

## Science Fair Abstracts 2018:

### #1 Gravity Powered Electricity

In the world today, 1.2 billion people do not have access to electricity. This affects the food consumption, education, and shelter of people in every country across the globe. I created an electrical generator powered by gravity to provide a source of electricity for houses that do not have access to it. My goal was to power a small LED light to demonstrate the potential for this type of a generator. The generator spins with the dropping of a weight, so there is no need for a battery - making it more convenient for struggling families or individuals. Strong neodymium motor magnets rotate around coils of copper magnet wire, allowing the magnetic field to introduce a current into the wire. The wire is connected to a multimeter, which reads the voltage generated by each test. After tests showed that no voltage was being generated, I revised the design multiple times. I used a thicker wire (gauge 30) to carry a larger current and used alligator clips to strengthen the connection between the wire and the multimeter. Although my results show that the generator was not successful in generating electricity to power an LED, my unique design offers a new approach to the generation of electrical energy.

### Project #2 Self Watering Plant Pump

Plants have been suffering due to lack of under watering, over watering, and just overall lack of controlled water intake over long periods of time.

This prototype is programmed to efficiently water plants without any type of human contact besides occasionally refilling the tank. After assembling the prototype, it was tested whether or not the sensor would create an output to send to the microprocessor and then if the output at the microprocessor would turn into input through the relay and to the pump in order for the prototype to start pumping out water in case there is a LOW of 7 or restraint on watering when there is a HIGH of 13. This was shown by testing the prototype's reaction when exposed to different water levels in plants such as, no water, a tablespoon of water and two cups of water. When there was no water the pump was automatically started in order to begin watering the plant until it reached a HIGH of 13. When starting with a tablespoon of water, the pump once again turned on but it took a shorter amount of time to reach a HIGH of 13. Finally, when the plant was

already watered fully with around two cups of water, the pump did not turn on as it had already reached a HIGH of 13. This is evidence to show that a plant can be effectively watered and survive without the constant need for human contact.

### Number 3 Magnesium Light Deterrent

When one is being attacked or assaulted, pepper spray or mace isn't always reliable, and requires one to be at a relatively close range. This project investigates the usage of magnesium as a deterrent, as the combustion of it produces an extremely bright light. The original idea was to test several different lighters and see which one ignited the magnesium the fastest. While the concept held true, the lighters did not ignite the magnesium anywhere close to the desired speed, with a single ignition taking well over a minute to happen. In order to remedy this, a micro-blow torch was used, which yielded a reasonably fast ignition in around five seconds, with some deviation depending on the condition of the magnesium. Though the created deterrent is large and unwieldy, it could make a difference in a dodgy situation. Not only that, but it could also evolve into a much smoother and user-friendly model in the future.

### Project #4

#### Ocean Currents Powering the Future

The use of ocean currents to power our communities can positively impact society because its a renewable resource that will cost less money. It will also be better for the environment by burning less fossil fuels. This research addresses the problem of saving natural resources and bettering the economy. The main method to testing this theory was creating an at home version of hydropower. To make it possible to test the theory that ocean currents can generate the necessary energy to power electricity by using a homemade turbine, a sprinkler pump to simulate an ocean current, and a bucket of water. The turbine working with the created current was able to produce enough energy to power an LED light. The conducted experiment supported the possibility of ocean currents creating enough power to generate electricity on a larger scale.

### #5

#### Robotic Arm

Do you sometimes find yourself in need of a helping hand? The purpose of this invention was to create a robotic arm that would be able to pick up and move an object. This invention impacts society by enhancing the ability to grip objects and allowing the handling of toxic substances. The problem investigated what is involved in the construction and movement of a

robotic arm. The approach used in investigating was to select motors of the appropriate strength and to adjust the dimensions of each of the “bones”. This was to balance the reach and lifting capabilities while reducing power requirements. Using high torque servos and two pieces of wood 8 inches long, the arm was able to lift a maximum weight of 14.7 ounces, while maintaining a maximum current of 1.9 amps. These results show that a simple robotic arm can lift almost a pound and require just a little bit more current than supplied by a moderate sized battery pack. These results show that there is a relationship between the length of an arm and the amount of torque and power needed.

## #6 Efficient Solar Oven Abstract

With not everyone in the world having access to electricity, especially after this past year’s natural disasters, it is important to search for alternative energy sources. This project sets out to capture the energy of the sun in the form of an efficient solar oven. Two ovens were built, one of household products and the other out of less common items. The ovens were tested on two sunny days during the winter in order to observe their effectivity. It was clear that the more complicated oven reached a higher temperature much faster than its simpler counterpart. One day, for example the large oven reached 60 degrees Celsius in the same amount of time it took the smaller oven to reach 40 degrees. The results support the idea that electricity is not necessary for food to be cooked.

## #7 Sudoku Solver

The Sudoku Solver can provide assistance on sudoku puzzles. Sometimes people just want a small hint when they are attempting a sudoku puzzle. But when solving a sudoku puzzle there is no assistance other than receiving the entire solution. I have built a program that can give you a small hint instead of taking away your liberty to solve the majority of the puzzle. I coded this program in a basic coding language called QBASIC and saved it to my laptop. Hopefully this program can help people receive a small boost when they would like one when solving a sudoku puzzle instead of forcing the entire solution.

## Project #8: The Relief Wrap

Excited and anxious dogs are likely to cause problems in public as well as within the homes of their owners. They may become aggressive, and have the possibility to cause harm to not only others, but to themselves as well. The Relief Wrap is designed to reduce hyperactivity and anxiety in dogs by hugging them tightly and applying vibration and pressure to three acupressure points meant to relax them. Three small dogs were tested first in a calm setting, then in an excited setting. The Relief Wrap was then applied with and without vibration. Each dog appeared calmer when the wrap was applied without vibration, however when vibration was applied, two of the dogs appeared confused while the other ran off. These results do not conclude that the Relief Wrap with vibration works, however without vibration, it works to relax dogs.

## Project #9: Hydraulic Generator

Hydraulic energy is an alternate energy source which can be very efficient with proper construction and water pressure. This research could be essential. This generator could be the foundation for ideas for alternative energy sources that we could use instead of fossil fuels. This project produces energy from the flow of water as an alternate energy source. During the process, water will flow through a turbine. The turbine is attached to a rotor. The flow of water will cause the turbine to spin the rotor, which is next to a stator with coils on the side of it. This movement will create electrical energy. The generator ran for a minute, and created approximately 1.5V worth of energy. This is enough to power a small light bulb. These results provide evidence that, with a more advanced generator powered with more hydraulic force (like water rushing through a dam), we could work towards powering an entire city.

#### Launch: A Study of Aerodynamics (#10)

Finding the most efficient and farthest flying - in essence, the most aerodynamic - paper dart could help further research in aeronautics and consequently work towards lowering the amount of gas used in planes and other flying vehicles, not only reducing the cost of air travel but helping the environment stay clean as well. This project attempts to find the effects of fins and slits in the body of the darts in an effort to see which affect the flight of the dart in different ways. Each dart type was fired 5 times, starting with a control of straight, triangular fins and no holes. The distance covered was measured, and then the dart's body and/or fins were altered. Another five tests occurred. The control darts flew about 100ft. The darts with twisted fins, as well as a more rounded and tear drop shape flew the furthest, upwards of 130 ft. The dart with with slots cut into the body of the dart flew only about 80 ft. In conclusion, with altered fins, the darts fly farthest, and the controls flew further than the altered bodies.

#### #11 - Electromyography

Electromyography allows amputees to have control over functioning robotic prosthetics. This project investigates the effects of EMG signals based on the location of recording and the athleticism of subjects. To begin the tests, sticker electrodes to detect EMG signals, a Muscle Spiker Shield that converts the EMG signals into electrical outputs with different strengths, an Arduino to control a servo motor depending on the strength of the signal, and a robotic claw to control using the entire system to do testing was acquired. Two subjects with different levels of athleticism had EMG signals recorded from different muscles on their bodies. For each subject the amount of time that they could hold a cup while using the device was recorded to represent

the signal strength. Four trials were conducted for each location: the forearm (flexer carpi), the bicep (bicep brachii), the thigh (vastus medialis), and the calf (gastrocnemius). The results clearly showed that athleticism does affect the EMG signal strength due to endurance and less body fat. The results for subject 2 were approximately 40% less effective than those of subject 1. In this test subject 1 was more athletic than subject two. The location that we found was most effective was the bicep and the least effective location was the thigh. For both subjects, the bicep produced the strongest signal and the thigh produced the weakest. These results shows that the effectiveness of an EMG signal is largely dependent on the location where it is recorded and the athleticism of the subject tested.

## Project 12: Earthshaking Ecosystems

The pH of soil has been known to affect the health and growth of plants. This project investigates the effect of pH on plants, insects, and aquatic life. On day one, five ecosystems (two acidic, two basic, and one neutral) were made and for 30 days were observed to determine the germination and growth of the plants. At the end of the experiment, it was determined that the neutral ecosystem had the best growth and the basic had the least. The animal factor does not play a part because they all had passed away. These results determined that cilantro plants are best grown in neutral soils which can be applied to an individual's garden or farm.

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### The Destructive Power of Cell Phones

Have you ever wondered how much radiation a cell phones gives off? This project was designed to study the effect of cell phone radiation on plants and compare the damage done to the cells. For a period of X days, potted green beans eight per pot, were grown two pots were grown next to an active phone while the other two pots were grown without a phone. The plants were watered, observed, and measured every day. After the 2 week period in which the plants grew, thorough observations indicated that the beans that were exposed to cell phone radiation had significantly less growth and proper development than the beans grown in normal conditions. With this data it can be concluded that radiation emitted by common cell phones hindered the growth rate and cell development of the bean plants exposed to it. If this is what cell phones can do to the growth and development of life than maybe keeping kids from obtaining phones at young ages and not using it as much yourself is a smart decision.

#### 14 The Effects of Ocean Acidification

Increased carbon emissions have caused ocean acidification leading to the degradation of coral reefs. This project examined the effect of different concentrations of carbonic acid on seashells. It also examined the natural pH buffer effect of coral reefs. For a period of 2 weeks we submerged shells in varying concentrations of carbonic acid. For trial 1 we let the shells sit in the solutions for the entire 2 weeks, and the other trial we replaced the solutions that the shells were placed in to maintain a constant pH. For trial 1 the pH of all the solutions was initially about 4.5 and at the end of the 2 weeks it was about 8.1. For trial 2, putting the shells in fresh solution daily, the shells lost about 1.84% of their mass over the 2 week period. Increased carbon emissions do have an effect on coral and when exposed for longer periods of time, can have an even greater negative impact. These results provide evidence that ocean acidification is a serious problem and in order to preserve these coral reefs, the world needs to shift towards greener energy.

#### Project #15 The Effects of Nicotine on Living Organisms

The use of nicotine products has been known to have significantly dangerous effects on the human body. It has also been linked to long term impacts on the environment. The direct effects of nicotine on plant growth has yet to be discovered. Tests have been carried out, however a mass experiment has not been conducted due to the unknown dangers high doses of nicotine can cause on plants and living organisms. Nine bean plants were grown over a course of two weeks; three watered with tap water; and the other six with three varying strengths of Marlboro cigarettes dissolved in water. The comparison between how fast and how tall each plant grew based on the amount of nicotine they were watered with showed the effects of nicotine on the growth of plants. It shows nicotine will have short and long term effects on living organisms as it does on the human body.

#### #16 The Cleaning Power of Laundry Detergent

Many brands of laundry detergent claim to remove stains the best, even going so far as to show a visual of some vague bubble shape taking dirt and grime out of clothes in commercials. The purpose of my experiment is to determine which of the larger brands of laundry detergent actually cleans various stains the best. Various strips of cloth were stained and cut into pieces, doused with a brand of detergent, and washed at various temperatures. The detergents tested were Tide, Gain, Oxiclean, Arm & Hammer, and a Wal-Mart Great Value detergent. The results showed that Tide performed the best out of all the detergents, with warm being the best out of

Tide. The results are mostly inconclusive, due to how close the actual results were to each other. The results show that most laundry detergents clean better than each other, it is mainly the conditions that the wash itself is, and what the stain is, that will determine how well the end result ends.

## #17 Lead Busters

Lead is a very harmful element that can cause serious health issues for adults and especially children. Testing for lead in certain household objects is necessary for safety precautions. This project investigates how varying the pH of a test solution affects its ability to dissolve lead. We tested how much lead was dissolved in a 50 mL solutions of 100% distilled water, 100% vinegar, 50% vinegar, and 75% vinegar for 4 hours, and then again for 24 hours. We discovered that the most lead was dissolved in the 50% vinegar solution which had a pH of 2.60. The 75% vinegar solution which had a pH of 2.49 and the 100% vinegar solution which had a pH of 2.46 dissolved about the same amount of lead. The 100% distilled solution did not dissolve any lead. These results show that a pH of about 2.60 is the optimal pH to test lead in. This will help parents efficiently test if objects or the pipes in their home contains lead.



## #18

Schools nationally rely heavily on the results of standardized test scores, and students futures are often determined by the results of these tests.

This project tests the effect that punishment vs rewards as a group have on average test scores. A group of ten volunteers were put in a room and given 30 seconds to complete a non inelegance matching test, they repeated the test three times, once with a reward offered to the highest scorer, once with a punishment enforced on the lowest scorer and once as a control. The control group scored an average of 19.2 correct answers, the reward group scored an average of 21.1 correct answers with 8 participants improving their score, the punishment these yielded the most significant difference with a group average of 22.5 with eight test subjects scoring their highest score and all ten showing improvement over their scores for the reward test. While more testing needs to be done, and these results are in no way conclusive, the results appear to show that both a deterrent and a reward improve the way students take tests, however factors such is the time spent studying and the topic of the test would also play factors in a students overall grade.

## Project #19

### Conduction of Heat in Aluminum Foil

When you cook food in an oven the food and the tray it's on will get very hot. Therefore when kids aren't careful when taking food out of an oven, they will burn themselves. This project investigated whether aluminum foil is safe to cook with, and if it can prevent burns. We cooked aluminum foil by itself in different shapes and different amounts of time, in a 350 degree Fahrenheit oven. In our results it showed that even if aluminum foil is in an oven for 10 minutes at 350 degrees it will not be very hot. To run this experiment we had 300mL of 66 degree filtered water and we placed the aluminum foil from the oven into the water and we recorded the temperature change. We had 4 different shapes, flat, folded twice, folded three times, and in a crumpled ball. Originally the base dimensions were 7"x6", then we would make the shapes we needed. The time intervals we used were 1 minute, 3 minutes, 5 minutes, and 10 minutes. The flat piece only increased the water by 1 degree for the 1 and 3 minute intervals, at 5 minutes the temperature went up to 68 degrees and at 10 minutes it went up to 69 degrees. Our experiment followed a certain pattern where the 1 and 3 minute times would increase the water the same temperature, and the 5 and 10 minute times would increase it one extra degree. These results support that aluminum foil is safe to touch while using it to cook in an oven.

## Project #20

The process of drilling for fossil fuels is harmful to the environment and is generally unregulated. This project looks at grass plants as a biomass energy and a source for generating ethanol that can replace fossil fuels in a safer, more environmentally friendly way. For this project, wheatgrass and corn plants were grown and fermented in a closed system for a period of two weeks. Masses of each system were measured before and after fermentation to determine the increase of mass due to ethanol production. The percent ethanol production for corn was 1.14% and the percent ethanol production for wheatgrass was 4.47%. These results support that the conversion of grass to biomass energy is an effective alternative to drilling for fossil fuels.

## #21 - The Effect of Electricity on Plant Growth

A new way to grow plants taller and faster without the use of harmful chemicals is needed because of world population growth and therefore the demand of more food. This project investigates how the application of an electrical current through the soil of a plant affects its growth rate and height. For a period of 9 days, electricity was run through a pot containing three radish seeds for five minutes each day. The voltage of the current was varied between pots and the height of each plant was measured each night at the same time. In the first trial, the results proved the hypothesis, with the control plants having the lowest average height as well as being the last to sprout. However, the second and third trials were the opposite, where the control plants had the highest average height. Therefore, no solid conclusion can be drawn from this experiment, except that the introduction of electricity to plants has little to no effect on the overall growth of radish plants.

## Project #22 Plant an Idea

Priming, cuing implicit memory by providing cues that stimulate a memory without awareness of the connection between the cue and the retrieved memory, is used in advertising and daily life and it is important for consumers to know how much this influences their decision

making (Zimbardo, Johnson, Weber & Gruber, 2010, p. G-9). This project determines if colors, patterns, or numbers affect thought processes. Participants were randomly assigned the orange (priming) or blue (control) test, asked to touch the pattern with a pen, write three assigned numbers, and then say a vegetable out loud. Their age, gender identity, and response were recorded in a chart. The results show that because the P-value of  $0.6196 > 0.05$ , there is not convincing evidence at the 5% level that there is a difference between the true proportion of people who responded carrot with the orange test and the true proportion of people who responded carrot with the blue test. The results show that priming does not have a statistically significant effect on overall decision making.

#### Project #23 The Perfect Jump shot

The purpose of my experiment is to find out what the necessary range of arc is for a made shot and how the height of a player affects their arc. With this research, players will be able to figure out what their arc should be to be a consistent shooter. This research will show people in all sports that technique and form helps with your success as a player or coach.

The project investigates the arc of shots that go in and the role that height plays in shooting for players.

Each of the four participants took ten jumpshots to find the arcs of their made shots. They took shots on 3 different heights of 10 feet, 9 feet, and 8 feet to see the role of height in shooting. I took a video of each of the shots to find the necessary information for the experiment.

Based off the footage, I found a different range of arcs including the highest and lowest ones. A plane was created using the 18 foot distance to the hoop and the different hoop heights to find the arcs of the makes to calculate the range of the “perfect jump shot. The arcs were estimated from the video. Participants made more shots as the heights of the hoops got shorter. In most cases 1 or 2 more shots out of the 10.

Every shot arc that is in between the highest and lowest arcs will be a definite make. Taller players also have a higher chance of making shots over shorter players based off the data.

#### Project #24

### **The Effects of Acid Rain on Plant Life**

Did you know that today, many ecosystems around the world face air pollution? Air pollution is an environmental issue that causes increased acidity in rain which affects the vegetation of the planet and therefore affects the entire food chain. This experiment is designed to investigate the impact of water with different pH balances on a variety of plants. For a period of 19 days, the three types of plants, spider plants, variegated english ivy, and kalanchoe, a type of succulent, were divided into groups of three and each group was assigned an acidity to be watered with about every four days. As the days progressed, changes in the plants were observed

and photographed and the heights of the plants were also measured. For the kalanchoe the average growth measurements were 2.73 cm for group 1, 2.76 cm for group 2, and 1.36 cm for group 3 and for the ivy, group 1 had a average growth of 0.2 cm, for group 2 it was 1.16 cm, and for group 3 it was a -0.433 cm. For the spider plants, the average growth measurements were 0.6 cm for group 1, 1 cm for group 2, and 0.2 cm for group 3. The results support that the plants grew best height-wise over time in the slightly acidic rainwater, with the pH of 5, and natural rainwater is also slightly acidic. They also suggest that the polluted acidic water is harmful to plant growth.

#### Project #25 GLO Fish

Gene insertion is the possible next step for the cure for cancer. Scientists are trying to find a way to insert healthy genes into the cancerous cells to destroy them. This project investigates the possibility of inserting a pGLO gene into common goldfish eggs. After the goldfish laid eggs in home tank, the eggs were slightly removed from the water and inserted the gene into the unfertilized eggs. Many eggs did not hatch from the insertion. There were 9 eggs that did hatch. 8 of the goldfish did not glow and the last one expressed the gene a very small amount. The results were inconclusive based on the very small mortality rate and the very small expression of the gene. With more trials and better equipment, this may be possible.

#26

Which water is which?

## Abstract

The research was conducted because sometimes, some waters can taste different than other waters, and this experiment was designed to figure out why if they are all made up of the same properties and basic atomic structures. This research will make people aware of what they are drinking and will allow them to be more cautious when choosing the brand of water that they may want to drink. This project investigates the coalition between the taste of water and the minerals that are in it, and if those minerals have an effect on the taste. Twenty five volunteers tried six different unknown brands of water, and they rated the taste of each by putting them in order of least to favorite taste wise. The volunteers typically chose the brand Fiji as their overall favorite brand. However there were a few participants who claimed to not taste a noticeable difference in the taste, except in the distilled water. Based off the data found, it's possible to say that the data was overall inconclusive due to issues that stemmed from water companies not sharing their methods of purification or what minerals exactly they put in each bottle. It'd also take a lot more than just the original twenty five participants to make a true statement as some hardly noticed any difference in the water.

## #27 - Fact or Myth?: You need to wait 30 minutes after eating to swim to avoid cramps

Common myths say that going swimming within 30 minutes of eating will cause cramps and that person to drown. This project investigates the effects of eating various foods before rigorous exercise. For four days, a week apart, four volunteers ate a lunch given, including a turkey sandwich with an apple, pizza, spaghetti with meat sauce, and a salad with a cookie. Afterwards each volunteer did as many full push ups they could manage, swam 200 meters, then did as many more pushups as they possibly could. During this experiment no participant experienced cramps, but all felt negative bodily reactions, especially after eating the pizza and the spaghetti. Throughout this experiment the participants were able to increase the amount of push ups that were successfully completed before each swim, but the negative feelings and weakness from the exercise did impact the amount completed afterward. These results conclude that eating before swimming will not cause a person to cramp up and die, but it is not recommended to do a rigorous amount of swimming due to physical discomfort.

## #28 Phones, Is It The Best Thing?

The usage of phones has increased over the years. We look at our phones at least eighty-five times a day. People don't exactly know how it affects their bodies. Our experiment will show people how it affects us throughout our lives. It will also test to see how people are addicted to their phone, have back pain, and have mood changes. We would measure how long it would take them to check their phone and ask them if they suffered from back pain and mood changes. We would measure how long it would take them to check their phone and ask them if they suffered from back pain and mood changes. The experiment will take up to two to three minutes. The participants phone ringer will be on to help conduct the experiment properly. They will put their phones face down in the middle of the table and the timer will start.

## #29

The growth of goldfish is affected by different environmental factors, such as overpopulation, the cleanliness, and the size of the tank. This project investigates the effect of

said environmental factors on the growth of the goldfish tested. For a period of 4 weeks, fish were kept in certain conditions, and at the end of each week their growth was measured. There was a slight difference in growth between each of the different environments and the control groups, but no significant difference since the testing period was only a month per trial and longer testing time is needed for more significant results. The overpopulation had the biggest impact on the rate of growth with only 2.5%, where the control had a 7.8%, the other tests had far less significant results. These results support the fact that fish cannot be put into environments that are either stressful or unsanitary to them in anyway.

### **#30 Heat and Enzyme**

In every human exists several different enzymes that aid the process of digestion. These enzymes create a chemical reaction that will directly break down what is consumed or aid metabolic processes in some way. However, when an enzyme is placed in an environment that is too hot, it will cease to function. This project investigates this effect, and sets out to find at what temperature an enzyme, in this case the enzyme bromelain, will cease to function. In order to find this out, pineapple was placed on gelatin. Pineapple contains the enzyme bromelain, which breaks down protein. In order to find the exact temperature at which bromelain ceases to function, pineapple slices were placed in boiling water and tested at increasing increments of 5 degrees celsius. As the temperature rose, the enzyme activity at first increased to an optimum temperature 45 degrees celsius and then from there the enzyme got less and less effective. As for our results we found that bromelain ceased to function at temperature 65 degrees celsius and up. This meant that the Jello could no longer be broken down because the enzyme had lost all functionality. Though enzymes have varying temperatures at which they lose functionality, this experiment shows how enzyme activity is affected by temperature and how at 65 degrees celsius and up the enzyme bromelain ceases to function.

#31

### **Radiation vs Plant Growth**

Microwaves and its radiation have been known to affect things around the microwave, and more importantly, the things in it. This project investigates the effect of microwave radiation on plant growth/seed germination. Over the course of four weeks, summer squash seeds were planted after being put in a microwave for different amounts of time. There were six different times, all spread out from 0-30 seconds, each with three seeds. The results were not as expected. The control group seeds (0 seconds) were all around 3.5 inches, and so were the seeds that were microwaved for 5 seconds, 10 seconds, and 20 seconds. However, the number of seeds (out of 3) that successfully sprouted declined as the amount of time in the microwave went up. These

results mean that the radiation of the microwave did not affect how tall or how much a seed grew, but it affected the odds of the seed being able to grow at all.

### #32 - A Workout for your Brain

Exercise has been known to promote better mental health, and better short-term memory. This research investigates the effect of vigorous exercise on short-term memory. A group of 18 volunteers, varying in age, took a quick memory test, then performed a group of vigorous exercises. When finished with their workout, the volunteers retook the test. About 83% of the volunteers tested scored higher on the second test than the first, while 11% scored lower. There was one volunteer, or 6%, who scored the exact same. These results support the fact that exercise is beneficial to mental health care, and increases short-term memory.

### **From Brine to Beverage**

### **#33**

Freshwater is taken for granted because of ignorance towards how saltwater can affect your body and your health. The purpose of this experiment is to educate people on how to obtain freshwater where only saltwater is at their disposal. This project investigates whether a higher salinity or lower salinity will produce fresher water and which will have a bigger difference in salinity, before and after the experiment. Six desalinators were constructed and placed in direct sunlight, three of the desalinators contained 1 teaspoon of salt in blue water and another three contained 3 tablespoons of salt in red water. Each desalinator contained the saltwater solution and a medicine cup placed on top of the solution, plastic wrap covered each desalinator, secured by a rubber band, and small pebbles made the plastic wrap dip down toward the medicine cup allowing the condensation to drip and collect in the medicine cup. The results from each solution using a conductivity probe showed that the original high salinity solution had 37300  $\mu\text{S}/\text{cm}$  of salt, 240  $\mu\text{S}/\text{cm}$  for the post high salinity, 36570  $\mu\text{S}/\text{cm}$  for the original low salinity, and 220  $\mu\text{S}/\text{cm}$  for the post low salinity. In conclusion, the lower salinities had the least amount of salt in the post experimental solutions whilst the high salinities had the greatest difference between the saltiness of the solutions. This experiment was proven reliable for obtaining freshwater and allows those to gain freshwater in conditions where only saltwater is available.

# Abstract: #34 Glow Stick Chemiluminescence

The purpose of this experiment was to see how chemiluminescence reacts to certain temperatures. The temperatures we used was freezing, cold, warm and hot. We conducted this research to see how the chemical reacted to temperatures; and how to make the chemiluminescence chemical in glow sticks light up longer and brighter. This research impacts society because if they wanted to expand the brightness and life of a glow stick, they will know what temperature they achieve this at. People should care about the work we did because if they ever had to use this chemical in an experiment of their own, they would know how to make the brightness last longer. The problem that we solved is how the chemiluminescence reacts to certain temperatures. We took 4 hours to run 4 different trials all with the 4 different temperatures in each of the labeled cups. We measured each temperature in each cup with a thermometer for consistency; and so it would be about the same in each trail. We then put the sticks in the water and measured the brightness on a scale of 1-4 in 3 time frames of 1-minute of stirring, 5-minutes of stirring, and 1-hour of sitting in its labeled cup. We obtained that in the beginning of our experiment, the hot water had the highest result in brightness, cold and warm were similar in brightness in the middle, and freezing was the duller of the four. At the end of our experiment, it turned out that the warm waters glow was consistently the brightest, hot and cold were similar with a lower brightness, and freezing had little to no light left. We concluded that more extreme temperatures like hot and freezing did not hold the brightness and color of the glow stick after the 1-hour of experimenting. It turned out, the more regular temperatures did. We found that warm water was the most effective to the glow stick and made the glow brighter and last longer than the others. The results contributed to the investigation, is that to keep the glow sticks glowing longer and brighter the temperatures cannot be too extreme and should stay at a warmer temperature preferably to colder temperatures.

Project #35 Does radiation from radio waves emitted by wifi routers stunt plant growth?

Some people say that you should not be sleeping near your phone at night because your phones give off radiofrequency energy (radio waves), a form of non-ionizing radiation, from their antennas and this could cause your brain to not grow as fast while you are sleeping. Now I could not test to see if this is true on humans, so I used plants (cilantro and basil) and our home wifi-router (also gives off radiofrequency energy, a form of non-ionizing radiation, from their antennas) to test this theory. My project tests to see if growing plants near wifi-routers will stunt the plant's growth. I planted 2 sets of 20 basil plants and 16 cilantro plants each growing in a separate room. Both by the same side of the house exposed to the same amount of sunlight and water. The only difference is that one is growing next to the wifi-router. On the most recent test (3/26/18) is showed that throughout this month, the cilantro plants growing away from the router were on average 10.36 cm tall and the cilantro plants growing near the router were only



7.6 cm tall. Also there are more sprouts of basil on the tray away from the router rather than growing next to the router. These results show that the radiofrequency energy (radio waves), given off from cell phones may cause a stunt in the growth/development of your brain since they caused a stunt in growth for the plants.

Project #36

## Chemical Music

Music has always existed prominently in the world, and is listened to by many for the simple matter of enjoyment. However, the mystery of this joy is scientific, and more often than not, it is misunderstood by most people who do listen to music. What happens to your body as you listen to music? This particular project explores the very question. Using heart rate monitors, 30 volunteers will be setup to a heart rate monitor and a pair of headphones. Music will play through the headphones and the change in heart rate will be recorded. Each volunteer will be tested for 3 different songs, totalling 90 test results. The participants were each very different as far as what made their heart rate slow or speed up. Thus it was difficult to exemplify a trend or overall progression of the volunteers heart rates. The results show that everyone will go through physical/chemical changes in their body, when listening to music that happens to appeal to the specific individual. The research done proves eloquently that music does effect the human body.

#37 CRISPR Cas9 Gene Editing

Newly developed technique of CRISPR Cas9 Gene Editing has been established a theoretical course of treatment for future diseases and has the possibility to allow for the selection of certain characteristics in the advancement of modern society. Currently, it serves as a great innovation that has various applications within biomedical research. This project investigates the effect of environmental conditions on the growth of genetically altered E. coli. To alter the bacteria, a transformation mix was created, thereby allowing the plasmid to enter the DNA of the E. coli after the Cas9 enzyme “cut” the host DNA. The transformed bacteria established Streptococcus resistance. For a period of five days, the transformed E. coli were set to grow at differing temperatures, ranging from 0°C to 37°C. Based upon the conclusion of the experiment, it was deduced that there was no significant effect of temperature on the transformed E. coli growth from room temperature (20°C) compared to incubation growth (37°C) with the exception of

slight lagging time between the growth speeds of the cultures. In colder climates (0°C), the development of transformed E. coli showed larger amounts of growth than the untransformed bacteria. The results support the fact that higher temperatures and longer incubation periods produce ideal conditions to aid the growth of altered E. coli. However, the experiment also concludes that genetic transformation also can facilitate growth in harsh climates that would otherwise prove not to be an environment suitable for bacterial growth.

#### Project # 38

##### Copper Corrosion

Copper is used in many architectural projects and many tools throughout the world, but is susceptible to natural acids. There are reports of buildings and structures made of copper collapsing because the copper has corroded away from being exposed to the natural elements. This project experiments the types of acids that could corrode copper. Over the span of a week, pieces of copper wire were placed in different substances with different pH levels in order to determine the effects that these acids had on the copper. After the week was over, noticeable changes could be observed from the wires. An acid with a lower pH of 1.0, sodium bisulfate and distilled water, has had the most dramatic effect on the corrosion of the copper wire and as the pH increased, less changes could be observed. These results conclude that copper can be corroded by some substances. This information can be used when building structures consisting of copper because it can help provide a better understanding of what substances copper can withstand and can be better protected against the harmful elements.

#### Project #39

Over the counter antibiotics are easily obtained and used daily to treat small cuts and scrapes. This project investigates the effectiveness of two types of topical OTC antibiotics and their generic brand counterparts. Six different plates were streaked with E Coli k-12 bacteria on the entire plate and labeled one as control, one as neosporin, one as bacitracin, one divided into four for each antibiotic, and two with one of each generic brand antibiotic labeled on it. Next antibiotic was spread on  $\frac{1}{3}$  of their designated plate and in their quarter of the other plate. This was repeated for the next three days until all of every plate (besides control) was covered with antibiotic, and the results were recorded. After one day, every plate had complete growth except for the neosporin (name brand and generic), where there was no growth near the antibiotic. After two days, there was no bacteria growth whatsoever on any plate regardless of antibiotic, and after 3 days the same results were shown. These results initially showed that neosporin works as described while perhaps bacitracin does not. However, the results after two days had no contribution to the goal of the experiment and further testing would have to be done to understand why nothing grew past day 2.

#### Project #40 Gum Over Concentrating

The chewing of gum allows your brain muscle along with your memory to work, and this can help you focus, and remember and prosper in school during a test. Our project is to help teachers understand why chewing gum should be allowed and how it has an impact on grades. Our project is to investigate how chewing gum, when specifically or not at all helps improve grades. A variety of students were tested three times and were given timed test, of two minutes each, with the same difficulty and subject, but different problems each time. While taking the three tests, students were under different circumstances. The first test was taken with no gum chewed, the second was taken with gum chewed five minutes prior, and the last test was taken with gum chewed the whole time. Upon reviewing the results of our test we came across something interesting. We found that students who chewed gum five minutes before the test were able to answer more questions, even if they weren't all answered accurately. This shows that chewing gum five minutes before the test had an impact on the students overall performance on their test scores. This conclusion could lead to new studies in how people with learning disabilities like ADHD could perform better on a test. When they are distracted or focused on everything else, chewing gum before a test could be an answer of how to improve tests scores and grades.

#### Project #41

##### Making a Primitive Solar Panel Cell

The concept of carbon dioxide emissions damaging the planet's atmosphere is well understood. In this experiment, a primitive, yet functional device for converting the energy of sunlight into usable electrical power was created. The concept is based on creating a semiconductor by heating a copper plate, thus turning the outer molecular layer into copper oxide. A copper plate, as well as the semiconductor, sit in a salt solution. Taking data of the current at different times of the day, the homemade solar panel made makes about  $\frac{1}{2}$  the current of a commercial solar panel. These homemade solar panels, although making less current than a bought solar panel, can be used to charge a battery, and multiple would be able to charge an average home. By using these, instead of the fossil fuels used trivially, carbon dioxide emissions would decrease.

#### **#42 Heart Rate Based on Type of Music**

Based on tempo and genre different styles of music can affect heart beats per minute. Listening to different genres of music can help slow down or speed up heart rate. Music could help people control their heart rates and stabilize heart rates of weaker hearts. The project investigates which genres of music increase and decrease heart rate. The test was run on 20 people who listened to four genres of music: pop, jazz, classical, and country for one minute each. Before they listened to any music and as they were listening to each genre of music their pulse was taken and recorded. The results show that pop and country music increased heart beats per minute and jazz and classical decreased heart beats per minute. The results prove that music can change someone's heart rate just by listening to it for a minute. Music therapy could be used more for people with higher rates of heart attacks and other heart conditions.

#### **Project #43**

What should your tee height be to the most distance in your drive?

The purpose of this research is to help golfers gain distance in their drives by finding the ideal tee height. We conducted this research because we are both interested to see what tee height works the best. This project analyzes the distances from different tee heights, and what tee heights had the most efficient drives. To start our experiment we went to a golf simulator, we each took 5 shots on different tee heights to test which height was the best. The distance would also be affected by how strong the participant was, and the driver used. The participants' drives varied quite a lot from the 0 mm to 80 mm tee height that we tested. The 40 mm and 50 mm tee heights ended up hosting the longest drives and the most efficient launch angles. Although, the 30 mm and some of the higher tee heights were not too close behind the 40 and 50 mm drives. One thing that was noticeable, was that the drives with no tee actually had considerably more distance than the drives with a 10 mm tee which always had the lowest the distance. The average lowest distance increased by over 50% to the average highest distance. With the data we collected we can conclude that the heights 40 mm to 50 mm would result in the most distance for your drive, we also concluded that if the tee is too high it will be harder to hit off of.

#### **#44 Tarnished Silverware**

Tarnished silverware can be cleaned in a variety of ways, each of which polishing the silverware in more or less efficient ways. This project puts to the test the effect that different

mixtures have on cleaning the tarnish off silverware. Two tarnished spoons were soaked in separate bowls lined with aluminum foil and filled with hot water. Baking soda was mixed into one of the bowls and laundry detergent into the other. Three other spoons were scrubbed down with either ketchup, corn starch paste, or hand sanitizer. Each spoon was periodically checked and timed until the tarnish was removed to satisfaction. Three tests were conducted for each method and the times were averaged. The average times in ascending order were 500 seconds for ketchup, 660 seconds for hand sanitizer, 740 seconds for cornstarch, 1280 seconds for laundry detergent, and 1480 seconds for baking soda. Scrubbing tarnished silverware with ketchup turned out to be the most efficient way of cleaning. The scrubbing methods were much more efficient but took much more effort, while the soaking methods took much more time but took much less effort. This can aid anyone from a homeowner to a restaurant business.

#### #45. Reaction time in relation to temperature.

Most people believe that cold weather decreases peoples reaction speed. This experiment is meant to help people understand how weather can affect people's reaction time, and help people understand what the optimal temperature is for competing in a sport or other kind of reaction based activity. This experiment will help us decide if the human body reacts faster while hot or if it reacts slower while cold. To find this out, me and my partner used a website that helps find an average reaction time (link will be below) to figure out the reaction of being at about 70 degrees, being cold (around 30-40 degrees) and being warmer at about 80-90 degrees to find out what temperature will help you react the fastest or the slowest, and which one is in the middle. Our results were that the warm temperature helped people react faster, and the cold made the people react slower, with the middle temperature being in the middle of course but by only a few milliseconds, but every test subject had the same results either way. Our result means that if you want to have the greatest reaction time that you can, for whatever circumstance you may need it, it is best to be in warmer weather as opposed to cold weather.

#### **46. Can the Nerve Cells of *Caenorhabditis elegans* Regenerate Faster when grown in different environments?**

Nerve regeneration could possibly help diminish the number of paralyses and fatalities that are linked to nerve cells. This project investigates the effect of temperature on the nerve cells of *Caenorhabditis elegans* (*C. elegans*). For a period of roughly 2.5 months an unset number of *C.*

*elegans* were grown in Nutrient agar, LB broth, and *E. coli*. The worms were grown in an incubator at 25 degrees celsius, as the worms began to grow and reproduce, they were then placed in different temperatures: one in the 25 degrees celsius environment, one at room temperature and the last was placed inside a fridge. No worms showed changes in their nerve cells. However, if there was a difference it was very minute. These results do not provide any evidence that temperature affects the nerve cells of *C. elegans*. However, if the experiment was conducted over a longer period of time, perhaps there would have been a noticeable difference in the nerve cells.

#### #47 To Fold An Egg

Substances with different levels of pH have different properties, which affect their effects on other compounds they come in contact with.

This experiment observes how the pH levels of different liquids affects their ability to break down other compounds, and how quickly they can do it.

For a period of two weeks, a total of 10 emptied eggshells were left to sit in 6 different substances, each with different pH levels. The eggs were evaluated every few days to monitor how quickly their shells broke down.

The eggshells submerged in the more acidic substances showed to be significantly more efficient at breaking down the shells than the neutral and more basic substances. The shell in vinegar became fully broke down and fully exposed the eggs membrane after only five days, and in the same amount of time the shell in the lemon juice had been broken down roughly 50%, leaving half of the membrane exposed. The shell placed in the borax solution had seemingly over-expanded and burst for an unknown reason, both the original and the back up. The shell in the other base and the water showed to be unaffected.

By the end of the experiment the vinegar shell had been full dissolved, and the lemon juice shell still had about a quarter of a shell remaining. The water and milk of magnesia shells still showed virtually no signs of being broken down. These results prove to support the fact that the more acidic a substance is, the more able the substance is to quickly dissolve other compounds.

#### #48 Dogs Eat Differently

The eating speed of dogs and how to best regulate it has long been a mystery to humans. My research is important because it can help keep our best friends healthy and living happy lifestyles. That alone should be reason enough to pay attention to my research. This experiment researches the effect a slow eating bowl has on a dogs eating speed, and whether or not it affects dogs that eat faster more than dogs that eat slower. When conducting my research I only used one changing variable between all dogs. The only thing about the experiment that changed was the bowl used. The dogs eat from each bowl at different times during the day and are timed while eating. The purpose is to see which dog eats faster and how

the slow bowl affects their time. The results of my experiments show that the slow eating bowl makes an extremely large difference when compared to a normal bowl my results can help dogs live happier longer lives, by making sure they are not eating either too fast or too slow. The results of my project, which show differing results with no pattern other than slower times in the slow eating bowl means that the dogs eating speed from the normal bowl and the slow eating bowl have no correlation to the dogs original eating speed. One fact that should be noted is that the dogs began to learn how to eat out of the slow eating bowl faster, with repetition. This research shows that slow eating bowls have no differing effect based off of what speed your dog originally eats at, and how much the bowl affects them. It is different for every dog so you'll just have to see what works for your pet.

#### #49 - Forest Fire Prevention

Forest fires are a huge problem in today's world. In recent forest fires, many houses in places like California have been damaged. This experiment was designed to inform others of the causes of forest fires, and what makes them spread. In a scale model of an actual forest, forest fires were lit using a candle buried in the ground, and the effects of wind speed, temperature, precipitation, humidity, and type of forest were tested over 3 trials for each factor. It was found that wind speed had the greatest influence on the distance that a forest fire could spread, with high wind speeds allowing the flames to spread up to a radius of six inches. During the controlled tests, without wind the fire had trouble spreading beyond an average of 1.5 inches. Other factors including temperature, humidity, precipitation and the type of forest had only marginal effects on the radius. In conclusion, if a forest fire has been ignited, then the biggest factor to keep in mind when gauging the destructive potential of a fire is wind direction and speed. High wind speeds deliver increased oxygen to a fire and can allow it to burn hotter and spread farther. Though it is our eventual goal that all forest fires may be prevented through the education of the dangers of forest fires, once a fire has begun, wind is the greatest factor that influences its continual spread.

#### Project #50

##### **Inattentional Blindness**

Inattentional blindness has shown to lead to car accidents and failures in everyday awareness. This project is aimed at investigating which age groups and genders are more subjected to inattentional blindness. Over the span of a month, participants of the project were

shown a short video in which two groups are passing a ball back and forth. Partially through the video a person walks into the frame for a few seconds and then leaves. The participants are then asked how many times one group passed the ball back and forth, and whether or not they noticed something unusual (the person who walks into the frame) throughout the video.

(We still have not completed our research/data table)

#### #51. Metal vs. Wooden Baseball Bats

The performance value of metal baseball bats has been argued upon since their introduction in the 1970s. This experiment is designed to answer whether metal baseball bats perform better than wooden bats. In the experiment, the bat being tested was mounted horizontally facing a pitching machine 10 feet away. The machine pitched a ball at 40 miles per hour at the middle of the barrel for each bat. Twenty trials were conducted for each bat. The machine's speed, the distance from the machine to the mount, and the number of trials were adjusted after determining that the results gathered were not repeatable. The metal bat performed better than the wooden bat. The average of all distances measured from the point of impact to the initial landing point of the ball was 76.6 inches. The ball averaged a distance of 45.35 inches after striking the wooden bat. The data collected from this experiment supports the fact that metal bats perform better than wooden bats.

#### # 52 Effects of Light on Pictures

For pictures, there's three main components to taking them. There's the camera that's used, the object being captured, and the light. Overall, it's the light used that has the most effect on the outcome of the picture. Throughout this project, the question has been, which type of light has the most effect on the pictures taken with a digital camera. To conduct this experiment, there were three different types of light used. There was halogen, incandescent, and fluorescent black light. For each type of light I took 10 pictures with flash and 10 without flash. Each picture had the same object and the camera at the same angle and the light in the same place. Between the incandescent



and halogen lights, the incandescent light had a softer light without flash and the halogen was brighter and harsher. But with flash, they both had the same appearance. The fluorescent black light without flash had a dark blue hue effect on the picture. But with flash, it almost exactly matched the photos with flash from the other two lights. The only difference is it was blurry. In conclusion, the pictures with flash for all lights had the same effect. The fluorescent black light without flash had the most effect on the pictures.

### **Project Number 53**

Essential Oils: Essential to Life?

In recent years, the issue of antibiotic resistance has become more prominent in the pharmaceutical field. This project explores the theory that essential oils have a similar effect on bacteria as antibiotics. The effect of essential oils was tested on bacteria swabbed from various door handles. Three oils were tested, oregano, malaleuca, and a blend. They were compared to a topical antibiotic ointment and a control dish which contained just bacteria. None of the dishes of bacteria showed any difference after being exposed to the antibiotic ointment or essential oils. The number of colonies remained the same before and after three days of treatment and then again after six days. The results were inconclusive, neither test had an effect on the bacteria. In order to achieve relevant data this procedure would need to be altered to have specific bacteria in which the treatments will target and to compare the essential oils with a different, more effective antibiotic.

Project #54

### **The Effects of Caffeine on People with ADHD**

The characteristics of Attention Deficit Hyperactivity Disorder (ADHD) have an effect on the concentration and hyperactivity of people diagnosed with it, which impacts their attentiveness. This project analyzes the effect that caffeine has on productiveness, concentration, and human reflexes. Twenty five volunteers, ten with ADHD and ten without, completed a virtual puzzle, then drank four tablespoons, or two servings, of espresso. The other five participants acted as a control group; they completed the same task, but did not drink the espresso. After waiting ten minutes, the volunteers completed the same puzzle, with different pieces, and were timed while doing so. All participants improved by the second trial, although participants with ADHD completed the puzzles faster than those without, leaving little room to improve. Volunteers who were not diagnosed with ADHD took more time to complete the first puzzle, so they had more room to better their time. The control group also performed better, but

not by much. These outcomes proved that caffeine may help people with and without ADHD concentrate better on simple tasks.

#### Project # 55 Battle of the Sexes: Optical Illusions

Studies have shown that the male brain can perceive smaller details than the female brain, which can help police forces solve cases that involve small details. This project determines which gender can examine finer characteristics. We selected twenty volunteers of the same age group to inspect four different pictures with hidden faces in them, and timed to see how long it took the volunteer to find all the faces for each picture, then averaged the times for both genders and compared the averaged times to find results. Our results showed that the female gender had a shorter average time for each picture. Throughout the study we noticed that most of the male volunteers taking the test had given up and didn't complete the task of finding all the faces in the picture. These results prove our hypothesis incorrect, and that the female gender can find smaller details better than males. This means that the police force should most depend on the opinions of a female officer when examining more optically detailed cases.

#### #56 Loafing Around

My project was about what type of yeast makes the tallest, least dense, and longest lasting (without mold bread). I conducted this experiment because I wanted to know what type of yeast makes the greatest bread. This important to know if you want to make tall and fluffy bread. The problem I solved was how to find the best yeast for making your bread. For this experiment I made 4 breads and changed the yeast in them to compare the differences. The only variable I had was the type of yeast, everything else in the recipe was the same. This concluded that the bread with the least density was bread number three made with cake/fresh yeast, and the tallest bread was number two made with active dry yeast. The mold component did not happen, after two weeks there was no visible mold on the slices, however the bread was very hard and light. A lot of moisture had evaporated. The best overall bread was cake yeast because it had the lightest density and the tallest height. During the second trial, bread number three was tied with bread number two for height.

#### Project #57-What Makes it Grow Better

Improving plant growth could lead to an increase of plants produced helping to end world hunger and increase natural products in the world diet. This experiment tests the effects of water, MiracleGro, and a nutrient supplement. The nutrient supplement consist of nitrogen, phosphorus, potassium, calcium, magnesium, and fulvic acid. 45 seeds were planted were planted 3 weeks ago, 15 with MiracleGro, 15 with the nutrient supplement, and 15 with standard soil. The plant's stem are measured each week. There was no major difference but the nutrient supplement had outgrown both the soil and MiracleGro, the stalk of the nutrient supplement had a brighter color

stalk and leaves. These results support that a nutrient supplement helps improve plant growth better than plants who were planted in standard soil or MiracleGro.

#### #58 Abstract - Wormy Warnings

Earthworms have an immune system with an acute sensitivity to human sex hormones, and the alike. An exhibition of this sensitivity upon exposure, though a change in mortality rates and/or growth, supports the presence of the hormone and its resulting effects on the earthworm anatomy. Phytoestrogens, compounds that mimic the sex hormone estrogen produced by the human body, are believed to be high in concentration in certain plant-based foods (including, but not limited to: legumes, peas, nuts, and grains). This project investigates if earthworms exhibit the same sensitivity to the phytoestrogens supposedly found in these foods as they do upon exposure to the human sex hormone estrogen. The creation of two separate environments, with a phytoestrogen presence, and lack thereof, by providing the worms with several water and/or phytoestrogen-based solutions allowed for the recording of changes in worm mortality (and size) after a week's exposure. When exposed to phytoestrogens, 100% of the earthworms died; contrastly, only 7% of earthworms died after a week's exposure to solutions of just water. At the 10% significance level, it can be concluded that the presence of phytoestrogens did have an impact on earthworm mortality. By finding that phytoestrogens are closely enough related to estrogen, it can theoretically be concluded that a change in human diet (specifically focusing on the consumption of phytoestrogen-containing foods) may yield specific changes in the human anatomy. These changes could serve as treatments for various cancers, obesity, menopause and its resulting symptoms, acne, and more.

#### Heartburn and Antacids #59

Acid Reflux is an ailment that occurs when acidic gastric juice enters the esophagus and irritates the lining, commonly after eating. Often called Heartburn, it affects many people around the world. Symptoms include burning sensations in the chest, nausea or stomach pains. In order to counter the discomfort of heartburn, people use antacids. Antacids are medicines created with bases to neutralize the acidity of gastric juice. The information gathered in this research project may benefit people suffering from heartburn when deciding which type of antacid is best to use. This project explored the change of pH on simulated stomach acid when combined with an antacid. To copy the process of digestion, a mock-stomach acid solution was created using hydrochloric acid and water. Four trials were conducted to determine the best type of antacid to use when experiencing heartburn; Tums, Pepto-Bismol, Pepcid or Alka-Seltzer. Each antacid was "ingested" by either dissolving it in a glass of water, crushing it with a mortar and pestle (To simulate chewing) or simply placing it in the test tube like normal swallowing of a

pill. After this, the antacids were mixed with the solution. To determine the better antacid, the pH of the solutions were taken before and after the medicines dissolved. The initial pH of the stomach acid was 4, the goal of the antacids was to neutralize it to a pH of 7. At the end of the trials, the antacid that worked best to neutralize the stomach acid was Pepto-Bismol. For all four trials, the second pH measured 7. Alka-Seltzer was a very effective antacid as well, one of the trials ended with it at a pH of 8 and the other three ended with a final pH of 7. Tums' average pH was a 6. The final antacid, Pepcid, had an insignificant pH change. From an initial pH of 4, the final pH for Pepcid was 5. The results from this research show that Pepto-Bismol is an effective base that neutralizes acids very well, making it a good antacid for heartburn. From these results, a person can determine the most effective antacid to use if they get acid reflux.

## **#60 Distracted Driving**

Distracted Driving is the leading cause of accidents among teenage-drivers in the United States. This project investigates how several common distractions affect two teenage drivers as they maneuver through a cone course. Over a five hour period, the two teenage drivers drove a timed cone course set up on a runway to evaluate how much time each distraction would deviate from the control. Distractions evaluated were eating, texting, talking on the phone, listening to music, and changing clothes. On the course, each cone hit resulted in a five second penalty on the time. The control for Driver A was 151.4 seconds. Texting added 6.6 seconds to the control time, eating added 17.8 seconds, talking on the phone added 9.1 seconds, changing clothes added 15.4 seconds, while listening to music decreased the control time by 19.6 seconds. The control for Driver B was 137.4 seconds. Texting added 21.4 seconds to the control time, eating added 9.1 seconds, talking on the phone added 19.6 seconds, changing clothes added 33.1 seconds, and listening to music added 2.1 seconds. These results show that almost all distractions affect the quality of a teenager's driving, but listening to music appeared to make the driver more alert and focused. Distracted driving in general should be discouraged by parents, as one distraction will lead to another, and eventually to an accident.

## **#61**

For hundreds of years, cancer has been winning the battle against scientists and doctors around the world. Lymphocytes (B & T cells) in the bloodstream are the main defense against the dangerous disease. While the amount of T cells present in the bloodstream is dependent on many factors, this project looked to examine the effect of a family history of cancer on white blood cell composition. Twenty random samples of white blood cells from the available

inventory were taken and lymphocytes were sorted, then CD4 T cells were sorted out. Finally, a T cell count was performed on each sample. A normal T cell count falls between 500 - 1500, out of the twenty samples, eighteen, or 90%, of them fell within this range. When analyzing counts within this range, there was no correlation between family history of cancer and T cell count, therefore without correlation, a statement about causation cannot be made. However, this has sparked the idea of further investigation into other factors (such as age) that may affect T cell count.

#### Project # 62 The Effects of Music Tempo on Work Rate

Many people have difficulties focusing while doing work. Identifying the type of music that produces the best work, while still being efficient would help those people stay on task. Volunteers were each given 2 worksheets, one being math-based and the other being language-based. They were then asked to complete the worksheets while listening to a song of a specific genre on repeat. Their accuracy and the time they took to complete them were recorded. The participants reported that the electronic music made focusing on the math specifically, very difficult, while the opposite observation was made by those who listened to rap. Those who listened to classical felt more calm and confident in their answers on both worksheets. These results show that classical is the most beneficial music to listen to while working, while electronic music has a negative impact.

#### Project #63 Melting Ice: The Fastest Method

Icy roads have led to many deaths, due to car accidents. This project investigates the most efficient method to melting the ice on the roads. For six hours, blocks of ice sat in different reactants to test their efficiency. The ice sat in isopropyl alcohol, sugar and ice melt; the room was kept at 66°F. The isopropyl alcohol proved to be the most effective method. The ice was 95% melted after five hours. Sugar proved to have little effects on the ice, and ice melt caused about a 50% decrease. These results proved isopropyl alcohol to be more effective on ice, and should be considered for use on roads.

#### #64 Energy in Common Sources of Food Waste

Millions of tons of inedible food products are thrown away each year worldwide. Many of these products, such as fruit and vegetable peels, fruit pits, and nut shells could potentially be burned to produce clean energy. The purpose of this experiment was to determine how much heat energy certain types of food waste generate when burned. Five common sources of food waste were tested in this experiment: orange peels, peach pits, cherry pits, squash peels, and peanut shells. The food was burned under a beaker containing water and the change in the

temperature of the water and the mass of the food were recorded in order to calculate heat released per gram of mass lost. The cherry pits would not catch fire and the squash peels did not burn long enough to raise the temperature of the water. Out of the three types of food that did burn, the peach pits and peanut shells released the most heat per gram of mass lost, each averaging to about 1.69 Joules per gram. The orange peels only released an average of .348 Joules per gram. These results show that out of the foods tested, peach pits and peanut shells would be most effective in generating energy when burned. Burning inedible food products to produce energy could reduce the amount of food wasted each year.

## 65 A Solution to Pollution

In the world, one million water bottles are bought each minute, and that number is expected to grow to one million two hundred thousand by 2021. Americans alone throw away 35 billion plastic water bottles a year. This project investigates the ability of agar-agar gelatin to replace water bottles and water containers. For ten days I observed the molding capability, the agar's ability to hold water, and how long the cup can last without drying or leaking water. When a common and effective mold was found, the cup was placed in differing conditions. One was placed in a fridge, one next to a fire, and one in room temperature. As a control, two cups were placed in each position, one containing water and one without. With a small cup mold, the gelatin was a reasonable option to hold water for approximately three to five days before the water evaporated completely and the mold shrunk. These results support evidence that agar gelatin could replace plastic water bottles if molding technology and shelf storage life could be further developed.

## #66 Does Aloe Vera Juice Preserve Strawberries Better Than Water?

Have you ever thought about how to preserve strawberries and keep them from molding so they preserve for longer? In this experiment, we were trying to prove whether or not aloe has a better effect on the preservation of strawberries opposed to water. We conducted this research in order to try to test ways to preserve fruits such as strawberries. This research will impact society because it shows that aloe vera better preserved strawberries than water did. Our hypothesis was that the aloe was going to preserve the strawberries better than water will because aloe can heal so we assumed that it can also preserve. Our project investigates the effects that aloe has on preserving strawberries compared to just water. During a duration of 5 days, 6 strawberries were soaked in aloe vera juice and water. Then, they were left in containers, covered with seran wrap, with air holes in the container. Daily, they were checked for their condition including dark spots and any type of mold. It was determined that aloe vera juice can preserve strawberries better than using water to preserve. They both had an effect on the preservation, but the strawberries with aloe had less mold than the ones that were contained in water. These results support the fact that

aloe vera juice can better save strawberries and is a good way to preserve strawberries if not eaten immediately.

#### Project #67- Effect different colored lights have on plant growth

The purpose of this experiment is to see if different colored lights have an effect on the plant's growth. If a certain colored light makes the plant grow faster, other people can use that colored light to make the plant growth more efficient. We are doing this experiment because it can really change how people grow plants, which can be more effectively. This project investigates the effect that different colored lights have on plant growth. To experiment if there is a difference between different colored lights, ten of the same type and sized plants were used, with two plants under each colored light. The plants were measured before being tested, and were measured every day at the same time. All of the plants were kept in the same room, ensuring the same amount of outside light affected each plant. The plants were given the same amount of water, as well as being placed in the same amount and type of soil. Both of the plants under the red lights grew the least, one of the blue light plants grew the third least, the two green lights grew the fifth and sixth most, the other blue plant grew the fourth most, the two white light plants grew the third and fourth most, while the two yellow light plants finished first and second. These results show that the yellow lights clearly help plants grow the most, possible because the yellow light resembles the sun. Now that this is known, it could be helpful for people growing plants, that yellow lights make the plant grow faster.