topics as I can and I want to help solve these problems.

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

EV

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

L8

Project Number

2507

Title: Novel way to remove Carbon in the Home Environment

Student Name(s): P. Popova

Abstract:

CO₂ is always present in the atmosphere and its average concentrations are currently below safety thresholds. Indoors, however, it is considered to be an air pollutant, and has to be monitored as an indoor air quality factor and removed if its concentration reaches unsafe levels. Until recently scrubbing carbon from the atmosphere had only few applications: in spacecrafts, submarines, and airtight spaces where life needs to be sustained. Lately, with rising atmospheric levels of CO₂ and poor air quality in big cities, the reduction of CO₂ concentration down to safe levels indoors may become of interest soon. Several well developed chemical and physical methods of removing CO₂ from air exist, but require expensive materials, waste lots of energy, and have a significant positive carbon footprint.

The aim of this study is to search for an alternative, eco-friendly, sustainable, and scalable way to scrub CO₂ from indoors and to determine whether naturally available green algae photosynthesis can be used as such a process. The absorption of CO₂ in algae bioreactor columns was investigated by measuring and comparing CO₂ concentration in inlet and outlet valves, as well as ambient CO₂ concentration in airtight testing enclosure under various conditions. A species of algae, *Chlorella vulgaris*, was cultivated and used, as well as a control empty tank.

The results showed a measurable reduction of relative CO₂ levels in comparison to control as well as a reduction of ambient CO₂ level inside of the enclosure both under sunlight and artificial light.

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

EN MI EM

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

137

Fair Category

L8

Project Number

2508

Title: Spherification

Student Name(s): C. Kostelni

Abstract:

The objective of this project was to find out if different substances could be spherified using sodium alginate and calcium chloride. Spherification is a process of dropping a liquid into a specific solution and as the two touch a chemical reaction happens. The outside of the dropped liquid forms a gelatinous shell and then when taken out of the solution, the shape of the liquid stays in a spherical shape. Information for my research project was obtained from reading articles and watching online food videos. I used different edible liquids that mirrored the tastes of certain foods. The data showed that any liquid can be spherified and it is easier to spherify liquids with a thicker consistency. If they do not have a thick consistency, then getting the liquid into a sphere shape can be more challenging.

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

CH

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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- Yes No

CSEF Official Abstract and Certification

Word Count

248

Fair Category

L8

Project Number

2509

Title: Copper Contamination of Freshwater sources which pollute and harm the ecosystem and its consumers (Phytoremediation)

Student Name(s): S. Vash

Abstract:

Background: Copper chloride (CuCl) and other forms of copper contamination are evident in samples of freshwater. CuCl is toxic to humans and aquatic life alike. To combat this, phytoremediation is a method which plants in soil and water to extract copper. The purpose of my experiment was to use specific aquatic phytoremediators, to test which one was the best. In this experiment, two different aquatic plants were used. Duckweed and water lettuce are known to be phytoremediators.

Hypothesis: If I use water lettuce and duckweed in two equal parts of copper contaminated water, the water lettuce will be the most effective because it is best at absorbing ion compounds (copper) even with low concentrations.

Methods: I used 1299ppm of copper chloride in each jar for two phytoremediators. I placed the plants in the contaminated water with 300 ml in each jar, measuring the copper levels before the experiment began and every other day for eight days. The control had no plants. To test my copper levels, I used standard methods by measuring qualitatively the color/pigmentation in the water.

Results: The water lettuce had the most change in CuCl levels. My hypothesis was correct, the water lettuce did have more change rather than duckweed. In each well there were different pigmentation levels (Fig 1, 2, 3).

Conclusion: My hypothesis was correct, the water lettuce did remove levels of copper, and so did the duckweed. My control where there was no phytoremediator, had no change in copper chloride levels.

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

EM EV CH

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

108

Fair Category

L8

Project Number

2510

Title: Type of light on sweet corn

Student Name(s): A. Falcao

Abstract:

I thought of this project by looking at experiments on the internet that had to deal with plants, but instead of plants I used sweet corn. This project is to see if colored light will have a better effect on the growth of sweet corn than natural light. The beginning prediction was that blue light will increase the growth of sweet corn. The hypothesis was proven correct for the reason that the sweet corn grew more inches with the blue light as opposed to the red light. This experiment was very important because it shows that blue light increases the growth of sweet corn which could help the community.

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

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

- Yes No

CSEF Official Abstract and Certification

Word Count

143

Fair Category

L8

Project Number

2511

Title: Bread Business on the Rise

Student Name(s): T. Barbieto

Abstract:

Yeast heavily affects the product of a baked loaf of bread. Inappropriate amounts of yeast result in varying loaf heights or a prominent yeast flavor. This lab shows the effects of yeast when baking, even at home. While following a bread recipe containing baking yeast, or *saccharomyces cerevisiae*, the volume of yeast was altered while the rest of the ingredients stayed the same. The loaves measured were baked with no yeast, one teaspoon (tsp), two tsps., and three tsps. Conclusions were drawn from measurements taken from the bottom of the loaf to the apex. The trial with no yeast performed the worst in its rising ability, however the trial with the most yeast performed similarly. The hypothesis to be studied was partially correct, as the average loaf heights were not as varied as expected. The investigations conducted could help when testing new recipes.

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

BI

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

243

Fair Category

L8

Project Number

2512

Title: Rapid Screening for Hypertrophic Cardiomyopathy Using Single View Portable Echocardiography

Student Name(s): B. Chiravuri

Abstract:

Hypertrophic cardiomyopathy is a medical condition that affects more than 1 in 500 people. It is genetically transmitted and causes the walls of the heart ventricle to become hypertrophied and thick. In advanced stages it can cause heart failure, but there are no symptoms in many younger people who have it. HCM is the most common cause of sudden cardiac death (SCD) in people under 35 including competitive athletes. Exercise causes more risk in HCM patients. The standard way of diagnosing HCM is with an echocardiogram but this is a time consuming and expensive test. My hypothesis was that a portable version of the echocardiogram with a single view could create a rapid screening protocol for HCM that could be done on site and with athletes. I interviewed two cardiologists who confirmed that a single parasternal long axis view (PLAX) would be the best single view for HCM. After this was validated, I created a protocol using a hand-held ultrasound probe with my smartphone, a single ultrasound view, and manual calipers that took less than 3 minutes to measure wall thickness. Anonymous, de-identified single view PLAX images of known HCM patients, normal controls and dilated cardiomyopathy (DCM) patients were then shown to me in random order. My protocol detected almost all of the HCM cases. There was a false positive detection rate with non-HCM controls. These results suggest that a simplified portable protocol for rapid screening of HCM is feasible.

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

ME CBIO

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

- human subjects potentially hazardous biological agents
 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

162

Fair Category

L8

Project Number

2513

Title: The DNA of Fruit

Student Name(s): M. Serraro

Abstract:

Abstract

The purpose of my science fair project is to compare the DNA of different fruits to see how different they are. The question I am asking is whether the DNA of the fruits will be different or the same. My hypothesis is that the DNA of the fruits will be different because of the varied characteristics the fruits have. To complete my project I will extract the DNA from the fruits. Then I will examine the DNA under a microscope, take photographs, and compare the images. I observed that the DNA of the fruits were different. In addition, although it surprised me that the strawberry's DNA was the most unique in its traits, the kiwi and peach were the most similar. After completing my experiment and comparing the DNA, I came to the conclusion that my hypothesis was correct and the DNA of the fruits were unique to each fruit and their variety of characteristic traits was the most important factor.

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

CB PS

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

196

Fair Category

L8

Project Number

2514

Title: Do Dead Leaves Help Plants Grow?

Student Name(s): D. Ciscel

Abstract:

This project was created to determine what effect adding dead leaves to an Echeveria's soil would cause on the Echeveria's growth. To answer this question, I conducted an experiment in which one pot would be filled with dirt and the other with dirt and 5-10 dead leaves. An Echeveria plant was then placed in each of the pots and both were watered about once a week. Every other day, the plants were measured with a ruler and the data was put in a document. After fifteen days, the collected data was put into four graphs and reviewed. My hypothesis at the beginning of this project was that the Echeveria with dead leaves added to its soil would grow faster than the Echeveria with no dead leaves in its soil. This is because the dead leaves would provide extra nutrients to the Echeveria, enhancing its growth. My results showed that the Echeveria with dead leaves in its soil grew slightly more than the other Echeveria, making my hypothesis partially correct. Furthermore, I have made the conclusion that it will take further experimentation to fully prove my hypothesis due to the close and limited nature of my results.

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

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

- Yes No

CSEF Official Abstract and Certification

Word Count

252

Fair Category

L8

Project Number

2515

Title: The RightSwitch: An Automatic Light Switch Sterilization Device

Student Name(s): S. Wu

Abstract:

The concept of the RightSwitch first came to mind when I was researching various scientific articles, and came across a study that claimed the common light switch harbored around as much bacteria as the average trash bin. With the outbreak of COVID-19, the light switch was a silent menace—a hotspot for germs and potential pathogens disguised as an everyday appliance. The project objective was set, to design a device that automatically decontaminated light switches efficiently and effectively.

Numerous designs were brainstormed and terminated, as the completed model required a strong balance between efficiency, effectivity, and safety. A 70% isopropyl alcohol solution was selected as the disinfectant agent, as it was able to eradicate germs without many negative effects.

After weeks of trial and error, my device operated successfully. When motion at the light switch was detected from an infrared sensor, a servo ejected the alcohol from a spray bottle, with a visual and audible alarm system for safety. Although the prototype worked as intended, bacterial measurements were unable to be completed with Petri dishes due to uncontrollable events.

The RightSwitch, although created for light switches, has an incredibly versatile design and can be implemented to automatically disinfect other everyday contaminated objects. With an oscillation spray feature or through the use of different sensors, this device could be used on a variety of items, from sink faucets to door handles, cell phone chargers, and toothbrush holders—the RightSwitch can be adapted for a myriad of other appliances with the right adaptations.

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

EE AT MI

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

228

Fair Category

L8

Project Number

2516

Title: Which Filtration Material Leads to the Best Drinking Water?

Student Name(s): W. Lewis

Abstract:

The question I'm exploring is which filtration material leads to the best drinking water. I'll be looking at 2 forms of activated carbon to see how the particle size affects the quality of the drinking water. My purpose is to provide insight into the best filtration material for filtering water so people can know which filtration material is best for drinking. I will be exploring how well the charcoal filters out the water and if a specific particle size does a better job through adsorption. The scientific concept of adsorption is the sticking of atoms or molecules to a surface. Scientists have found that adsorption increases if the chemicals are in contact with activated charcoal. They have also found that adsorption increases as the temperature decreases as well. I'll be exploring this using granulated activated charcoal and powdered activated charcoal. By exploring this idea, people have a better idea of which carbon filters they should get. My hypothesis was that the powdered activated charcoal would filter the water most effectively. The data I collected supports this hypothesis. The powdered activated charcoal filtered out the colored water the best and the color rating was excellent compared to the original color. Even though both types of charcoal are porous, I concluded that the powdered activated charcoal used adsorption better than the granulated activated charcoal due to a greater surface area.

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

BE

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

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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

- Yes No

CSEF Official Abstract and Certification

Word Count

247

Fair Category

L8

Project Number

2517

Title: The Latch

Student Name(s): N. Makin

Abstract:

Finding veins in patients can be difficult, and many factors can vary the ease of that process. The objective of my project, The Latch, is to make the vein-finding process easier and less painful with a free and reliable solution. This project includes an application for both iOS and Android that works without an internet connection. There were multiple data collection journeys and experiments held to create this app. Most vein-finding devices use infrared/near-infrared light to penetrate the skin and make veins visible through your skin. However, the app uses color filters on the image taken to emphasize the newly-found vein. To figure out what color filters work best, I have sampled over 65 photos of people's arms (with consent) and have created a spreadsheet with different combinations of colors. To assist experimentation, I have added configuration options like the number of pixels to be skipped to improve image processing time, the color to exclude for the vein, and the threshold of how far the vein color can be from the set color. I researched how color finding, dot finding, and line finding works in C# and started testing my solutions with the 65+ images to find the straightest vein. I will be incorporating this function in the subsequent version of this app. To conclude, this app helped me learn a lot more in developing mobile applications through Xamarin, and it will hopefully be a handy tool for nurses in the future.

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

CS AT EN

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 vertebrate animals controlled substances

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

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

4. Is this project a continuation? Yes No

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