NAME(s) **Lindsay Albee**

PROJECT NUMBER **B01**

SCHOOL Northfield Middle High School

GRADE 11

TEACHER Shane Heath

PROJECT TITLE **The Effect of Red Wigglers (Eisenia Fetida) on the Nutrient Content of Compost**

ABSTRACT

Composting is the process that turns food scraps into soil. The purpose of this experiment is to compare compositing rates of food scraps with and without worms in an effort to quantify/measure the advantage to the soil (if any) of using worms (E. Fetida) as opposed to the breakdown of food scraps through decomposition. This experiment compared bins of varying amounts of worms (500 bin of worms, the 1000 bin of worms, and the 2000 bin of worms) to a bin with equal additions of food scraps but without worms. All bins were subject to the same environment. The experiment compares the soil composition of the bins over time by measuring pH, Nitrogen, Phosphorus, and Potash. I predicted that the bins with the highest number of worms will produce higher levels of soil nutrients at a faster rate. Every 3 weeks when enough food waste (kitchen scraps) was collected, I added 3 pounds of compost to each bin and repeated this process three times. After each of the three weeks, and before more waste was added, I took samples and tested the soil for nutrients. The data collected showed that as time went on, the bins with the greatest number of worms produced the greatest amounts of potash, nitrogen, and phosphorus. The most consistent soil factor across the treatments was the pH. In trials one the pH started out around 6 to 6.5, which is more acidic. In trial two, the levels went from 6.5 to 7, slightly acidic to neutral, and then in trial three the levels were 7 to 7.5, neutral to alkaline. The Nitrogen and Phosphorus rose more gradually, and then the Potash rose only slightly throughout the experiment.

NAME(s) **Shawn Allard**

PROJECT NUMBER **M01**

SCHOOL Big Picture South Burlington

GRADE 9

TEACHER Jim Shields

PROJECT TITLE **One-minute per page: Comparing Screenplays to Final Film**

ABSTRACT

In the film industry, there is a term thrown around that ôone page equals one minute of filmö which this project is based on. The purpose of the experiment is to test whether or not there is a correlation between the script length and screen time. The experimenter predicts that the number pages of the screenplay does not constantly correspond with the length of the film. The experimenter examined original student-produced films and compared the screenplay length to the length of the finished film in minutes. By 3/20/15 the experimenter will have examined 3-5 films from data collection. In conclusion, the experimenter will take the data from real unbiased films, and the purpose of this is to show whether or not the term ôone page equals one minute of filmö is true or not. This will help filmmakers in the future with estimating their films lengths.

NAME(s) **Madison Allen**

PROJECT NUMBER **B45**

SCHOOL Fredrick H. Tuttle Middle School

GRADE 7

TEACHER Amelia Lutz

PROJECT TITLE **Does Eating a Healthy Breakfast Result in Good Grades**

ABSTRACT

The purpose of this project is to find out if students that eat healthy breakfasts will get good grades. My hypothesis is if you eat a healthy breakfast, then you will get good grades. That would also mean that if you eat an unhealthy breakfast, than you would get bad grades. I determined that a good grade is a B+(88) and higher and that a healthy breakfast is under 500-650 calories and fulfills one third of your daily recommended food groups according to the United States Department of Agriculture.

In this investigation, I tested 30 students between the ages of ten and fifteen. Each student filled out a google form that asked what they had for breakfast, their age, their gender, their math grade, their science grade, their social studies grade, and their language arts grade. Using the survey results, I went to an online health website called SuperTracker and figured out from there, what each subjectÆs breakfast had for calories and food portioning. From my testing, I can conclude that my hypothesis is correct yet incorrect. Everyone who ate a good breakfast got good grades, but some people who ate unhealthy foods got good grades. Some of the results could have been unreliable because the test subjects did not feel like their real grades were safe to give out.

NAME(s) **Morgan Ambrose**

PROJECT NUMBER **C01**

SCHOOL Milton Middle School

GRADE 7

TEACHER Janet Smith

PROJECT TITLE **Vitamin C in Tea**

ABSTRACT

Vitamin C (ascorbic acid) is an essential antioxidant needed by the human body for healthy cell growth and maintenance. Certain green and black teas are known for their vitamin C content. I used titration to determine the vitamin C content of three green and three black tea varieties. I predicted that green tea contained more vitamin C than black tea since black tea is processed through fermentation which could break down the vitamin C molecule.

Iodine reacts with ascorbic acid in a one to one ratio. Iodine was titrated into a tea solution with a starch indicator. The endpoint of titration was determined when the solution turned a purple color. The concentration of ascorbic acid was calculated for each tea sample. I used four controls included starch, ascorbic acid, iodine solution and a water control.

The average concentration of vitamin C was 35.96 milligrams per gram of green tea. The average concentration was 32.71 milligrams per gram of black tea. The results indicate that green tea contains more vitamin C than black tea with a 9.5 percent difference between the two. This matched my hypothesis; however, I was surprised by the relatively small percent difference between tea types.

One potential source of error may be the coloring of the tea solution which complicated determining the endpoint during titration. This may have affected the volume of iodine solution added, therefore elevating the calculated vitamin C concentration. Another source of error may have been the fact that ascorbic acid breaks down with heat over time.

It is good to know that tea contains ascorbic acid which is essential for the human body. It would be interesting to determine the vitamin C content in other drinks to help maintain a healthy diet.

NAME(s) Claire Ammirato
PROJECT NUMBER B37
SCHOOL Mater Christi School
GRADE 7
TEACHER Mark Pendergrass

PROJECT TITLE **Play Ball!...then go wash your hands?**

ABSTRACT

The science fair project titled Play Ball!...then go wash your hands experiments with culturing bacteria and was built on the focus question: What tested sports equipment had the most germ colonies? The corresponding hypothesis stated that the game basketball sample will have the most bacteria. The swabbed sports equipment agar plates concluded which piece of sports equipment had the most germ colonies. In result from background research, it was learned that the agar substance in culturing petri dishes is a dried hydrophilic(attracts water) colloidal (suspension, gel) made from red algae. Further research implies that the germ theory explains how many diseases are caused by specific microorganisms. The test dealt with determining if microorganisms were/are on ten different types of sports equipment, for example; a wooden hockey stick handle and a soccer ball were swabbed for bacteria. The used swabs were wiped onto agar petri-dishes and set under a heating lamp for proper incubation. On the fifth day of recording observations, the bacteria in each petri dish was counted. The factor that could have affected the testing was that temperatures of the heating lamp during the process of incubation rose above 100 degrees Fahrenheit which may have resulted in killing bacteria although in the end result bacteria was clearly compared to one another. The tennis ball agar plate had the most germ colonies indicating the original hypothesis was proved false.

NAME(s) Manolis Anemikos
PROJECT NUMBER G01
SCHOOL Milton Middle School
GRADE 6
TEACHER Janet Smith

PROJECT TITLE **Are Our Fish Safe? The Effects of Fertilizer on the Water Quality of Lake Champlain**

ABSTRACT

Farmers use fertilizer to help the growth of their crops. But, when fertilizer is mixed with water it becomes harmful to plants, animals, and ecosystems because of toxins and high levels of chemicals. Some of the chemicals in fertilizer are nitrates and phosphates.

I tested the effect of fertilizer on Lake Champlain water. Based on my research, I predicted the more fertilizer added to water the lower the dissolved oxygen, phosphate, and pH levels would be over time. I thought that the nitrate levels would increase. The samples tested were of water taken from Shelburne Bay and then mixed with 6-5-11 fertilizer in concentrations from 0 to 10.0 percent. The water with no fertilizer was my control.

I measured each of the factors over five days using nitrate and phosphate test strips, a dissolved oxygen meter, and a pH meter. The findings matched my hypothesis for oxygen, pH and phosphate. Oxygen levels decreased over time in all samples, including my control. Nitrate levels remained around 10 ppm for most samples, but went to 25 ppm for the 10 percent sample. The pH levels decreased as the amount of fertilizer increased. The average pH for the control was 7.2 but it was 5.7 for the 10 percent sample. Phosphate levels increased in the lower concentrations. The 0.25 percent sample had a high concentration of 100 ppm while the 10 percent solution had a high level of 10 ppm. The data for nitrate and phosphate was qualitative because I used test strips which indicated the numerical range instead of more exact values. This could be a source of error.

Less phosphate in water might mean less algae growth and therefore less dissolved oxygen. This may be harmful to fish that live in the water and the surrounding ecosystems.

NAME(s) Hamza Azhar, Jagr Rinehart
PROJECT NUMBER GP09
SCHOOL Frederick H. Tuttle Middle School
GRADE 7
TEACHER Chris Towle

PROJECT TITLE **How Caffeine Affects the Heart Rate**

ABSTRACT

The purpose of this lab is to find out what is going on in your heart when you drink different doses of caffeine. It was a good test to see if caffeine in different drinks were changing the heart rate, because many people consume caffeine in the world daily. The results will show that the heart would beat faster. The best caffeine is from drinks that the average human likes to consume because that way we can also tell what happens to the average human heart.

To perform this experiment, the person tries a drink, a cup, or 8 ounces, then wait 30 minutes and record their heart rate every 5 minutes. The drinks that were decided for use for the experiment were Diet Coke, Tetley Tea, and a normal testing controlled variable being water. Then the test started with the drinks, and as the experiment went on the numbers showed that the heart was beating by a considerable margin faster than before we tried the drinks.

The results lead that clearly there was a change in heartbeat when consuming caffeine. It was concluded that the heart has a change when you drink or consume caffeine in any way shape, or form. In the beginning, the hypothesis said that caffeine does affect the heart rate, but it was never imagined to be as different as what it was seen to. If this experiment was redone, there would use different hours of sleep and food, and use different drinks to get a more accurate result and sense of what caffeine does to our hearts.

NAME(s) Lucianna Bailey
PROJECT NUMBER B46
SCHOOL Northfield Middle High School
GRADE 11
TEACHER Amy Urling

PROJECT TITLE **The Effect of Habitat Reduction on the Mass of Pill Bugs (Armadillidiidae)**

ABSTRACT

The goal of my experiment was to observe the effect of habitat reduction of the mass of Armadillidiidae. My hypothesis was if Armadillidiidae were put into habitats decreasing in size and resources, the control being the largest habitat with the greatest amount of resources, that as the habitats decreased in size, the percent increase in mass would be less or there would be a loss in mass because of their depleted number of resources that they would need to survive. In my experiment, I took the mass of four groups of four Armadillidiidae and put them into four containers, the control being a volume of milliliters, container A of 700 milliliters, container B of 500 milliliters, and container C of 150 milliliters. I filled each container with dirt, food for the Armadillidiidae, and sprayed them with water. After fifteen days, I filtered out the dirt in each of the containers and weight the four groups, calculating their percent increase in mass. In the control container the Armadillidiidae had a 10.69 percent increase in mass, the group in container A had a 3.27 percent increase in mass, the group in container B had a -6.24 percent increase in mass, and the group in container C had a -17.86 percent increase in mass. My hypothesis was supported by my data, that as an organismÆs habitat is reduced, theyÆre increase in mass reduces or their mass decreases. It is important to understand the impact of habitat reduction on organisms and take this information into consideration as human kind spread throughout the world.

NAME(s) **Spencer Baker, Peter Miller** PROJECT NUMBER **GP24**

SCHOOL FHTMS GRADE 7

TEACHER Mr. Towle

PROJECT TITLE **Which Brand of Duct Tape is the Strongest?**

ABSTRACT

The purpose of this experiment is to find out which brand of duct tape is the strongest. The duct tape brand will be the strongest because it is the first brand to ever be made and since then, they have been improving it. There are three different test that were used in the experiment. The first one is strength test. It is to measure how tough the layer is. It was conducted by attaching a certain amount of tape to a wooden frame and pressing it on a scale with a nail on the scale. The second test is the fire spread test. This test measures how long it takes for fire to burn through. The fire spread test was interesting because some tape didn't burn at all and we held the flame next to it and it melted through and other went into flames quick. This can also have to do with the thickness of the tape because the thinner tape seemed to melt and the ticker tape seemed to burn. The third test was the grip test. By attaching a strip of tape to the end of a table and attaching a bucket to the end and adding weight in the bucket until it broke. We found out that the Gorilla brand had the best results in every test, so it is an easier answer. Gorilla Brand is the strongest duct tape. We have learned that Gorilla brand is the strongest tape and if you are looking for a job when you need the strongest tape, its gorilla.

NAME(s) **Nicole Barone** PROJECT NUMBER **B02**

SCHOOL Milton Middle School GRADE 8

TEACHER Greer Krembs

PROJECT TITLE **Can Compost Attract Animals?**

ABSTRACT

Compost piles can attract pests such raccoons, rats, deer and rabbits. The purpose of this experiment was to show what types of animals you would attract if you did compost certain items such as meats, fruits and vegetables. I wanted to show what risks you would be taking when composting certain foods, depending on what species of animals you are willing to attract.

I collected one pound of fruit and vegetable compost, and one pound of meat compost. I put the fruit and vegetable compost outside first. I set up one game camera on a tree not too far away. It captured pictures when triggered by movement near the compost. It was set up for five days. After five days, I removed the fruit and vegetable compost and repeated the same process for another five days with the meat compost.

The game camera did not capture any photos of any animals. My results were not what I had predicted. I had expected a large majority of animals to be attracted to both compost piles since the experiment was set up in a wooded area. There were many sources of error in this experiment. It snowed a lot and the compost was covered completely. It was very cold outside so the compost froze. I think the scent of the compost was masked by the snow. I plan to attempt this experiment again in the spring or summer when warmer temperatures would keep the compost thawed. Also if I were to redo this experiment I would try different combinations of compost. Then compare my findings to this experiment to conclude what time of year is best for composting.

NAME(s) Ali Barritt

PROJECT NUMBER B47

SCHOOL South Burlington High School

GRADE 9

TEACHER Curtis Belton

PROJECT TITLE **The Effects of a Normal Lack of Sleep on Eye Comfort, Redness, and Vision**

ABSTRACT

The vision, eye comfort, and eye redness of adolescents were examined on three different occasions per subject. Most of the subjects received less than the amount of sleep recommended to their age group to be healthy (<8.5 hours) before being examined, and others received the suggested amount of sleep or more before being tested, serving as a control group. Subjects were not tested if they needed contacts or glasses, their eyes had been affected by anything (i.e. computer screens, excessive eye-rubbing, conjunctivitis), and if they opened their eyes for more than ten minutes during the night (their sleep was interrupted). The aim of the experiment was to see the effects of lack of sleep on eye comfort, redness, and vision. After learning that sleeping disorders like sleep apnea can cause blindness or blood vessels in the eye to burst, it was hypothesized that if a person (an adolescent in this case) were to receive a normal lack of sleep, referring to an amount of sleep significantly less (a half hour to two and a half hours deficient) than the amount medically recommended to the individual, his/her eyes would be redder, more uncomfortable, and his/her vision would be worse than that of someone who received the suggested amount of sleep or more. The subjects were then tested on their vision with a basic vision test using a hand-held vision chart, had their eye redness determined by ranking the redness on a scale of 0 û 4, their eyes compared with pictures of eyes that fit each scale degree, and were asked to state their eye comfort, based on a scale from 0 û 8. Preliminary data show that amount of sleep received does not affect vision, eye redness, or eye comfort.

NAME(s) Rebecca Barwin

PROJECT NUMBER S01

SCHOOL Burlington Technical Center

GRADE 12

TEACHER Betsy McLane

PROJECT TITLE **The Correlation Between Music and Emotion in Adolescents in High School Band**

ABSTRACT

The purpose of this experiment was to find a correlation or lack there of between certain musical genres and the behaviors that they elicit in adolescents. To obtain these results, participants were anonymously surveyed while listening to a selection of music by either Eminem, Mozart, or Mumford and Sons. The survey asked about the emotions they felt while listening to the music, and what kinds of behaviors or activities someone their age might partake in when feeling these emotions. The majority of those who listened to Eminem felt happy, but they also felt anxious or stressed and a little bit angry. Almost everyone who listened to the classical selection reported feeling happy and relaxed, and the ones who listened to Mumford and Sons indicated that they felt relaxed and both happy and sad. Because of the behaviors happiness and anxiety cause in adolescents, hip hop music can be tied to physical activities, be it for fun or as an outlet for their nervous energy, an increase in productivity, participation in favorite hobbies, and yelling/arguing. Feelings of happiness or relaxation caused by classical music were linked to an increase in activity (sports, hobbies, social interaction, etc.). The emotions elicited by indie music were similar, but they were also connected with behaviors such as increased or decreased social interaction, depending on the person, and an increase in sleep or meditative activities. These connections between music genre and positive or negative behaviors help to understand the teenage psyche a little more, but the information can also be used to create a change in the habits of young people by exposing them to a wider variety of music.

NAME(s) Luke Beatty
PROJECT NUMBER S02
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton

PROJECT TITLE **The Effects of Background Noise on Concentration**

ABSTRACT

This experiment is testing the effects of background noise on concentration. Based on prior knowledge of background noise it was hypothesized that the background noise would affect the concentration of the subject subtly. The background noise used in the experiments is a recording of F-35 fighter jets flying above multiple times. The experiments will be carried out by having the subject sit at a desk and put a pair of headphones on their head. This will cancel out all other background noise in the area. The subject will then complete a set of problems on a piece of paper. After the completion of the set of problems the time and accuracy will be recorded in a database. The subject will then complete a different set of problems of similar difficulty. During the duration of the second set of problems the jet noise will be played in the headphones. The time and accuracy of the second test will be recorded into the database. The data will be analyzed by finding the percent change between times and accuracies between test one and test two. This new information will be recorded into the database. It is expected that the subjects will take longer on the tests with background noise, but accuracy will remain the same.

NAME(s) Alexander Beauregard
PROJECT NUMBER B03
SCHOOL Mater Christi
GRADE 8
TEACHER Mark Pendergrass

PROJECT TITLE **Humpty Dumpty's Fatal Flaw**

ABSTRACT

Which has a thicker shell, a pasture raised egg or a conventional store bought? A pasture raised egg would be measured for its egg shell thickness, it would be thicker than a conventional egg. The thickness can tell how old the egg is and how much washing it has been through. Twelve eggs where bought for each egg type, also a caliper was bought. then the eggs where broken on the equator, the whites and yolks were dumped out. There were three measurements per egg. Those three measurements were averaged out to one average. That happened to all 24 eggs. The average thickness for the pasture raised eggs was 0.4431 mm. The average thickness for the conventional eggs was 0.43 mm. The hypothesis was proven correct. It stated that the pasture raised eggs where going to be thicker than the conventional store bought eggs.

NAME(s) **Ethan Behr**

PROJECT NUMBER **S03**

SCHOOL Mater Christi School

GRADE 7

TEACHER Mark Pendergrass

PROJECT TITLE **At the Speed of Age**

ABSTRACT

The science fair project At the Speed of Age tested whether people of different generations use new technology at different speeds. Research shows that Generation Y is sophisticated in their use of technology, and that Generation Z is tech-savvy because they are growing up with advanced technology. An NXT robot was programmed using RobotC, and a course was designed for the robot to follow. A video game was created in Scratch, and a paragraph was written for participants to text. The test involved participants from four generations (Generation Z, Generation Y, Generation X, and Baby Boomers) completing three timed tests (robot, game, and texting). The hypothesis stated that if people from four different generations use several types of new technology to complete tasks, then the people in the younger generations will complete the tasks faster. The twenty-two participants each completed the robot, game, and texting tests, and the times were recorded for each test. In addition, observations were recorded, and three post-test questions were asked. Times were recorded on the data table, and averages were calculated and illustrated on a graph. The hypothesis was partially correct, because the data showed that Generation Y had the fastest times on the robot test and the video game test, and the fastest average time for all tests. However, unexpectedly, Generation Z was the slowest to complete the robot and texting tests, and their average time for all of the tests was also the slowest.

NAME(s) **Devon Beland, Duncan Frazer**

PROJECT NUMBER **GP34**

SCHOOL Windsor High School

GRADE 9

TEACHER Raina White

PROJECT TITLE **The Power of Music: The effect of classic rock and grunge rock on human emotion**

ABSTRACT

The purpose of this experiment was to see the effect of grunge and classic rocks on teenage emotion. The hypothesis was that teenagers mood would change for the worse after listening to grunge but would improve after listening to classic rock. This experiment is valuable if you want to know what type of music you want to play to calm someone down or improve their mood. Another reason we chose this is because we wanted to know how this music effects other people too to see if it had the same effects on them as it did us. The reason we chose these genres of music is because one has a reputation of being sad and angry whereas the other has a reputation of being happy and uplifting so we wanted to see if those stereotypes translated into our results.

The hypothesis for grunge was supported because 62 percent of peoples moods changed for the worse but the hypothesis for classic rock was not supported because 62 percent of peoples moods got worse after listening to it. In conclusion the results of this experiment showed that grunge and classic rock both negatively affected teenage emotion.

NAME(s) Grace Bendoski, Kendall Sheean

SCHOOL Fredrick H. Tuttle Middle School

TEACHER Christopher Towle

PROJECT NUMBER GP35

GRADE 6

PROJECT TITLE **Memory of a Student: Auditory vs Visual**

ABSTRACT

The purpose of this was to determine if students are primarily auditory or visual learners. We planned to test the accuracy of studentÆs memory based on how they were presented with information, in this case, a twelve character sequence of letters and numbers. Students would have the most accurate memory when we presented a sequence in color and letting them observe it for a certain amount of time because research has shown that most people are visual learners, and color helps them remember things.

○The test we choose to do was 3 different tests: Hearing, Seeing (each seeing test is 5 seconds each), seeing with Color (the letters were blue and the numbers red). Each number sequence has 12 numbers or letters. These 3 tests determine if the tester remembers the most in each category. We wanted to see how much kids could remember with a sudden instant memory test. To perform this experiment we first wrote the the number sequences and put the third sequence in color. We then gathered 20 students to test and tested them all in a time window between 2:39PM and 3:25PM. To test them we read them the first number sequence, let them see the second for five seconds, and did the same with the third, and recorded what they said.

○Once we had compiled all of our data into charts and graphs, we could see that our findings had shown what we had predicted. On average students got the first sequence 41% correct, the second 45% correct, and the third 52% correct. Students were simply more accuracte when viewing the information, and more so in color. We learned how students learn best, and can use this for more effective studying.

NAME(s) Emily Benz, Sadie Vincent

SCHOOL Christ The King School

TEACHER Mrs. Srivastava

PROJECT NUMBER GP36

GRADE

PROJECT TITLE **Color Confusion**

ABSTRACT

Abstract

We wanted to find a connection between a personÆs selective attention and the brainÆs processing speed. We tested if warping words eliminated the stroop effect, a conflict in our minds between reading names of colors versus seeing ink colors, and if the results varied with age. This experiment is used to study the brain, screen people and to diagnosing certain mental illnesses.

We wondered whether warping words eliminated the conflict between color and text in the Stroop Effect and if the result changed with age. We used three tests on ages 7-60 years old. We tested subjects individually and had them read off a list consisting of eleven various strips of color; this was the Color Block Test (CB) . The Stroop Test (ST) was a list of color names all printed in contradicting colors and the Warped Words Test (WW) was the same material as the ST but the words were warped. To keep the subjects from memorizing the material, we had them read for one minute between each test. Every test was timed and recorded into charts organized by age.

We hypothesised that warping the ST to make words incomprehensible would eliminate the stroop effect and also that the results would change with age. Our data tables prove our first hypothesis correct. Although the results were the same, the average difference in time for the first and second grade between the ST and WW was bigger than any other, 10.92 seconds, concluding that both hypotheses were correct.

NAME(s) **Joseph Bianchi**

PROJECT NUMBER **P01**

SCHOOL Woodstock Union High School

GRADE 11

TEACHER Jennifer Stainton

PROJECT TITLE **Color by the Numbers**

ABSTRACT

The lush Vermont foliage is an intriguing topic, coveted by sight seeing tourists and monitored by interested scientists. Currently ôPeak Foliageö is a loose term referring to the time in foliage season when the colors are the best. However, when ôPeak Foliageö occurs is subjective and varies from location to location.

In this project, the day and location of the economically important ôPeak Foliageö was scientifically determined. The peak traffic data points for the months of September and October were used as an indicator of each locationÆs ôPeak Foliageö. Since people drive to where and when they think ôPeak Foliageö is, traffic volume is an excellent indicator of a subjective topic. By normalizing and analyzing the stateÆs continuous traffic count data for the past 7 years, where and when the tourist and sightseers are traveling was determined. This data, consisting of around 72 traffic collection sites, was compiled and organized into one massive spreadsheet and then was normalized to a one point scale to show the peaks.

The ultimate goal of this project was to solve the problem of how to scientifically predict when the economically important ôPeak Foliageö season is happening in VermontÆs tourist towns. This information can be used to build a working computer model to give every sightseer the inside scoop on when and where to experience ôPeak Foliageö. Having targeted knowledge of when ôPeak Foliageö will occur would enable tourists and businesses to better plan their vacation activities.

NAME(s) **Alana Bigos**

PROJECT NUMBER **S04**

SCHOOL Milton Middle School

GRADE 8

TEACHER Greer Krembs

PROJECT TITLE **Perception of Art**

ABSTRACT

Gender stereotypes and age impact the way people observe and think about the world. I wanted to test how gender and age affect how people perceive art.

I collected four images, two of them being optical illusions, and the others having an array of colors. I predicted boys would see blue in the two color photos, and girls would see pink, because of the set gender roles that imply blue is a boy color, and that pink is a girl color. Of the optical illusions, I predicted adults would see faces about to kiss, but children would not because they are not as familiar with kissing, due to their level of maturity.

I tested 30 subjects: ten kids ages 8-10, ten teens 13-15, and adults 30-50. In each age group, five subjects were male, and five were female. I tested each subject individually and instructed them to tell me the first thing they saw, then showed the first image, and recorded their answers. I repeated this with all four images.
I identified various patterns about what ways the different groups interpreted the photos. For example, photo number one could appear as a candlestick or a pair of silhouetted faces about to kiss. Most adults saw the faces but teens and kids tended to see the candlestick.

If I were to test this experiment again I would test a larger number of subjects so I could collect more data. More data would provide clearer evidence and support my claim by showing stronger patterns that indicate signs of age and gender affecting how someone will see a piece of art.

NAME(s) **Jasmine Bombard**

PROJECT NUMBER **C02**

SCHOOL Fredrick Tuttle Middle School

GRADE 7

TEACHER Mr.Towle

PROJECT TITLE **Which type of Cheerios stays crunchy in milk the longest?**

ABSTRACT

The purpose of the experiment is to determine which of the following Cheerios; Multi Grain Dark Chocolate Crunch, Original, Honey Nut, and Multi Grain stay crunchy in milk the longest? The cereals with multi grains will stay crunchiest in milk the longest because their ingredients have the least quantity of items that dissolve fast such as sugar. This experiment was conducted by pouring one cup of milk and one cup of each type of Cheerios in a different bowl. Then asking volunteers to rate how crunchy each type of cereal is after two minutes. The rating scale was 1 being the soggiest and 10 being the crunchiest. After analyzing the data, the data concludes that the Multi Grain Dark Chocolate Cheerios stayed crunchy in milk the longest. The hypothesis was partially correct because the Multi Grain Dark Chocolate Cheerios had the ingredient whole grain. However, the next crunchiest cereal was the Honey Nut Cheerios which did not have multi grain in it. By comprehending this information about Cheerios, the public would be encouraged to buy Cheerios that are crunchy in milk the longest, because nobody enjoys a bowl of soggy cereal.

NAME(s) **John Bourdeau**

PROJECT NUMBER **P02**

SCHOOL Missisquoi Valley Union High School

GRADE 10

TEACHER Dana Dezotell

PROJECT TITLE **Production of Biodiesel Using Ultrasonication**

ABSTRACT

The purpose of this novel engineering design research is to find out if biodiesel can be produced faster by heatless transesterification, without the aid of heat or a chemical catalyst. In place of a chemical catalyst or heat, I used ultrasonication to cause the transesterification reaction to occur faster. The recipe I used to produce biodiesel was 200 ml of vegetable oil and 40 ml of Methanol. I poured the vegetable oil and methanol into the ultrasound machine (a 40kHz Ultrasound Cleaner) and waited 5, 15, and 30 minutes for the transesterification reaction to occur. After this, I allowed the biodiesel to settle away from the waste (glycerin) and next day I separated the two layers. I tested and compared the amount of heat created per gram of biodiesel, and also I analyzed the esther shifts present in biodiesel by a proton NMR and an IR scan, both of which came out positive showing that biodiesel was produced after 30 minutes of ultrasonication. The NMR results was analyzed against the standardized values of the starting material, stearic acid, since the transesterification is an equilibrium process. The scan showed that the alcohol was completely consumed in the reaction, making the methanol to be the limiting reactant. Producing biodiesel in 30 minutes using ultrasonication is significantly shorter than producing biodiesel using the industrial method, over several days. In this project the dependent variable is the amount of heat per gram of biodiesel, while the independent variable is amount of time of ultrasonication. This research could be applied in real life as to create a faster way of producing biodiesel as an environmentally friendly, renewable energy source.

NAME(s) **Isabelle Boutin, Meredith Stetter**

PROJECT NUMBER **GP01**

SCHOOL Main Street Middle School

GRADE **8**

TEACHER Amy Kimball

PROJECT TITLE **Hydroponics and Salinity**

ABSTRACT

Fresh water supplies are rapidly disappearing due to climate change. These changes will not only affect human living conditions but also our agricultural structure. This study was conducted with the intent of determining whether the salinity of the hydroponic solution affected the growth of the kale and arugula seedlings. Given the research, the hypothesis was that plants grown in the saltier solution would grow higher after the given amount of time. After starting seeds in soil, some were then transplanted to a freshwater or saltwater solution and height of growth was recorded over eight days. All plants experienced the same growing conditions. Results showed that plants grown with fresh water had faster growing rates in comparison to plants grown in salt water. This statement is true for both the arugula and kale plants and no considerable difference in height was noted between the two types of seeds. Additionally, growth seemed to slow substantially after plants were transplanted in the hydroponic medium. However, a small increase in height was reported after plants began in the hydroponic system. These results show that itÆs very difficult for plants grown hydroponically with a salty solution to reach full potential of growth. However, itÆs possible that other types of seeds, such as from plants that grow closer to the coast, or a genetically modified seed would produce better results.

NAME(s) **Isaac Bradford-Feldman**

PROJECT NUMBER **C03**

SCHOOL Big Picture South Burlington

GRADE **10**

TEACHER Jim Shields

PROJECT TITLE **Cereal Potatoes, A Serious need for potatoes as a future energy source.**

ABSTRACT

The experiment was based on a similar experiment conducted by Haim Rabinowitch at the Hebrew University of Jerusalem. The purpose of the experiment was to determine if there is a difference between the electricity generated by a boiled potato and a raw potato. The hypothesis being that boiled potatoes produce more electricity than raw. Materials used include three raw potatoes, three boiled potatoes and 2 copper pennies. First, the researcher took two potatoes of similar sizes, one boiled for 10 minutes and one raw. Next, the Researcher connected one penny and one galvanized nail on opposite sides of each potato. Finally, the researcher connected alligator clips and hook them up to the penny and nail then hook the opposite clips up to a volt meter. Analysis of the data shows that a white boiled potato produced less constant average voltage than a raw potato. Results of the experiment contradicted Scientist Haim Rabinowitch having more voltage on a boiled potato than raw.

While going through with the experiment, the researcher encompassed several problems. Seeing that electricity flows in a current not a building measurable force, thus 12 volts charger would not gain power seeing the default average current for potatoes boiled or not does not reach 12 volts.

NAME(s) **Eleanor Braun** PROJECT NUMBER **S05**

SCHOOL Main Street Middle School GRADE 8

TEACHER eli rosenberg

PROJECT TITLE **How do Facial Expressions Affect Levels of Happiness?**

ABSTRACT

How do facial expressions affect level of happiness? I thought that forming different facial expressions affects happiness. In my experiment, I predicted that smiling would cause test subjects to be happier, and that frowning would cause test subjects to be less happy. I predicted this because seeing a smiling face can recall memories of yourself smiling, triggering positive emotion, and I predicted that the same will be true of frowning. I still had to test, however.

To test this theory, I created a short questionnaire in which several statements related to overall happiness are rated on a scale of one, strongly disagree, to six, strongly agree. I also created two slideshows, one with several pictures of smiling faces, and one with several pictures of frowning faces. I then gave a group of people the questionnaire, then showed them the smiling face slideshow and asked them to imitate the faces they saw on the screen, after which I gave them the questionnaire again. I then gave a second group the questionnaire, and showed them the frowning face slideshow, also asking them to imitate the faces they see on the screen, after which they did the questionnaire again. For a control, a third group filled out the questionnaire without viewing a slideshow.

I found that forming different facial expressions does affect happiness. The data show that, when asked to rate statements on a scale of one, strongly disagree, to six, strongly agree, participants were, collectively, five æpointsÆ, so to speak, happier after having smiled. Participants who frowned were, however, collectively six and one half points less happy than they were before frowning. This shows that smiling does make you more happy, and frowning, in turn, does make you less happy. Therefore, facial expressions affect happiness.

NAME(s) **Ainsley Busby** PROJECT NUMBER **B04**

SCHOOL Saint Mary's School GRADE 5

TEACHER Craig Hill

PROJECT TITLE **Get the Sensation**

ABSTRACT

Have you ever eaten a mint and felt that it cooled your mouth down? Have you ever wondered if mint really lowers the temperature of your mouth? Have you ever wondered that itÆs just a sensation? The purpose of this experiment is to figure out if mint actually reduces a personÆs mouth temperature or if itÆs really just a sensation.

○My hypothesis is that mint will lower oneÆs mouth temperature. The procedure used in this experiment includes having test subjects eat the same hot sauce and then recording the temperature in their mouths with a digital thermometer. The subjects were then told to eat a mint and the temperature of their mouth was recorded again. The experiment was conducted two times for each test subject using two different types of mints, Altoids and Mentos.

○The experimental results did not support my hypothesis. That is, the results did not show that either mint reduced the temperature of the test subjectsÆ mouths. My conclusion is that mints donÆt actually reduce the temperature of oneÆs mouth. The cool feeling is probably just a sensation.

NAME(s) **Cassidy Button** PROJECT NUMBER **B38**

SCHOOL Milton Middle School GRADE 8

TEACHER Janet Smith

PROJECT TITLE **It's All About the Face - A Study of How Acne Products Affect Bacterial Growth on the Face**

ABSTRACT

Acne is a skin disorder common among teenagers, caused in part by the bacteria Propionibacterium acnes. I examined the effect of two acne products in addition to lemon juice and pure acetylsalicylic acid on the growth of bacteria from swabs of student faces. I predicted that the benzoyl peroxide product would be more effective than the product with salicylic acid since it more widely advertised. I predicted that lemon juice would demonstrate an antibacterial effect, however not as significant as the two acne products.

I grew bacterial colonies on agar plates. Half of each plate was used to grow bacteria without any antibacterial product. The other half was used to test the bacterial growth in the presence of either benzoyl peroxide product, salicylic acid product, lemon juice, or pure acetylsalicylic acid powder. Filter paper discs were soaked in each antibacterial factor and then transferred to the plates.

I measured bacterial growth on each section of the plate, compared the number of colonies on both, and determined the percent change for each factor tested. Controls were analyzed for bacterial growth from the agar itself, the swabs, and the filter paper discs. There were fungal colonies present on the filter paper control, which were also present around some of the filter paper on three of the sample plates. This was considered a potential source of error.

The number of the bacterial colonies decreased in the majority of plates. The average percent change for the pure acetylsalicylic acid was negative 98 percent, the salicylic acid product was negative 94 percent, the lemon juice was negative 86 percent, and the benzoyl peroxide product was negative 64 percent.

It appears that salicylic acid product has more of an antibacterial effect than the benzoyl peroxide product and that lemon juice is also an effective antibacterial agent.

NAME(s) **Amelia Canney** PROJECT NUMBER **S06**

SCHOOL St. Francis Xavier School GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE **Can You See What I See?**

ABSTRACT

I chose to do an experiment based on subliminal perception. This is the science of something you see or hear but do not consciously acknowledge. I used a self-prepared video to determine the amount of help someone needs when attempting to find the object in question. For my hypothesis, I said that if the age of the person (manipulated variable) increased, then the amount of hints needed (responding variable) would decrease. I also decided to use kids from kindergarten, fourth grade, and eighth grade in my procedure. I based this on my research, which stated that the brain continues to grow until the age of twenty one, during which the brain starts to notice more.

○My experiment consisted of me showing the video to the child being tested, then asking them if they saw any change to the video. If they said they did not, I gave them a hint and showed the video again, and so on until the child saw the object in question. The order of the hints was this:

Something fades into the scene.
The object is in this area (upper right, lower left, etc.).
Give vague description.
Give more detailed description.
The object is right here (point out).
The object is a (tell what object is).

○My data showed a variety of results, but the average decreased with each increasing grade, so it appears that my hypothesis is correct. However, I feel that my experiment was a bit simple to accept the results and call it quits. I feel I should have taken two other considerations into my test: background and audible distractions. I could have used videos with different backgrounds to determine what effect it has, and show videos in different environments to see if distractions meant that the data would vary.

NAME(s) Grace Carlomagno
PROJECT NUMBER S07
SCHOOL Main Street Middle School
GRADE 8
TEACHER eli rosenberg

PROJECT TITLE **Does Being a Musician Affect Spatial/Visual Reasoning?**

ABSTRACT

In my experiment, I tested to see if being an instrumentalist or vocal musician improved a person's visual reasoning. I hypothesized that, because scientists have proven that there is more grey matter in musicians' brains than non-musicians' brains, and because advanced music theory requires musicians to comprehend numerous patterns and sequences of notes, a person's musicality does affect their spatial/visual reasoning abilities.

I made one google form to assess my subjects' visual thinking using a visual puzzles book and another google form assessing my subjects' musicianship. After emailing my quizzes to as many people as I could, I used a graph-making tool to represent the results I received and I searched for patterns and relationships between the variables in my graphs and spreadsheets.

The data showed that there is no relationship between musicality and visual reasoning. In fact, the group of musicians and the group of non-musicians I tested both scored an average of fifty points, meaning they were both fifty-percent accurate. I concluded that playing music does not improve a person's visual thinking abilities.

NAME(s) Jeff Carter
PROJECT NUMBER B05
SCHOOL Burlington Technical Center
GRADE 12
TEACHER Betsy McLane

PROJECT TITLE **Age vs Tickling**

ABSTRACT

I have noticed that children appear to be more ticklish than adults. I wanted to find out whether adults just had better control over their outward appearance (despite actually being tickled), or whether adults actually are less ticklish due to wear on their nerves. To do this I laid the subject on a table with palms up and shoes off. Gently, but quickly, I brushed the subject with a cotton ball on the sole of foot for 2 the length of their foot/hand. I asked the subject on a scale of 1-10 (one being the least ten being the most tickled they have ever been) how ticklish the cotton ball was. I also had the adults answer a questionnaire, asking whether they thought they lost feeling over time. After completing this test on several test subjects, the data didnÆt show that adults were less ticklish than children. However, it does show that the female subjects (in both adults and children) were more ticklish than male subjects. We can draw a few conclusions from this result. First is that adults are just as ticklish as children. Second is that females are more ticklish than males.

NAME(s) Mary-Alyssa Chambers
PROJECT NUMBER S08
SCHOOL Burlington Technical Center
GRADE 12
TEACHER Betsy McLane

PROJECT TITLE **The Effect of Sources of Sexual Education on Sexual Literacy**

ABSTRACT

Adolescents seek out knowledge about sex and sexuality from a variety of sources, like magazines or television, peers, parents, and from their schools. Receiving an accurate and in depth sexual education leads to safer and healthier sexual choices in teenagers. Sources of information like television or magazines can be inaccurate and harmful, while pornography inaccurately portrays healthy sexuality. Better sources of information are parents and studies have shown that discussing sex with a parent resulted in teenagers taking safer sexual risks later in their development than the ones who didnÆt. Schools that provide quality, non-abstinence only, sexual education classes have contributed to a national trend of decreased teenage pregnancies. However, inclusive and thorough sexual education programs have long been a source of contention and the majority of school sexual education programs have incorrect or misleading information. This experiment is meant to show the discrepancy between sources of sexual education for high school students and the quality of studentsÆ actual sexual literacy.

○Limited to high school students or recent graduates, this study consisted of a questionnaire paired with a brief assessment. The former asked the subject to list their sources of sexual education, to choose their most helpful source, and then to qualify their sexual knowledge. The assessment consisted of several objective questions about topics that would have been covered in an inclusive and comprehensive sexual education class.

○The results show that although the top sources of sexual education were friends and school, the majority of respondents reported that friends were their most helpful source of sexual education. The majority of respondents also described their own sexual education as average and described their amount of knowledge as ôsome knowledgeö.

○Looking over the accuracy of respondentsÆ sexual literacy, using the correct answers on the assessments as a gauge, five out of the six answers were answered incorrectly between six and sixty three percent of the respondents.

○Judging by the sources of sexual education preferred by the majority of respondents and the number of incorrect answers on the assessment, it would seem that the

NAME(s) Victoria Chang
PROJECT NUMBER P03
SCHOOL Frederick H. Tuttle Middle School
GRADE 7
TEACHER Christopher Towle

PROJECT TITLE **Crushing Eggs**

ABSTRACT

The purpose of this experiment is to test which way can eggs withstand more force, side-to-side or end-to-end? It was hypothesized that eggs will withstand more force end-to-end (standing upright) because an egg is basically made up of two triangles and triangles are the strongest shape. The experiment consisted of balancing a slab of wood on top of the egg. I then continually added 1 oz. of rice on top of the egg until it cracked completely. Repeat this step twelve times for eggs on their side and twelve times for eggs on their ends. To keep the eggs standing upright take a singular part of an egg carton and stand the egg up in that.

The results showed the eggs that stood upright resisted on average more weight. Upright eggs resisted on average 106.75 ounces and side-to-side eggs resisted on average 104.75 ounces. In conclusion, upright eggs lasted more pressure than side-to-side eggs. The hypothesis was correct because upright eggs withstood on average 106.75 ounces and side-to-side eggs withstood on average 104.75 ounces. With this knowledge, it could help people who store eggs, or factories who store eggs in egg cartons, to continually store them upright and not side-to-side.

NAME(s) Lydia Charbonneau

PROJECT NUMBER B06

SCHOOL Federick H Tuttle Middle School

GRADE 7

TEACHER Christopher Towle

PROJECT TITLE **Does Smell Affect Taste?**

ABSTRACT

It all started with my moms famous Lemon Pepper chicken. As sides she made Mashed
Potatoes and Brussels sprouts. As I made my way to the Brussels Sprouts I wonder if their was any way to get out of eating them. And that's how i decided to do this Experiment, Does Smell Affect Taste? Smell will affect taste. Have you ever noticed that when you have a cold you can not taste the sweetness of grandma's chocolate chip cookies?That's because your nasal cavity is stuffed up with mucus and leaves food tasting really bland. So to test that theory out I gathered ten kids and blindfolded them to have them taste ten food items to determine the difference between the smell and taste of the item. And after surveying 10 kids and 5 trials i have determined the truth. My hypothesis was correct. It was much harder for kids to taste when their nose was held close because just like the instance with mucus. There was not any space to breathe or inhale. Since the taste buds and what I like to call the ôsmell budsö work together you can't have one without the other. That's why my studies will show that the smell and taste will appear different because of that same exact reason.

NAME(s) Alexandre Chaulot, Trevor Houchens

PROJECT NUMBER GP08

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Is Amifostine Effective at Countering the Reduction of Platelets in the Blood Caused by Cy**

ABSTRACT

The purpose of our experiment is to show that amifostine counteracts the effects of cyclophosphamide. Cyclophosphamide attacks the progenitor cells of platelets during mitosis. Since there are many stages in the lineage of platelets, there are therefore many instances of mitosis, which causes reduced platelet counts. Our experiment tests whether or not the amifostine can reduce the effects of cyclophosphamide by elevating the platelet counts.

There were two groups of mice. The control group was injected with cyclophosphamide and the experimental group was injected with cyclophosphamide and amifostine. Then, we humanely euthanized the mice. We collected their femurs and took blood from each mouse. These femurs were sectioned into twenty micrometers thick slices in a cryostat. This allowed us to view the bone marrow at a uniform thickness. We then used immunohistochemistry to tag megakaryocytes by targeting serotonin. We also collected blood smears, and performed H and E staining on them. This allowed us to differentiate between platelets and red blood cells. We collected the data by counting platelets and megakaryocytes.

Our blood smears that were treated with cyclophosphamide and amifostine had significantly more platelets than those treated solely with cyclophosphamide. Our current data collection in our immunofluorescence imaging of megakaryocytes is incomplete. However, if this data agrees with our blood smear data, our data will support that amifostine stops the effects of cyclophosphamide even within the bone marrow. This would be one way to lower the risk of hemorrhaging or internal bleeding in chemotherapy patients.

NAME(s) **Gordon Clark**

PROJECT NUMBER **P04**

SCHOOL Avalon Triumvirate Academy

GRADE 8

TEACHER Amanda Gifford

PROJECT TITLE **Fibers of the Future**

ABSTRACT

This day and age, the age of internet, is fueled by companies yearning to create the fastest, and most efficient form of data transfer. During the early 2000s, an idea that was created during the 1960s increased greatly in popularity and significance, the fiber optic cable. Besides being superior in many ways to the traditional copper cable, fiber optic technology is very expensive. The replacement of the traditional glass interior of the cable with a common transparent mineral could potentially be a way to reduce prices. These minerals have visibly optical properties, for instance, low levels of opacity or highly light-reflective interiors. In this study, for a control, since a commercial fiber optic cable could not be found, an array of plastic fibers surrounded by a layer of black tape was used to imitate a cable. A hypothesis, that the Ulexite would prove the most effective at conducting light, was made after observing the properties of the minerals by eye.

To test, the minerals and cable were oriented so that the light could pass through it and illuminate the lux meter at the other end, the ambient light of the room was taken from the results to accurately represent the data.

○When tested, the cable performed strikingly better than the minerals when measured at a zero degree angle, but the minerals performed equally and sometimes greater than the cable when measured at the sharper 45 degrees. This suggests that the minerals contained reflective interiors for conducting light at sharp angles but lacked the transparency to accommodate light very effectively in either case.

○Altogether, despite the minerals exceeding the cable in some instances, the mass production of cables containing these minerals is still not very practical. However many benefits of the minerals could be used to improve the future of fiber-optics.

NAME(s) **Zachary Clark, Patrick Maguire**

PROJECT NUMBER **GP22**

SCHOOL Main Street Middle School

GRADE 7

TEACHER Amy Kimball

PROJECT TITLE **WiFi Efficiency Mapping**

ABSTRACT

The reason we undertook this science fair project was mostly out of a frustration in our daily lives: not being able to use the internet in the classroom because it was a ôdead zoneö. We were also motivated to do this project because if we could figure out where the school might be over-broadcasting, we would be able to suggest the removal of certain routers to save power and resources. The hypothesis was that the number of routers is directly related to over-broadcasting and therefore the amount of routers should be reduced, thus saving power and money at the same time. The process was to get a heat mapper software, overlay floor plans, map the three floors of the school, determine where routers are needed, and make suggestions based on this as to where to put routers. After mapping the school, the results show just the opposite of the hypothesis. Some places in the school need more routers due to their extremely bad connection to the network caused by the brick and other blocking types of walls that are implemented into the schoolÆs physiological structure. There are several rooms that could use more WiFi, especially some of the soon to be 5th grade rooms next year. In conclusion, our school's WiFi network needs to be re-examined so that all classrooms will have strong connectivity to allow students to accomplish their work next year with minimal frustration.

NAME(s) Ryan Croxford
PROJECT NUMBER C04
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton

PROJECT TITLE **Effects of Anti-gelling Agents on the Caloric Biodiesel**

ABSTRACT

This experiment in its present form is the study of the caloric efficiency of biodiesel after an anti-gelling agent is introduced. This experiment is different from experiments that have been conducted in the past because it compares different products on the market that could have a significant efficiency reduction when using biodiesels.

The caloric value of the standard biodiesel prior to adding the anti gelling agent will be found using a bomb calorimeter. Different anti-gelling agents will be added to the fuel and the same mass of fuel and additive will be burned in the bomb calorimeter as the control. The expected results are that all additives should cause decreases in caloric efficiency but the commercial anti-gelling agent should have a smaller negative impact.

A possible experimental error that could have occurred in the data collection is an uneven distribution of anti-gelling agents due to solubility in the fuel.

This study contributes to the community in two ways. It should help people in all industries that use biodiesel to reduce the amount of biodiesel used which in turn will create a cleaner burning diesel that will help the environment.

NAME(s) Sabrina Cunningham
PROJECT NUMBER S09
SCHOOL Burlington Technical Center
GRADE 12
TEACHER Betsy McLane

PROJECT TITLE **Correlation Between GPA and Sports**

ABSTRACT

The research conducted reports on the results of a recent survey of high school students. The survey asked the high school participants about their GPA and if they played any high school sports.

The purpose of the survey was to see if participating in high school sports affects students' GPA, and if it is a positive or negative correlation. To recruit participants for the survey I walked around my school and asked students to fill the survey out and explained that it would take less than two minutes to complete. The results of the research clearly show that participating in a high school sport has a positive effect on students' GPA, so it is beneficial. This research contributes to the general public's understanding of the effect playing sports has on students' academic success. It is often thought that playing sports is time consuming and requires students to miss school so people believe it has negative implications. The data shows that sports have a positive effect and the data suggests that it is due to students having a community to rely on for help and having GPA requirements to participate in sports.

NAME(s) Amber DeBartolo, Peter Jaarsma
PROJECT NUMBER GP13
SCHOOL Windsor High School
GRADE 11
TEACHER Catharine Engwall

PROJECT TITLE **Effects of Natural Vs. Chemical Coagulants**

ABSTRACT

The purpose of this investigation was to test the negative effects of two coagulants (Moringa Seed Extract and Aluminum Sulphate) used for water treatment. The hypothesis was that the Moringa Seed Extract would have less harmful side effects on the water. This was hypothesized due to the fact that Extract is less chemically strong than the aluminum sulphate. To test this hypothesis, water from four different bodies of water (two still and two running) were collected. The pH, nitrates, and phosphates, from each sample was measured as a control. Next, 0.4 mL of moringa seed extract was mixed into two graduated cylinders from each sample; 14 mL of test water per sample. 0.4 grams of aluminum phosphate was mixed into two graduated cylinders from each sample also filled with 14 mL each. These cylinders were allowed to sit for 24 hours. After this time the pH, phosphate, and nitrate test were conducted again. The results were recorded, and compared to those of the control sample. The results showed that the Aluminum sulfate caused more drastic changes in pH than the Moringa Seed Extract, while both increased the clarity of the water to about the. It was concluded that the Moringa Seed Extract could still be used to purify the water, and had less harmful effects overall than the aluminum sulfate.

NAME(s) Libby Delaney, Chloe Alexander
PROJECT NUMBER GP32
SCHOOL FHTMS
GRADE
TEACHER Amelia Lutz

PROJECT TITLE **How Colors Affect People's Thoughts, and Moods**

ABSTRACT

We studied how colors affected peopleÆs thoughts and moods. Our hypothesis was that if colors impact peopleÆs thoughts and moods then there will be a pattern between a color and a specific mood. Our procedure was to create a spreadsheet for results (color, first thought, age, gender, feeling,) then to survey at least 100 people on how they feel and what they think of when they see the color selected at random, and finally we would enter the results. One of our principal findings was that certain colors play huge roles in our everyday emotions; such as 43% of all females under the age of 20 thought that black reminded them of the dark. We also found in our studies that only two women both over the age of 20 said that light green reminded them of a safety vest. Another results we came to conclude with this project is that 14% of people feel that happy is associated with yellow. In conclusion, while conducting this project we experienced how colors control our thoughts and moods, and patterns between age, and gender. Our next steps would be to look for deeper relationships between colors affecting how human beings function, and address and investigate more on colors affecting peopleÆs everyday lives

NAME(s) Clark Deng, Derek Gagnon
PROJECT NUMBER GP19
SCHOOL South Burlington High School
GRADE 11
TEACHER Curtis Belton

PROJECT TITLE **Using UAS-Based Precision Agriculture to Combat European Corn Borer**

ABSTRACT

Economic losses in the United States due to invasive species is 137 billion annually. By 2050 there will be an additional two billion people and it will be necessary to produce 70 percent more food to address such a population growth. This increase in food production can be achieved through the implementation of precision agriculture. Precision agriculture is a method of merging technology and crop management. The goal of the project is to develop a plan that can determine the presence and precise location of European Corn Borers within corn fields to increase crop yield and reduce the amount of excess pesticides applied. Our project focuses on corn and European Corn Borer, the primary predator of corn. Corn is grown throughout America and national output represents 32 percent of the global corn production. Through working with university professors and FAA mentors, we designed a fixed wing UAV that complies with all FAA regulations in addition to a groundbreaking detection plan that together achieve the goal of the project. We devised a genetically modified plant that will support the existing commercial crops in the field by acting as an indicator plant. The indicator plant will designate the presence and location of pests in the crop field. This solution can potentially increase overall crop yield by over 15 percent while reducing the necessary pesticides by over 75 percent. This concept can be applied to any crop. Our project has the potential to revolutionize the future of precision agriculture and crop production.

NAME(s) Colin Desch, Isaac Maddox-White
PROJECT NUMBER GP26
SCHOOL Main Street Middle School
GRADE 8
TEACHER Amy Kimball

PROJECT TITLE **Power It Down**

ABSTRACT

When computers are shut down rather than kept on they use much less power and can save money. This project looked at how much energy computers use when they are on, sleeping, or shut down. The hypothesis stated that a computer will use much less energy when it is sleeping than when it is on, and even less when it is shut down. With ôKill-A-Wattö meters, the amount of kilowatt hours was recorded overnight with some computers left on, some computers sleeping, and some computers shut down. The results showed that computers use much more energy when they are left on than when they are sleeping, and sleeping computers only use a little bit more than computers that are shut down. This shows that there is power and money to be saved by taking the time to shut down computers.

NAME(s) Tre' Diemer
PROJECT NUMBER S10
SCHOOL Mater Christi School
GRADE 8
TEACHER Mark Pendergrass
PROJECT TITLE **The Sleep Cycle**

ABSTRACT

The experiment ôThe Sleep Cycleö tested whether activities done before sleep effect activities done afterwards.
The hypothesis stated, ôIf people do intense activities before sleep, then it will positively affect sleep quality, calm activities will do the inverse effect.ö REM stands for Rapid Eye Movement, a stage of deep sleep where dreams typically occur and often
last for about twenty minutes. This causes the personÆs eyes to move around rapidly as if living a dream. Sleep Cycles, are periods of sleep that last for about ninety minutes and transition between deep sleep, light sleep and the stages in-between. During
testing each participant bought ôSleep Cycleö, an Iphone app that analyzed the personÆs sleep cycle during sleep. Data was collected through ôSleepSecureö, an online database linked to the app that gave several charts and diagrams. Some included, sleep quality,
sleep activity effect on sleep, and sleep quality per day of the week. After testing, many data points proved the hypothesis correct, while others did not. Sleep quality based on the times people went to bed was also tested. Going to bed at nine P.M. proved
to have a negative effect, while going to bed at twelve A.M tended to be positive. The results demonstrated how people are affected by actions done before sleeping. Some things previously thought to negatively affect sleep, improved sleep. For example, playing
an Ipod before sleep had a positive effect on sleep, while working-out had a negative effect on sleep. The test proved to be insightful and could help athletes, doctors and people looking to become more productive in preparation for their day. Many of the results concluded similarly to the example.

NAME(s) Isabelle DiPalermo, William Balkan
PROJECT NUMBER GP10
SCHOOL Christ the King school
GRADE 6
TEACHER Mrs.srivastava
PROJECT TITLE **Close Your Eyes for the Cure**

ABSTRACT

Do you get dizzy just looking at carnival rides that go around and around all day? Do cars make you feel queasy? The point of our experiment was to find a ôcureö for dizziness. We thought that by shutting your eyes and plugging your ears, that you wouldnÆt get dizzy.
Our hypothesis is that if you shut your eyes and plug your ears you will not be as dizzy as when you have your eyes open and ears unplugged.We spun volunteers around in an office chair three times. First with their ears plugged and eyes closed and then with their eyes open and ears unplugged. The participants were asked point in the direction they were spinning and then attempt to walk in a straight line. The results show that although all subjects knew in which direction they were spinning, there was a difference in their ability to walk in a straight line. On average, when closing their eyes and plugging their ears the subjects walked 39 centimeters closer to a straight line.
This proves our hypothesis that by shutting your eyes and plugging your ears you will get less dizzy. So, by means of earplugs and blindfolds America can be free of dizziness!

NAME(s) **Alexandria Dostie** PROJECT NUMBER **P05**

SCHOOL St. Francis Xavier School GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE **Hot or Cold○**

ABSTRACT

The purpose of my science fair project was to investigate which common home flooring was best for passive solar heating. Usually people who convert to passive solar heating have to change the way their whole house is set up. In this case they change their flooring to brick or concrete in order to absorb the most heat. I wanted to do this project to see if tile, linoleum, carpet, hardwood or laminate would obtain the most heat, so if you didnÆt want to go all out you would know which flooring to go with.

My hypothesis stated that tile would be the best for passive solar heating. I thought this because theoretically the more mass in an object the more heat it will absorb. Out of my 5 floorings I felt tile would absorb the most heat.

To investigate which flooring was best for passive solar heating I made a small scale room out of cardboard and put the flooring on the bottom of the cardboard box. Then I took a piece of glass and attached it to the cardboard box making it like a door. I then took my lightbulb (Which was in the light stand) , turned it on and set a timer for an hour. Every 5 minutes I checked to see what the temperature was. After an hour was up, I turned the light off and set the timer for another hour and checked the temperature every 5 minutes. I completed this test doing 2 test runs for every piece of flooring.

The data and observations proved to me that tile seemed to obtain the energy the best. The tile heated up to 89 degrees then decreased to 68. Based on my data my hypothesis was correct.

NAME(s) **Tom Dustira** PROJECT NUMBER **B07**

SCHOOL South Burlington High School GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **How Different Soils Affect the Fruit Bearing Brassica rapa**

ABSTRACT

This experiment tests the growing capabilities of four different soils for fruit bearing plants: silt, clay, sand, and peat. Based from previous content, it was hypothesized that silt would be the best soil in which to grow the plants. Plant height and total fruit weight will be the measured data. All plants are under 24 hour light and are watered once a day with 10 ml of water. The room is kept at a temperature range of 72 to 78 degrees Fahrenheit, optimal for the fast growing Brassica rapa. Data collected are still too little to make a final conclusion, however it is hypothesized that silt will be the second best. The control variable is sand soil since it is most dominant where the research was first conducted. To reduce error, the trays of plants are rotated continuously so that all plants will receive the same amount of heat and light. Plants are also only pollinated with plants in the same soil group. Furthermore, each tray was slightly separated from the others to prevent the soils from mixing. Future experiments building from these results could include testing optimal watering methods, or varying light intensity at differing intervals. This project investigates different soil variations, and how they affect fruit bearing plants.

NAME(s) Mallory Dutil
PROJECT NUMBER P06
SCHOOL Northfield Middle/High School
GRADE 11
TEACHER Amy Urling

PROJECT TITLE **The Effect of the Amount of Time from the Springboard to Blocking off the Table on Vault D**

ABSTRACT

The purpose of this experiment was to apply NewtonÆs Laws to gymnastics vaults. The hypothesis being tested is if the amount of time from when a gymnastÆs feet leave the springboard to when their hands block off the table is changed, then the distance of the vault will increase if the time decreases because of the properties of NewtonÆs third law. The first step was to set the vault to 5 clicks, place the springboard 2.9 feet away from the vault and lay two meter sticks down along the mat at the end of the vault. Then I set up a video camera to record the vault and a timer to record the time it took the gymnastÆs feet to leave the springboard to when her hands blocked off the table. Lastly, the gymnast performed the vault and I measured with the meter stick where her feet first landed. The average time for the first vaulterÆs handspring vault from the time when their feet left the springboard to when their hands blocked off the vault was .343 seconds with an average distance of 2.383 meters. The average time for the second vaulter was .40 seconds with an average distance of 1.533 meters. The third vaulterÆs average time was .357 seconds and her distance was 1.05 meters. My hypothesis is supported by my data because NewtonÆs third law states that every reaction has an equal and opposite reaction; so if a gymnast hits the springboard harder and faster, her hands should block off the vault faster which creates a farther distance. An experimental error was that it was impossible for a gymnast to stick every vault they perform, so if she stumbles or large steps are taken it can be difficult to exactly measure where her feet first landed.

NAME(s) Johanna Eddy
PROJECT NUMBER B08
SCHOOL Milton Middle School
GRADE 8
TEACHER Greer Krembs

PROJECT TITLE **Freeze, Thaw, Repeat**

ABSTRACT

The purpose of this experiment was to test what happens to the consistency of food when you refreeze it. I wanted to see what happened when you refreeze a fruit, a vegetable, and a type of meat. I wanted to test this because my family freezes food such as strawberries, and I wanted to see how refreezing them would affect their consistency. For fruit I tested strawberries, for vegetables I tested broccoli, and for meat I tested hamburger. I froze each type of food seven times. To get my data I would weigh each type of food. Then I would measure out any liquid that was created from freezing and thawing the food. Finally I would weigh the food after I removed the liquid.

Originally I thought that all the food would show major changes in consistency. I thought this because my background information said that ice crystals break down cell structures, so I thought it would work the same for all the food types. My experiment showed me that strawberries had the largest change in consistency, broccoli had some change, and hamburger had little to no change.

This knowledge can help you know what foods you can freeze for certain periods of time, and how to be economically smart when buying or freezing food . If I were to do this experiment again I would want to try different methods of thawing to see if that had any effects on the consistency of foods. For example if thawing food in water would have different effects then thawing food just by placing it on a counter or in a refrigerator.

NAME(s) **Peter Edwards** PROJECT NUMBER **P07**

SCHOOL Fredrick H. Tuttle Middle School GRADE 7

TEACHER Mr. Towle

PROJECT TITLE **Does Temperature Affect Battery Life?**

ABSTRACT

The idea of containing electricity in a capsule was originally figured out by Italian physicist Alessandro, who created the first battery in recorded history to emit a more extensive current of electricity in 1799. This was not the first battery. Studies conducted in the year 1938 led to the discovery of a 5 cm long battery in Iraq that could date back 2,000 years. In the past 100 years batteries have grown to be in high demand because of evolving electronics. Today there are 43 types of regular batteries and 31 types of rechargeable batteries. This experimentÆs purpose is to determine what type of AA will last the longest when it has been stored in a warmer or colder climate for an allotted amount of time. The hypothesis was Rayovac will last the longest because in a test conducted between Duracell, Energizer, and Rayovac concluded that Rayovac will last the longest by about 2 minutes of continuous use in a household flashlight. To conduct the experiment I placed some of the batteries in the freezer and the rest in front of my fireplace for 12 hours, then in the many hours that this experiment took, the results showed that storing the batteries in warmer climates (650-750) will have the best results. The information that I take away from this experiment will help make people aware of what temperature people should store their batteries for the best results.

NAME(s) **Jake Edwards-Stoll** PROJECT NUMBER **B09**

SCHOOL Burlington Technical Center GRADE 12

TEACHER Betsy McLane

PROJECT TITLE **Are Pre-Workout Supplements Worth The Money?**

ABSTRACT

This double-blind, crossover experiment served to determine whether expensive name brand pre-workout supplements actually help with anaerobic lifting exercises, and if they are even worth the high price. Subjects made three visits to the BHS weight room. They were blindly given either C4 pre-workout containing 135mg of caffeine, creatine nitrate, beta-alanine and other ingredients, 135mg of pure anhydrous caffeine mixed with Mio water flavoring, or a placebo of just Mio flavoring. After ingestion, participants completed as many repetitions as they could until failure of either machine leg press or barbell bench press at 60% of their one-rep maximum weight. After exercise, they were asked to fill out a survey ranking their levels of energy, fatigue and more. The results showed that ingesting some type of caffeine prior to anaerobic exercise does improve performance. Subjects averaged at least one bench press rep and four leg press reps more when ingesting C4 or pure caffeine compared to the placebo. However, the results are almost too close to determine if pure caffeine of C4 has a better effect on lifting. Subjects averaged 18 bench press reps and 31 leg press reps with caffeine, and averaged 17 bench press reps and 32 leg press reps with C4. From this experiment it can be concluded that the other ingredients besides caffeine in C4 pre-workout and other name brand pre-workouts have little to no effect on anaerobic performance. These results will benefit athletes and gym-goers as it can be concluded that buying C4 pre-workout ($30 for 30 servings) has no greater effect on performance than buying pure anhydrous caffeine ($20 for 8000 servings). With this information, pre-workout users can save a lot of money.

NAME(s) **Jessica Eustis** PROJECT NUMBER **C05**

SCHOOL Saint Francis Xavier GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE **Painted Ponies**

ABSTRACT

○Paint is a liquid material, that when applied to a substance, dries to a cohesive, solid film. My research question was does the type of paint affect how durable it is. My hypothesis was that enamel paint would be the most durable because I read that it is very hard to chip and doesnÆt come off with just water, like acrylic would. I used Breyer Mini Whinnies, small plastic horses, and I painted them with three types of paint, enamel, acrylic and oil. To test the durability of each type of paint I painted nine different horses, three with each type of paint, and dragged them across three different surfaces: a concrete floor, a sisal cat scratcher, and also rough sand paper. I tied a piece of ribbon around each horseÆs neck to try and keep the amount of force used the same. I also froze the horses because I read that paints can crack in the cold if they are not high quality. I only counted the damages on one side of each model, on the stomach. I found that the only damage that gave the horses marks was the rough sand paper. Due to the fact that these models were very light weight they didnÆt really rest heavily on the objects. Even on the sand paper there were very light to no marks on the three horses with the enamel paint on them. I found that the enamel paint was the most durable and the oil was the least durable. I think that the oil was the least durable because it is very thick and made for canvases.

NAME(s) **Hannah Fisher** PROJECT NUMBER **S11**

SCHOOL South Burlington High School GRADE 9

TEACHER Curtis Belton

PROJECT TITLE **Lie To Me**

ABSTRACT

This experiment is testing if adults can detect if teenagers (ages 14-18) are lying better than teenagers can. This experiment will be done through recording videos of teenagers who are asked to lie for three out of ten questions. Based off of prior knowledge on lie detection and through experience, it was hypothesized that teenagers will be able to detect lies from their own peers better than adults will be able to. This test will be carried out with 10 subjects, who will be filmed and asked questions. An example question is, ôWhat did you do last night?ö This allows the subject to elaborate on their lie or on their truth. A baseline will be established during the seven questions that they wonÆt be lying. From these 10 videos of these 10 subjects, clips will be taken out and a stand of videos will be taken for others to look at. Fifty teenagers and fifty adults will look at the video. Whichever group is more accurate in detecting lies will determine the end results. Because teenagers are the group that is lying, it is hypnotized that they will be able to tell the lies easier.

NAME(s) **Jared Forsythe**

PROJECT NUMBER **G02**

SCHOOL St. Francis Xavier School

GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Deadly Runoff○**

ABSTRACT

The purpose of my project was to determine if sediments and runoff from parking lots are harmful to aquatic organisms. I chose this project because I thought it would be interesting to observe how harmful the water on the streets is. After I had chosen my project, I read some articles on daphnia magna, the water crustacean that I used during my experiment. I decided that this would be a project to look more closely at how bad for the environment the runoff on the streets is.

My procedure was putting a certain number of daphnia in to each tube out of five. Each tube would have a label, A, B,C, etc. Test tube A would have all tap water, B would have 20% runoff, and 80% tap. I would increase the runoff by 20% for each additional tube. Each tube would be checked every fifteen minutes, then the daphniaÆs death rate was recorded over time. To investigate on some of the effects that the toxic water had on the daphnia, I recorded my observations.

My results have shown that runoff from parking lots is harmful towards aquatic organisms. I had done this procedure a second time. The second time I put ten daphnia in each tube, and then recorded their death rate every five minutes, the water was also diluted this time by 10%. Test tube A would have 10% runoff, 90% tap, and so forth. My data and observations proved to me that there is a large amount of toxins in runoff from parking lots. The Daphnia for test tube C, D, and E died within a half an hour. Test tube A, and B were still alive until the following morning. During this project I met my goals towards my question and my hypothesis.

NAME(s) **Jacob Gallow**

PROJECT NUMBER **P08**

SCHOOL Missisquoi Valley Union High School

GRADE 11

TEACHER Dana Maria Dezotell

PROJECT TITLE **How Does the Structure of Bridges Affect Resistance in Flooding?**

ABSTRACT

○Hurricane Irene, single handedly, destroyed less than 500 miles of road, and around 200 bridges. In total, the cost to repair or remake the destroyed roads was around 175-250 million dollars. With an interest in bridges, I decided to make a project relevant to the road and bridge destruction during hurricanes and floods. The amount of money used to repair flooded roads adds up a lot overtime, so by using strong, and inexpensive, bridges, we can make a better alternative for areas that are constantly being flooded. In my testing, I took the design of a truss bridge, and made improvements. I made 3 bridges, the first bridge a normal truss, the second bridge a normal truss with a single popsicle stick going through each triangle of the truss, and the third bridge reinforced according to the second bridgeÆs results. The most impressive thing that I received from the results was the bridges weight compared to how much the bridges held. I broke the bridges from their side, to simulate flood waters going against the bridge. Each bridge weighed no more than 83 grams, and the held rather large amounts of weight. The significance of this is that a bridge using a small amount of materials, and money, can hold a ton amount of weight. For example, the third bridge weighed 82.5 grams, and held 6,530.46 grams, about 80 times more than the weight of the bridge. In summary, my experiment shows of a way to reinforce our bridges against flood force waters, and to create a more inexpensive alternative for commonly flooded roads.

NAME(s) **William Gambero**

PROJECT NUMBER **P09**

SCHOOL Milton Middle School

GRADE 6

TEACHER Greer Krembs

PROJECT TITLE **Wind Turbines**

ABSTRACT

Wind turbines are sometimes useful to provide additional power to houses nearby. Many wind turbines are built near mountains or tall hills, where wind is usually about 28 mph. Wind is important for wind turbines to work. Without strong wind, it is a waste of metal. I decided to test what wind speed and range created the most power from my turbine model. I used a small, circular fan and a large box fan to make wind. Both had three different speed settings. Since the box fan had a larger blade length, I predicted it should have generated the most power because it would push more air causing my turbine to spin faster.

I connected a multimeter to the turbine to find out the average volts produced. I placed the turbine in front of one of the fans. I swapped back and forth from the small fan to the large fan and the three speeds for both of them: low, medium and high. I recorded the number of volts generated.

My results did not support my hypothesis. The smaller fan on high created the most volts, not the large fan. The force from the larger fan was creating friction on the motor of the turbine, which slowed down the rotation of the blades. The wind force made the turbine blades get pulled back, decreasing the power.

These results showed that wind turbines should be built on spots that do not have too little or too much wind. They need the right amount.

NAME(s) **Joshua Gaudette, Daniel Cardillo**

PROJECT NUMBER **GP25**

SCHOOL Windsor Middle School

GRADE 8

TEACHER Owen Campbell

PROJECT TITLE **Laser Visibility**

ABSTRACT

Our science fair project was on the visibility of colored lasers through liquids. We hypothesized that a 5mw green laser would give off the highest amount of light intensity compared to purple and red lasers.
Our first step was to block out all light in the room, and to make sure that all the mirrors and reflectors in the room are removed. We then made sure all of the lasers were under 4 inches of water and clamped at the 2in mark. We then conducted 4 tests to get an average light intensity for all of the lasers in the water. The averages supported our hypothesis that the green laser would be the brightest, then purple, and lastly red. We noticed that the reddish yellow dye, added to the tank, had an effect on the red laser causing it to come in second on that test.
Lasers are becoming a major part of our everyday lives. Lasers technology is now included in weapons for the military, surgeries, and therapies for smokers. We wanted to conduct research within these fields, and we wanted to know how lasers could be used in the future. We hope to conduct more research on lasers next year.

NAME(s) Shelbie Gebert, Valerie Koch
PROJECT NUMBER GP12
SCHOOL Windsor High School
GRADE 12
TEACHER Catharine Engwall

PROJECT TITLE **Printing vs. Spraying as an Alternative to Skin Grafting**

ABSTRACT

In 2008, The United States of America, saw over 410,000 injuries due to burns and approximately 40,000 needed hospitalization. (WHO, April 2014) Often, a burn victim is hospitalized because it is a second or third degree burn that needs immediate treatment. The current method of skin grafting can be very painful and comes with risks of infection for the donor site. Also, if the patient's body is burned too badly, they may not have enough skin left to perform the common procedure of skin grafting. This then asked the question, ôWhich method, between printing and spraying, replicates skin grafting the best?ö With extensive amounts of research, there has been information formulated on two other procedures used to help burn patients: using a bio-printer to print skin cells onto the patient, and using a bio-sprayer to spray skin cells onto the patient. This experiment will test whether spraying skin cells or printing them, better replicates skin grafting. The hypothesis was if skin cells are being applied to a wounded area, then printing is going to replicate skin grafting the best because it has better precision and consistency.

This experiment first started by building a 3D inkjet printer which can print bio-ink. After completing the build, gelatin and ink was used to compare the printer to a sprayer. The comparison was done by using gridded transparencies to see how much area was covered when spraying and printing into the box.

The hypothesis was supported by the data that was collected. However, more information is needed to make a more definite conclusion. Next time a solution more equivalent to the viscosity of bio-ink would be used.

NAME(s) Stephanie Gifford, Rylea Tetreault
PROJECT NUMBER GP39
SCHOOL Windsor High School
GRADE 9
TEACHER Raina White

PROJECT TITLE **Matching Voices to Unknown Faces**

ABSTRACT

○The purpose of this investigation was to determine if people could match the voice of a stranger to his or her face. This connects to the real world when youÆre talking on the phone or to someone you canÆt see. When you hear a voice, you make assumptions about what that person looks like. We wanted to test the accuracy of those assumptions. Our prediction was that people wouldnÆt be able to correctly match the voice of a stranger to his or her face because when people make assumptions, theyÆre more based on stereotypes rather than actual scientific evidence.

To test this, we had a test subject listen to a voice we had recorded earlier and then had them choose what they thought was the correct person behind the voice out of four pictures of people. Then they were asked to give a reason behind their decision, and we recorded both their answer and the reason for their answer. Since the subjects were choosing from four pictures they had a 25% chance to pick the correct picture. However, only 20% of people got the correct answer, and almost none of the answers were based on anything scientific. These findings supported our hypothesis that people canÆt correctly match the voice of stranger to an image of their face.

NAME(s) **Eric Godin** PROJECT NUMBER **P10**

SCHOOL Milton Middle School GRADE 8

TEACHER Janet Smith

PROJECT TITLE **Stand Back...This is Rocket Science!**

ABSTRACT

Rocketry is an area of interest to many yet few safe models are available for kids. The goal of this project was to design an environmentally safe working model rocket car that could be constructed out of everyday materials.

Baking soda and vinegar react in a one-to-one ratio as an endothermic reaction to create carbon dioxide gas as a product. This reaction was used to propel the rocket forward. The model was tested for the optimal amount of baking soda and vinegar to propel the car the farthest. A stoppered one liter plastic soda bottle was used to contain the chemical reaction and capture the carbon dioxide gas. The pressure from the gas expanded the bottle, shot off the cork and created the force to propel the car forward. It was determined that the minimum amount of baking soda to propel the car was 2 grams in 200 milliliters of vinegar. The maximum was 7 grams in 200 milliliters beyond which the cork could not be inserted before the carbon dioxide was released from the bottle.

The initial design was made from Kinetx wheels and axles with a foam rectangular base to which a bottle was attached with rubber bands. This design traveled a maximum distance of 767 centimeters, however, it curved to the left and there was excessive friction between the wheels and foam base.

A modified design was made with a pine base and smaller, plastic wheels with less friction in the axle which traveled a maximum of 298 centimeters in a straighter line. This design did not accelerate as much as the initial design beyond 5 grams of baking soda. The mass of this design was greater which may have decreased the distance traveled for a given force. Perhaps using a less dense wood could improve this.

NAME(s) **Nicholas Goodman** PROJECT NUMBER **B10**

SCHOOL South Burlington High School GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **The Effects of UV Light on Food**

ABSTRACT

The Effects of UV Light on Foods
Nicholas Goodman
South Burlington High School, South Burlington, VT, United States

The purpose of this experiment was to test if UV radiation would affect some foods. UV light is commonly used to treat foods like spinach, sprouts, spices, and onions. It was hypothesized that irradiating these foods would not cause any adverse effects, and that it might lengthen the shelf life on account of the lack of bacteria.
The first step in this experiment were to culture the K-12 strain of E. coli. Then, the bacteria was exposed to UV-C light in order to kill the bacteria and make sure the light was up to industry standards. The next steps were to irradiate a sample of the selected food, and to store it. Over time, the condition of the food was observed and recorded. Factors measured included length, color, level of wilting, texture, and smell. Comparing the condition of the irradiated food with untreated food gave us our results.
The experiment could have three results: food might deteriorate slower, faster, or at the same pace. Based on the results, UV light may be used to lengthen shelf life, or may not be used at all.

NAME(s) **Elizabeth Hall**

PROJECT NUMBER **B39**

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **The Effect of UVB on Human Epithelial Cells**

ABSTRACT

This project presents information on the effect of UV B light on the RNA of a human epithelial cell. The data collected is expected to support the hypothesis that this type of radiation can cause a genetic mutation when applied to a cell. PCR, or polymerase chain reaction will be used for means of data collection in order to analyze the results. These effects will be measured in terms of any variations from the control to the experimental group. During preliminary work, 15 seconds or 10 Jm-2 of UVB was irradiated onto three cell lines that represent the experimental group. The amount of radiation was kept constant throughout the experiment to limit the variation in results. The exposure caused dramatic cell death. Although data collection is not complete, this work suggests that mutations and changes from the original RNA will occur. The cells did not need to be irradiated in great strength in order for repair enzymes to lose strength, causing issues within the RNA. The unavoidable discrepancy in cell lines may have been the cause for experimental error, as it made the data harder to compare. This data in its final condition will be used to show the malignant effects of UV radiation. It was concluded that this type of radiation could be dangerous.

NAME(s) **Taylor Hall**

PROJECT NUMBER **B11**

SCHOOL Missisquoi Valley Union High School

GRADE 10

TEACHER Dana Maria Dezotell

PROJECT TITLE **The Effects of Ibuprofen on the Growth of Pisum sativum and Zea Mays**

ABSTRACT

Ibuprofen is one of the most well known painkillers around the world. It can be found in almost every household, and once it reaches its expiration date, what happens to it? A lot of people will just throw it in the garbage or even flush it down the toilet, but when it reaches the environment, it has many effects on plants and animals alike. These effects are unknown and without answers soon, it could change the way our environment functions. For this experiment, I used a sample size of twenty-four plants, twelve corn plants and twelve pea plants that were placed under a grow light and in a windowsill. My independent variable is the amount of ibuprofen given to each plant and the dependent variable is the growth of each plant. My control is a plant that was given no ibuprofen, but was given the same soil and water as the rest of the plants. I added different amount of ibuprofen to water and watered two common types of plants, corn and peas. Then I measured the growth daily and saw surprising results. As the amount of ibuprofen given to each plant got higher, the height of the plant got lower. The controls grew tallest, while the plants given 1000 mg of ibuprofen did not even emerge from the soil. This shows that ibuprofen can prohibit the growth of plants when it is absorbed into the surrounding environment.

NAME(s) **Jacob Harriman** PROJECT NUMBER **G03**

SCHOOL Weathersfield School GRADE 8

TEACHER David E. Lambert

PROJECT TITLE **Clean Up Materials vs Fuel Oil**

ABSTRACT

I chose to investigate how effective different clean up materials are at removing fuel oil out of water. I used the internet as well as an expert in the field to research my problem and form my hypothesis. I found that there are five main clean up materials used for fuel oil. If fuel oil spills in water then Oil Only absorbent pads will clean up the largest amount of fuel oil based on mass and volume.

I combined the fuel oil and water into one beaker and then used the different clean up materials in separate trials to remove as much fuel oil from the water as possible.

My experimental results supported my hypothesis. The Oil Only absorbent pads did absorb the most measurable amounts of fuel oil out of the water based on volume. I learned that among all three clean up materials that each is effective to some degree. However, if I had to choose a fuel oil clean up material I would choose the Oil Only Absorbent Pads.

If I were to continue in this area as a scientist in the future I would investigate and compare fuel oil clean up in water versus fuel oil clean from ground materials. I would also compare rough water clean up to calm water clean up, using booms and socks in rough water (ocean/rivers) versus using absorbent pads in calm water (lakes/ponds). I chose this topic due to the recent BP oil spill.

NAME(s) **Elisabeth Harrington** PROJECT NUMBER **B12**

SCHOOL Mater Christi School GRADE 8

TEACHER Mark Pendergrass

PROJECT TITLE **Organic vs. Non-Organic Food Preferences of a Rat**

ABSTRACT

The goal of this project was to determine if a rat would prefer organic foods over non-organic foods. The hypothesis was that if the rat had an option of organic, then he would choose the organic. During the research it was determined that any type of corn can be extremely dangerous to rats and cause tumors. When experimenting it was important to give small quantities of food over a period a time to ensure the health of the rat. The preparation required for the testing was purchasing items to build the containment area and the food options. Once all of the materials were obtained, the containment area was built and the testing began. Every day for ten days the testing was conducted two times with different foods. To gather the data, the rat was released inside the containment area for 30 seconds. His food preference was recorded along with the side (right or left) on which the food was presented. Alternating the sides of organic and non-organic gained reliability because it eliminated the possibility of a side preference. The hypothesis was correct as the rat chose organic 70 percent of the time.

NAME(s) **Jackson Harris**

PROJECT NUMBER **P11**

SCHOOL Mater Christi School

GRADE 6

TEACHER Rosie Harris for Mark Pendergrass

PROJECT TITLE **Parachutes Unraveled**

ABSTRACT

In this experiment, Parachutes Unraveled, the hypothesis was that when a bigger parachute is used, it will take a longer time for it to reach the ground. This test was used to answer the question, does the size of a parachute matter. During the testing, it was determined that air resistance, also known as drag, is what slows parachutes down for a softer landing. Without this, parachutes would not work. In the actual testing, four different sized parachutes were constructed out of heavy duty trash bags, thick nylon string, and a 5.0g washer used as a weight. The parachutes were cut to 20x20 cm, 30x30 cm, 40x40 cm, and 50x50 cm, and 16 pieces of string cut to 40 cm long. They were dropped from a platform balcony and timed in seconds. A factor that affected the testing is that the testing took place in a public area and people were around us, which meant the testing was interrupted. The 50x50 cm parachute dropped in an average of 4.5 seconds which confirms the hypothesis because this is the longest average time.

NAME(s) **Grace Hasselbach, Lauren Hunt**

PROJECT NUMBER **GP02**

SCHOOL Christ the King School

GRADE 8

TEACHER Mrs. Srivastava

PROJECT TITLE **5 Second Rule: Fact or Fiction**

ABSTRACT

Have you ever picked up a piece of food off the ground and eaten it, using the 5 second rule as your guide? Kids and adults alike have been making decisions based on the this rule for years, but we wanted to quantify the number of bacteria youÆre consuming, on food that has been dropped, and if the five-second rule is valid. Specifically, we wanted to know if the type of food dropped and the surface itÆs dropped on have an impact on the results.

We hypothesized that the amount of bacteria transferred to food would be small enough that the foods would still be ôsafeö to ingest. To test this hypothesis, we dropped a chocolate bar and raw hot dogs on different surfaces such as: a hardwood floor, a carpeted area, and the gymnasium floor for a total of five seconds. We included a control that was not dropped for each food type. We swabbed the food surfaces with a sterile swab that had been dipped in saline, and used it to swab the surface of a nutrient agar plate. We incubated the plates at 37 degrees Celsius for 48 hours.

We found that carpet transferred the most bacteria to both foods. The hardwood floor transferred the second most to the chocolate bar, and the gymnasium the second most to the hotdogs.

We concluded that the five-second rule is not hard-and-fast, it depends on the moisture content of the food and the absorbency of the surface itÆs dropped on.

NAME(s) **Juliet Hassenberg** PROJECT NUMBER **B13**

SCHOOL Mater Christi School GRADE 6

TEACHER Mark Pendergrass

PROJECT TITLE **Cocoa: Miracle Plant Grower?**

ABSTRACT

This experiment is testing to see if cocoa increases plant growth. Cocoa beans grow in lush, tropical environments. Does the cocoa contribute to the lush environment that it grows in or does it need that specific environment to thrive? What was learned while doing background research was that plants are a very important source of medicine. The chemical properties in raw organic cocoa are known to be very beneficial to humans and can be found in supplements and extracts. A diet rich in raw cocoa improves heart function and the immune system. ItÆs also the food highest in flavonoids which helps to improve our moods. Since cocoa has amazing health benefits, it was hypothesized that additional cocoa in soil will help plants grow larger and healthier. The testing procedure for the experiment included 18 radish seeds split up into three groups. One group of radishes had cocoa bean extract added to their water daily. The second group had organic cocoa powder added daily, and the remaining group had no additives. After one month the seeds were measured in millimeters. The average height for each group was recorded in the bar graph. The factor that affected the data collection was searching for the cocoa bean extract at local markets for the experiment. This reduced the amount of time used for testing and therefore the seeds were planted before the testing began. The data indicated that cocoa does not improve plant growth because the no additive group had the tallest average plants. This may be due to certain factors such as cocoa extract concentration and cocoa powder processed with an alkali. Further testing with different materials would need to be done to confirm if hypothesis is valid.

NAME(s) **Luke Hawley** PROJECT NUMBER **P12**

SCHOOL Main Street Middle School GRADE 8

TEACHER eli rosenberg

PROJECT TITLE **Does the Length of a Lacrosse Shaft Affect the Distance a Lacrosse Ball Can be Thrown?**

ABSTRACT

My project relates to lacrosse and physics. Does the length of a lacrosse shaft affect the distance a lacrosse ball can be thrown? I predicted that the longer shaft would throw the ball further than the shorter shaft. To figure out if this was true, I created a catapult that would grip the shaft and give me accurate results.

I thought that to get reliable results, I would have to do around 40 tests for each shaft. I tested the short shaft (3Æ) first. After measuring and recording the 40 trials, I switched to the longer shaft (6Æ). This procedure seemed to work the best for my experiment and I was very successful.

The data I collected was exactly what I thought it would be. The longer shaft had a longer throwing distance over the shorter shaft. The average throwing distance for the longer shaft was 11.08 yards. The average for the shorter shaft was 10.28 yards. Looking at charts 1 and 2, you can see that the longer shaft threw farther most every time.

NAME(s) **Jodi Hayes**

PROJECT NUMBER **P13**

SCHOOL Missisquoi Valley Union Middle/High School

GRADE 12

TEACHER Dana Maria Dezotell

PROJECT TITLE **Automated Dog Feeder**

ABSTRACT

The intent for my project was to create an automated device that would allow my dog (Ella) to be fed throughout the day while making sure she doesn't overfeed herself and so the feeding cycles can be customized. I chose to do this project because Ella will drag her food and water dish all over the kitchen floor when she has no food, that causes water to spill all over. I designed this prototype using 100% recycled materials and a Parallax Boe-Bot robotics micro-controller with an infrared sensor, and servo. I used my laptop and the Parallax BASIC stamp editor program to write code for the circuit to run the servo once every hour whenever my dog was near the infrared sensor. The optimum data turned out to be that one rotation of the servo-actuated feeder dispensed an average of 62.88 grams of dog food. An average feeding served manually is 98.3 grams served four times a day (393.2 grams total). The total amount of food that comes out of the feeder in six feedings is between 410 grams and 390 grams. Ella is now able to get food regularly throughout the day without overfeeding or making a mess.

NAME(s) **Zachary Hayes**

PROJECT NUMBER **S12**

SCHOOL Milton Middle School

GRADE 7

TEACHER Nathan Caswell

PROJECT TITLE **Music and Reaction Times**

ABSTRACT

People enjoy music while doing activities like playing video games, playing sports or even driving. If their reaction time slows, the consequence could be fatal. I created an experiment to see which music genre affects reaction times. The genres that I tested were rock, pop, country and control (no music). I predicted that the rock genre would produce the fastest reaction time. Studies show that rock made people feel more aggressive. This aggressive feeling could make people more focused and reflexive, causing their reaction time to quicken.

To test my theory, I designed and coded my own app. The app timed how long it took for the test subject to press a button that randomly appeared on the screen. I tested all 10 test subjects twice on each genre. I chose a quiet room to do the experiment and took one person at a time so there was as few distractions as possible. The test subject put the headphones on then selected which ever genre I told them to. They listened to the music and when the button popped up they would tap it as fast as possible. They then read back the time to me so I could record it.

When I found the mean of each data set, I found that the rock genre gave the fastest reaction time, and country gave the slowest. Then, I found the fastest and slowest genre was for each test subject. The mode of the faster set was no music, and the mode of the slower set was country. I can now say that country was definitely the slowest. I can not make an accurate conclusion of what the fastest genre of music was because the mean suggests rock, but the mode suggests control.

NAME(s) Rachel Hebert

PROJECT NUMBER C06

SCHOOL Frederick H. Tuttle Middle School

GRADE 7

TEACHER Amelia Lutz

PROJECT TITLE **The effects of different baking pans on the size and color of cookies**

ABSTRACT

This investigation studied the effect a nonstick coating of baking sheets has on baking cookies. My hypothesis is: if the pan has a coat of Polytetrafluorethylene then it will cause the cookies to be darker than cookies baked on an uncoated pan.
Using pre-made cookie dough each cookie was 19 grams and baked at 350 degrees for 14 minutes. Once removed from the oven they cooled for 4 minutes on the baking sheet. The cookies were observed on both sized for color and measured. After repeating the process three times, the results showed that the cookies on the pan coated with Polytrafluorethylene were darker and larger than the cookies baked on the uncoated pan. The cookies on the uncoated pan had a 6.6 cm diameter, the cookies on the coated pan had a 7.3 cm diameter.
Based on my research, I believe the reason the Polytetrafluorethylene made the cookies darker is because of friction. The Polytetrafluorethylene coating removes friction from the pan. This causes the cookies to spread out more on the nonstick pan resulting in thinner cookies which would cook faster and become darker in the same amount of baking time. The coefficient of friction in polytetrafluorethylene is very low, meaning it is one of the slipperiest substances in the world. One reason the coefficient of friction is low is because the fluorine tightly bonds with the carbon, causing it to repel molecules that touch it.
My hypothesis is partially correct because my results showed that the pan coated with Polytetrafluorethylene made cookies darker than the uncoated pan, but I did not know the cookies would be different sizes. I believe these are the reasons the cookies baked differently.

NAME(s) Olivia Hennessey, Juna Nagle

PROJECT NUMBER GP03

SCHOOL Main Street Middle School

GRADE 7

TEACHER Eli Rosenberg

PROJECT TITLE **Vermicomposting-Which Food Group Composts with the Best Quality?**

ABSTRACT

We started with a question. What food group composts with the best quality. In the end we hope to find that one composts significantly better than the other. We think that the fruits food group will have the best soil. We think this because fruits contain the lots of vitamins and nutrients.

Over a course of 51 days we will take a look at the quality of their compost and record it on a data table. We used red worms to help out with our composting. Also known as Vermicomposting. We recorded data every day on the spreadsheet, gave them water, and fed them once a week. After 51 days of this we took their soil and used a soil testing kit to test for levels of Potassium, Phosphorus, and Nitrogen. If one of the soils had a low level of a certain nutrient we knew that that soil was a lower quality than the others. This is how we got our results.

When we tested our soil the vegetables and fruits have the highest nutrient levels of all of the soils. But the grains had the highest worm count. We found that the fruits and vegetables when composted is good soil for plants that need high nutrient soil, such as phosphorus. But if you need a lot of soil you should use grains because they produce more worms which equals more soil.

NAME(s) **Rachel Hill**

PROJECT NUMBER **B14**

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Growth of genetically modified drought-tolerant corn: Is it better than organic corn grown**

ABSTRACT

There is incomplete and varying data on the success of genetically modified corn versus organic corn that led to the thought of this experiment.
It is hypothesized that the genetically modified drought-tolerant corn seeds will not perform more successfully than the organically grown corn when there is low water and it is expected that the two species to perform at a fairly equivalent level.
This experiment is important to determine if drought-tolerant GM corn seedlings are better able to withstand drought stress than organic corn seedlings.
There were 20 organically grown seeds and 20 genetically modified seeds incubated to germinate before being planted in small pots to grow for a week and then replanted in bigger pots to begin the experiment, 10 plants of both categories were given 10 mL of water every 3 days while the other 10 plants were given 50 mL of water.
The preliminary data indicates the hypothesis holds true and the genetically modified seeds are performing with the same proficiency as the organically grown seeds.
In the future, more experiments need to be done with these same seeds but preferable with less or more water given to both the low and well water plants.

NAME(s) **Makenna Hodgdon**

PROJECT NUMBER **S13**

SCHOOL Windsor High School

GRADE 9

TEACHER Raina White

PROJECT TITLE **Did you Say Cookie?**

ABSTRACT

The purpose of this experiment was to see what flavor, from a selection of uncommon flavorings, is the easiest to distinguish in a sugar cookie. I decided to research this question because I enjoy baking and believed that it would be easy to recruit the participants.

The flavorings used were watermelon, cherry, and strawberry. The hypothesis was that cherry would be the strongest flavor to easily distinguish. They were all from the same brand and concentration, so there wouldnÆt be different variables in the flavoring. Participants sat down at a table and got handed the cookies on plates one by one. When you eat something, the taste can linger in your mouth until you cleanse your mouth palate. Water turned out to be the best cleanser for that. Participants cleaned out their mouth palate with water between cookies so they had a fresh taste. During the tasting, the participants filled out their results in a survey.

The results show that 90% of people could taste the control cookie, which had no flavoring in it. 33% of people could overall tell that it was strawberry, 83% of people could distinguish the cherry flavoring and lastly, 46% of people could distinguish the watermelon flavoring. Of the 3 flavors tested, cherry was the flavor that was the easiest to identify, which supports the hypothesis. Future testing should explore more flavorings with a wider variety of people.

NAME(s) Nathan Hoffman
PROJECT NUMBER B40
SCHOOL Northfield Middle High School
GRADE 11
TEACHER Shane Heath

PROJECT TITLE **The Abundance of Microbial Growth on Frequently Used Unsanitary Surfaces**

ABSTRACT

Bacteria can be very harmful and a common form of bacteria to grow in places like high schools is E. coli. E. coli can be a very dangerous bacteria to humans and other animals, and it is important to disinfect areas with high bacterial loads in public areas to reduce the likelihood of transmission. The purpose of this experiment is to observe and show the abundance of microbial growth of germs like E. coli on highly used surfaces that are uncommonly cleaned. In this experiment, eight surfaces were selected because of two factors: Likelihood of being unsanitary and commonality of use. The surfaces were put into four categories based on their frequency of use and frequency of being cleaned. The 8 surfaces selected are a hockey helmet, the door handle to the school administrative offices, the cover of a popular book, the buttons on a vending machine, the enter button on a copier machine, car keys, a credit card, and the handle on a locker. My prediction was that the hockey helmet and the door handle will be the two surfaces that the highest abundance of bacteria growth because they have a high frequency of use and a low frequency of being cleaned. My data showed that the 8 surfaces swabbed grew a range of 3 to 200+ colonies of bacteria, they ranged in a percent coverage of 5% to 100% covered, as well as an average size of colonies from 0.10 centimeters to 0.83 centimeters. Of the data collected, the most striking of observations was that the hockey helmet had 200+ colonies, 99% coverage, and an average of 0.56 centimeter size colonies and that the door handle had 200+ colonies as well, 93% coverage, and an average colony size of .78 centimeters. This data supported my hypothesis that those two surfaces would have the highest abundance.

NAME(s) Lauryn Holsopple
PROJECT NUMBER M02
SCHOOL Milton Middle School
GRADE 8
TEACHER Janet Smith

PROJECT TITLE **Soccer Stats Kick Grass**

ABSTRACT

Currently, professional sports utilize mathematicians and data specialists to determine how data could be used to influence coaching strategies and determine playing styles. The goal of my inquiry was to examine data collected during the 2014 National Women Soccer League season and determine if specific correlations exist between the data sets and statistics that might be predictors of certain outcomes.

I compared a number of factors; for example, how the number of fouls a player suffered in a game relates to the number of fouls a player committed in a game. After plotting the corresponding statistics, I determined the line of best fit using the formula for a linear equation I used data from the previous season to attempt to predict correlating values which were then compared to actual values. The percentage difference between the predicted value and the actual value were determined. I was able to find relationships between some of the statistics, such as the number of shots taken versus number of shots on goal. However, I was not able to use my equations to accurately predict correlating statistics.

The results of my analysis do not indicate that soccer statistics can be predicted accurately. I am analyzing the data set further using the chi squared goodness of fit test. This may help to determine if, and how well, the values compared fit a specific pattern. It would be interesting to see whether this method of analysis would provide different results when looking at individual team rather than league statistics. This may indicate that correlations exist within specific teams based on individualized methods of coaching and styles of play.

NAME(s) James Hope

PROJECT NUMBER G04

SCHOOL Missisquoi Valley Union High School

GRADE 12

TEACHER Dana Maria Dezotell

PROJECT TITLE **Oil Removal from Water**

ABSTRACT

My science fair project was on removing oil from water using many different materials. I did this project because it interested me why we haven't tried many different ways to clean up spills that have happened in the past thirty years. This shows as we used the same technique for the BP Spill as was used for the Exxon Valdez spill in 1989. It interested me which raw materials could be used successfully to clean up these spilled. The one factor that was also in play was money, as finding an inexpensive material that was also successful would be key. In the experiment I used the same amount of oil and water for each trial to keep the results even. I tested the amount of oil removal using cotton, hey, oil-eating bacteria, and tree bark. These were my controlled variables. My dependent variable was the amount of oil absorbed. Along with this, my independent variable was the substance used to absorb the oil. To further my project I would like to get 3-4 different kinds of septic tank cleaner that has oil eating bacteria in it to test on the oil and determine which removes oil the best. I have yet to perform this experiment so my results are not currently present.

NAME(s) George Huffman

PROJECT NUMBER G05

SCHOOL Mater Christi School

GRADE 6

TEACHER Mark Pendergrass

PROJECT TITLE **Lowering the Viscosity of Oil**

ABSTRACT

The science fair project titled, ôVarying the Viscosity of Oilö measures the relative effectiveness of several techniques used in the energy industry to increase the production of oil. The experiment simulates one aspect of current methods used to improve the productivity of oil wells in the United States. The technique of injecting water and additives into the ground is controversial; putting detergent into the ground may contaminate our water supplies. The experimental part of the project involved pumping soybean oil out of a spray bottle containing aquarium gravel and the oil. Soybean oilÆs viscosity is similar to typical crude oil. The independent variable was the fluid used to enhance the extraction of the oil. The dependent variable was the amount of oil produced. After setting a standard by pumping plain (non-stimulated) oil, water in three different states was added to the oil in the reservoir, pumped, and measured. The fluids produced sat for ten minutes in a graduated cylinder until they were fully separated. The process was repeated and recorded three times for each independent variable. It was hypothesized that adding 150 milliliters water heated to 54 degrees centigrade to the reservoir of soybean oil would stimulate the production of the most oil. Results showed that adding a mixture of 150 milliliters of water and 10 drops of detergent produced the most oil. The stated hypothesis was incorrect.

NAME(s) Colton Hulce, Benjamin Becker
PROJECT NUMBER GP33
SCHOOL Big Picture South Burlington
GRADE 10
TEACHER Jim Shields
PROJECT TITLE How does food color impact taste?

ABSTRACT

The purpose of this experiment is to determine if there is a correlation between how humans perceive taste and how a food appears. The experiment was carried out on high school students (9th - 12th grade). The procedure consisted of providing the subjects with the same sample food (mashed potatoes) of varying colors (red, blue, green). The subjects were then asked to try each sample and determine which sample tasted best. While the study is incomplete at this time, the data suggests that subjects will find certain samples to have a ôdifferent tasteö than other samples. However, the experimenters hypothesized that some subjects would find certain colors to be more appealing than others thus tasting ôbetterö. The future implications for this experiment are that the data results could be utilized by producers of food, other than that the provided data could be of another source for future research.

NAME(s) Ava Hultgren
PROJECT NUMBER B15
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton
PROJECT TITLE

ABSTRACT

This experiment studies the bacteria and pathogens on cells phones of high schools students ranging in she from 14 to 18. It was hypothesized that when tested, the phones of males would have more bacteria and pathogens on them then the phones of females. Many studies have been taken about the bacteria and pathogens on household objects, door knobs, computers, countertops and they have found these surfaces have many kinds of bacteria and pathogens. Common places such as countertops, purses, and pockets are where cell phones spend most of their time. Experimentation showed many different kinds of bacteria and pathogens on the phones. The earpiece and home button on iPhones only were tested. Data has yet to be completed at this time. However based on the amount of bacteria found on the phones at this time it is known that cell phones are not clean. Many, many colonies grew from each of the phones that were tested. Errors could have occurred while swabbing the cell phones, a swab may have previously been touched contaminating the sample. However each sample was taken very carefully and with precision. In conclusion data is preliminary and will continue to be studied.

NAME(s) Tate Hurd, Ethan Rhoad
PROJECT NUMBER GP41
SCHOOL Windsor High School
GRADE 9
TEACHER Raina White

PROJECT TITLE **The Effect of Aromatic Food on Decision Making**

ABSTRACT

The purpose of this experiment was to determine if the aroma of popcorn affects decision making towards snack choice. Restaurants, such as those providing fast-food products, can increase the fragrance of their products to draw more people in therefore increasing their business. The hypothesis of this experiment was that a participantÆs desire to eat popcorn over other foods is affected by the smell of the popcorn.

In this experiment, the 36 participants were made up of three classes in two classrooms, consisting of 10th to 12th graders. On the first day of trial 1, participants were given three choices of snack foods: pretzels, chips, and popcorn with no aroma. The popcorn had no aroma because it was cooked earlier in the day. The participants were given a cup, asked to choose a snack and their choice was recorded. On the second day the same group was offered the same snack choices, but this time the aroma of the freshly cooked popcorn was present.

On the day when the popcorn had no aroma, 17 percent of participants choose popcorn. In comparison to the day with aroma 49 percent of the participants choose popcorn. The hypothesis was consistently supported through all of our trials. We plan to conduct more trials to have a larger data set.

In conclusion the results indicate smell has a big impact on making snack food decisions.

NAME(s) Casey Husband, Abigail Millard
PROJECT NUMBER GP05
SCHOOL Windsor High School
GRADE 11
TEACHER Catharine Engwall

PROJECT TITLE **The Antibacterial Effectiveness of Combatting Escheria coli (E. coli) with Numerous Spices**

ABSTRACT

Although Escherichia coli is oftentimes regarded as an extremely harmful bacteria, it can usually be treated and prevented with basic modern sanitary habits. Therefore, E. coli is a bigger problem in countries that do not have this type of sanitation, water testing capabilities, or organized response methods. This problem can be addressed using a simple method that reduces chances of infection and uses a countryÆs existing natural resources, such as spices. Stronger spices like cinnamon and numerous peppers have demonstrated antibacterial properties in previous studies. This experiment tested ten different spices; cinnamon, allspice, cloves, garlic, cilantro, bay leaves, black pepper, cumin, curry, and cayenne; both individually and in combinations of two, to find which were most effective in preventing E. coli growth. It was hypothesized that cinnamon, garlic, and cayenne would be most effective in preventing growth because they had demonstrated the greatest bacterial resistance in previous studies. The spices were infused into the agar that the bacteria was grown on and growth was observed, counted, and compared after twelve hours. As hypothesized, cinnamon and garlic were effective in preventing growth, but cloves were as well. Cloves were the most effective of the three, preventing growth completely. Cloves also demonstrated the ability to prevent the formation of biofilms. The bacteria grown with cilantro and cayenne formed biofilms, however when either of these spices were combined with cloves, biofilms did not occur. Applications include the use of cloves and other effective spices in food preservation, cooking, and kitchen sanitation. This would be an effective, but also an affordable and widely available method for combating E. coli. Currently, more trials are underway to ensure the consistency of results. Future testing may include a greater range of spices or the use of effective spices, such as cloves to kill existing colonies of E. coli.

NAME(s) Cody Hyldburg

PROJECT NUMBER P14

SCHOOL Milton Middle School

GRADE 8

TEACHER Janet Smith

PROJECT TITLE **Citrus Fruit Battery**

ABSTRACT

Fruits are not just good for keeping you healthy, they are also good for creating electricity, or are they? If you take zinc nails, copper wires, connectors, and citrus fruit, you have the materials to light up an LED light bulb. When you stick zinc and copper electrodes into opposite sides of the fruit, the copper takes electrons from the zinc, traveling through the wire. Since the copper now has more electrons it needs more protons. Protons are too big to go through the wire so they travel through the citric acid in the fruit. When multiple fruits are connected with wires and then to a LED light bulb, I discovered that all of the fruits worked together to light up a bulb.

Electricity is created when the electrons travel from zinc to copper of different fruits, which causes a chain reaction. Curious about which fruit was the best to use, I used a volt meter, which measures how many volts are in a fruit. Each citrus fruit had an average of .86-1.00 volts and my light bulb needed 5.6 volts to light up. The mango had the most voltage at 1.00 volts, whereas the lime had the least at .87. I discovered that although citrus fruit can help produce electricity, the LED light bulb does not take many AMPS. when you use a lamp light you would need more AMPS, and fruit does not have many of. So I would not recommend it as a light source.

These findings bring up the possibilities of fruit as alternative energy source on a small scale Millions of pounds of fruits are thrown away on a daily basis in the US. In addition, fruit growing developing countries without the modern convenience of electricity could possibly plug into a mango!

NAME(s) Chelsey Jewett, Brooke Ziemba

PROJECT NUMBER GP28

SCHOOL Missisquoi Valley Union High School

GRADE 9

TEACHER Dana Maria Dezotell

PROJECT TITLE **Light Sensors Make Movement and Sound**

ABSTRACT

We created two separate robots to solve two problems. We know that senior citizens with certain health conditions such as arthritis are not able to live alone because they couldnÆt do simple activities. We wanted to create a robotic hand that would be able to do the activities that they were not able to do themselves. The second problem that we wanted to solve was burglar alarms that were too big and noticeable by the intruders. We wanted to create an alarm that was small enough to be hidden but big enough to detect intruders. Our hypothesis was we thought that we would be able to make simple machines that would do a task depending on the code programmed in the computer. In order for our experiment to work, we had to insert a specific code also known as PBASICS, into a computer program. We had to be very specific because if we didnÆt put the exact code in we would get a whole different reaction or no reaction at all. We got most of the codes from a robotics book and from Mr. Daly. We were successful in our experiment because we were able to make simple designs and have them work efficiently without any problems. This was very worthwhile because we made these robots in order to help people. If we were to make our robots better we would try to make them more advanced by adding more equipment and having them be able to move with more ease.

NAME(s) Abby Kaija

PROJECT NUMBER G06

SCHOOL Woodstock Union High School

GRADE 11

TEACHER Jennifer Stainton

PROJECT TITLE **Drain Contamination in the Ottauquechee River Watershed**

ABSTRACT

Over the years, water quality has progressively surfaced as a global and local environmental issue. Water is the sustenance of all living creatures and without clean water agriculture and other economies would cease to function. Testing the Ottauquechee Watershed will give the community a greater perspective on how much pollution Vermonters are contributing to the worldÆs water system. Of the many water pollutant indicators, I chose to evaluate river health through orthophosphate, nitrate, nitrite, and pH because the increased levels link directly to man-made source pollution. I tested seven drains flowing into the Ottauquechee River and hypothesized that the drain water would be more polluted than the river water due to landscape position and inadvertent contamination from the populous of Woodstock.

After receiving a grant from The Vermont Community Foundation, I purchased two Hach water quality test kits and a narrow range pH kit. Using these tools, I repeatedly collected and tested water samples from seven different sites. My data, however, lacked cohesive agreement. My tests indicated varying amounts of pollution depending on the locations of each drain. Due to the results I obtained, I was unable to support my hypothesis. In spring 2015, I plan on continuing my experiment and testing the same sites because results will still benefit the community. There are a number of possibilities as to why my data appears inconsistent; my steep learning curve using the test kits, the variable weather events the day before sampling, and the potential error in reading the color scales of test kits. Through the course of my experiment, I became increasingly aware of water pollution in my community and learned a great deal more about the scientific process.

NAME(s) Toni Kail, Emily Greenstein

PROJECT NUMBER GP40

SCHOOL Big Picture South Burlington

GRADE 10

TEACHER Jim Shields

PROJECT TITLE **Conformity in Teenagers**

ABSTRACT

The experimenters modernized and re-attempted the already famous conformity experiment by Solomon Asch with a group of teenagers to analyze and compare results with the group of college students studied in the original experiment. The experimenters postulate that more than likely the participant being tested will conform to the rest of the group in a setting where the whole confederate group agrees on one response. The experimenters brought unaware participants into a room to see if they conform to the actors in what they think is a ôvisual perception test.ö Preliminary data predicts that on average one third (32%) of the participants conformed with the clearly incorrect majority on the critical trials.The experimenters postulate that the majority of the participants will indeed conform to the confederates in the settings where the whole confederates group agrees on one response.

NAME(s) Nathan Kakalec

PROJECT NUMBER M03

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **A Computer Model to Project the Outbreak of Agrilus planipennis in New Hampshire**

ABSTRACT

The purpose of this experiment is to create a computational model to project the path of the current outbreak of Agrilus planipennis (emerald ash borer) in New Hampshire. It was projected that a model could be created with an accuracy level of roughly 80%. Each model is based on a set of variables including distance from current outbreak, human population size, likelihood of wood transportation, average temperature and ash tree coverage. Each variable has a designated a weight pertaining to its overall importance in the model. The weights of the variables were adjusted during experimentation in order to increase the accuracy of the model. The models produced were tested for accuracy using historical data from the current outbreak of Agrilus planipennis in New Hampshire. The variables and their weights were altered based on the results. The best performing model is able to approximate historical results and project future spread to particular locales of Agrilus planipennis in New Hampshire. The data retrieved from this experiment could be used to help curb the current Agrilus planipennis outbreak in New Hampshire by focusing on detection and eradication in the highest risk areas. The model could also be used to project the chance of infestation for other states, including Vermont.

(Note: All species names should be italicized)

NAME(s) Gabe Katz

PROJECT NUMBER B16

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Effect of Salt Water in Various Concentrations on Lima Beans and Greens Beans**

ABSTRACT

The experiment is testing whether lima beans or green beans are more salt tolerant in various concentrations. It was hypothesized that lima beans would be more resistant to salt. To test this hypothesis, 70 plants were grown, 30 lima bean plants and 40 green bean plants. Each bean species was divided into a control group and four experimental groups, with six plants in each lima bean group and eight in each green bean group. The control group of each bean species was watered with freshwater, while the experimental groups were watered with salt water concentrations of 1.5%, 2%, 2.5% and 3%. In order to limit the variables, each of the beans was planted in the same soil and received the same amount of light and water. After 25 days of testing, the biomass of each of the plants was measured. It will also be noted which plant species appears taller and healthier at the conclusion of testing. The collecting of data is not yet completed, although the preliminary data support the hypothesis. Possible sources of experimental error include data being distorted by a small sample size and plants being watered with a slightly different concentration than intended. The data will be used to determine whether lima beans or green beans are more salt tolerant in concentrations of 1.5%, 2%, 2.5%, and 3% as compared to beans watered with freshwater. The results of this experiment can be used to make decisions about which crops to plant in areas that are known to have salt content in the soil.

NAME(s) **Elizabeth Kennedy**

PROJECT NUMBER **G07**

SCHOOL Missisquoi Valley Union High School

GRADE **12**

TEACHER Dana Maria Dezotell

PROJECT TITLE **Ocean, Pollution and... HAIR?**

ABSTRACT

My science project was for the cleaning of the ocean through organic means without harming the ocean any further. To do this I had to research many topics on not only oceanic pollution, but also in organic and natural pollution reducing/exterminating. I was able to come across a website advertising the use of hair to collect the oil from the ocean. I decided to use this idea as my science project. There are two ways the hair can be used in removing pollution. The first and more simpler way is to collect as much hair as possible and put it inside a nylon sock. the hair filled nylon could then be used to remove the oil on top of the ocean from oil spills. Because hair and nylons are both decomposable, they can be thrown away without harming anything. The second way is to donate the hair to Matter of Trust. They will them use the hair to create hair mats that will be thrown into the ocean. these can collect both the oil on top of the water or collect the oil on the bottom from previous oil spills. the second way is to create a ôhairmatö. A hairmat is basically exactly as the word says, a mat made out of hair. This would be used for collecting the oil on the bottom of the sea floor. I decided to use the first idea because it would more affordable and fast to do. I used tap water to represent the ocean and vegetable oil to represent crude oil that is spilled into the ocean. I then put the nylon filled with hair and left it in there for about 30 or less seconds and when I took it out again, it collected nearly 95% of the oil. I took pictures then and showed them in my science fair project.

NAME(s) **Lindsay Kilbury**

PROJECT NUMBER **C07**

SCHOOL Missisquoi Valley Union High School

GRADE **10**

TEACHER Dana Marie Dezotell

PROJECT TITLE **The Affects of Different Acidic Substances on Steel Wool**

ABSTRACT

I found an interest in the way corrosion affects the lives of many people. The rusting of their cars, the rusting of buildings, ect...This is why I chose to do the effects of corrosion on steel wool based on which acidic substances the wool was submersed in. I wanted to narrow down the liquids that are associated with corrosion, and better understand how it works. I was trying to achieve a high temperature caused by the corrosion on the steel wool. I wanted to at least reach 85 degrees, because that would mean there was a good amount of heat being produced by the reaction of the steel wool and the substance. In this case I did reach 86 degrees when the steel wool was placed and soaked in 100% pure vinegar. It was the highest temperature produced in my entire project. I found that my hypothesis was correct and the vinegar had the largest reaction on the steel wool in the end. Knowing this I can push forward with this research and go bigger with the acids I choose to submerge my steel wool in. I will then create a bigger reaction and achieve a temperature over 100 degrees and maybe even over 150 degrees. This experiment though helped set up the basis for future analysis.

NAME(s) Carissa Kinsman, Dana Fuller
PROJECT NUMBER GP38
SCHOOL Windsor High School
GRADE 9
TEACHER Raina White

PROJECT TITLE **Music and Effects on Duration of Exercise**

ABSTRACT

The purpose of this experiment was to find out if having music play while you are working out improves your performance. We wanted to see if what weÆve heard is true. The hypothesis of this experiment was that the number of burpees completed and the duration of a wall sit would be greater with music playing will be better than the results collected without music playing.

Each participant did a wall sit for as long as they could with the music playing, we had each of the participants hold a stopwatch while they did so. We had them rest for a bit and then had them do as many burpees as they could while having the music playing. We then waited a day and had them do the wall sit without the music playing, while having them hold a stopwatch. We then had them rest for a bit and had them do as many burpees as they could without the music playing. We recorded the results after they completed each task. The control for this experiment is the song we chose, each time that we tested we used the same song, we also made sure that we tested in the same area so that it was the same environment.

The experiment results showed that the average wall sit duration with music playing was 113 seconds and without the music playing was 81 seconds. The number of burpees on average with the music playing was 11 and without the music playing was 7. The results from this experiment supported our hypothesis, showing that when working out it helps to have music.

NAME(s) Dwayne Kirby
PROJECT NUMBER S14
SCHOOL Milton Middle School
GRADE 8
TEACHER Nathan Caswell

PROJECT TITLE **Multitasking and Memory**

ABSTRACT

Nine out of ten teens multitask and do not even realize it. If they are multitasking while learning, are they learning as much? The purpose of my experiment was to find out how well students can remember a number when multitasking. My hypothesis was, when multitasking students will not remember as much. This was because when multitasking, the nerve cell activity in one side of the prefrontal cortex, a part inside the brain responsible for processing information, increases and in the other side decrease. This other side is where the unimportant tasks are being processed.

I tested four students: two males and two females, all 13. They listened to music, played a game that required some math, and tried to remember a number that was 6 digits long. I also tested the same people on their ability to remember a 6 digit number when not multitasking.

As I expected, when the people were multitasking, they remembered fewer digits compared to when they did not multitask. When I compared the data, there was an average two digit loss for both multitasking and non multitasking between 20 and 30 minutes. At 30 minutes, multitasking had an average of 4.25 digits lost, while non multitasking had only an average of two digits lost.

My testing proves that multitasking does have an effect of memory. The longer people multitask, the more information they will lose. My experiment does prove that people can multitask but are not really getting all the information they are processing. This matters to students like me, who like to listen to music while doing work, as they may not be learning as much as they could be.

NAME(s) Nick Knudsen
PROJECT NUMBER B17
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton

PROJECT TITLE **The Sources of Escherichia Coli in Lake Champlain and the Surrounding Watershed**

ABSTRACT

The goal of this research project was to determine the sources of unwanted Escherichia Coli in Lake Champlain and its watershed and find possible methods of subduing them. Most strains of E. coli are not pathogenic, however, certain strains are major causes of foodborne illnesses. E. coli is found in the gut of humans, other warm-blooded mammals, birds, in sewage, food, water, and in other substances such as soil. E. coli is host specific, meaning that each strain is paired with a certain host animal. Even though certain strains of Escherichia coli may not be dangerous, if it is present in high enough amounts, it could signify the presence of other more dangerous microbes. There are no tests currently performed on water from Lake Champlain that can determine the strain, so potentially dangerous bacteria can be going unobserved and unregulated. It was hypothesized that the main source of E. coli in this area would be farm runoff. Samples were taken at six locations, three in Lake Champlain and three in rivers. The samples were plated and then cultured at a lab to produce larger colonies. The genome of E. coli colonies was then sequenced to determine the strain present in each sample. This strain was then used to pinpoint the host in the environment. Data collection is incomplete at this point in the experiment so no final conclusion can be given here.

NAME(s) Olivia Knudsen, Kasie Mills
PROJECT NUMBER GP17
SCHOOL Home School (Randolph Educational Resource Center)
GRADE 8
TEACHER Gina Sweet

PROJECT TITLE **The Quality of Crayons**

ABSTRACT

Our experiment investigates two physical characteristics and their correlation with the quality of crayon brand based on rub-off. We investigated seven different brands of crayons. Our research indicated that the most commonly known and highly praised brand of crayons is Crayola. In Crayola crayons, paraffin wax and color pigment are the two main ingredients used to make them as well as a secret ingredient that is not shared with the public. Our question was: Is there a connection between physical properties and the perceived qualities of brands of crayons? Our hypothesis was: We hypothesize that the better crayons will be denser because they have the most color pigment, and will take longer to melt.

For our experiment, we examined the rub-off of the crayons by briefly coloring with them. From the rub-off, we ranked the crayons according to quality. We determined the density of the crayons using a scale and water-displacement method. We measured the time it took to melt by putting them in the oven and checking them every thirty seconds.

Our results showed that the density of most of the crayons was very similar. We did not find a correlation between density and the quality. If the amount of pigment is related to density, we did not find a correlation. We did find a correlation between melting time and quality. The three highest quality brands, based on the rub-off, took the longest time to melt.

NAME(s) **Jenna Krussman**

PROJECT NUMBER **M04**

SCHOOL Main Street Middle School

GRADE 7

TEACHER Eli Rosenberg

PROJECT TITLE **Which Line Following Algortithm is the Most Efficient?**

ABSTRACT

I think that the turn and move ratio will affect the time and whether or not the robot completes the course. In my experiment, I predict that for coarse one, the higher the move number, and the smaller the turn number will cause the robot to finish, because course one is a straight line, so it won't need to make any turns. The higher the move number, the faster it will get to the other side, causing time to be shorter. However, on courses two, three, and four, I think that the turn number is going to have to be higher in order to make the sharp right and round turns. The quicker and the closer to the line the robot stays will cause the time to be lower, and more accurate.

I started my procedure by used the Lego Mindstorm EV3 Software to find an algorithm that would control a robot on Scratch Programming. After, I used Scratch Programing to create a robot that would be able to follow a line between the two colored background. I made 4 different courses to test the robot on. Next, I changed the move and turn numbers in order to find the best ratio for each of the four courses. Subsequently, I did multiple tests like this, and collected data.
I found that the move and turn numbers affect the time, accuracy, and whether or not the robot completes the course. For course 1, the higher the move number the more efficient the robot. For courses 2, 3, and 4, the turn number had to be significantly higher for the robot to complete the course, because it had to make curved turns or sharp right angles. However, the turn number couldnÆt be to high, otherwise the robot would go out of control.

NAME(s) **Gabrielle Lajeunesse**

PROJECT NUMBER **C08**

SCHOOL St. Francis Xavier School

GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Erasing Permanent Marker○**

ABSTRACT

In my experiment, I tested which solution would work best to remove permanent marker from fabric. In my hypothesis I thought that solvents containing alcohol would be the most effective. I expected these results because permanent ink and alcohol are both non-polar, and a non-polar will dissolve another non-polar.
To conduct this experiment I made ink spots on several fabric swatches with a Sharpie marker. I tested nail polish remover, seltzer water, bleach, rubbing alcohol, lemon juice, vinegar, water, and Dawn solution. I placed drops of one solution on a swatch and waited five minutes. Using a light probe and a Labquest, I measured the amount of light coming through the ink spot. I tested the swatch every five minutes, adding more drops and taking additional readings. After four readings, I scrubbed the swatch and took another reading. I repeated these steps using a different swatch for each solution. After seven days, I took final readings.
My results showed that all ink spots gave darker readings after scrubbing than the original swatches. After seven days all but one ink spot had lightened. However, they all tested darker than the original.
I predicted that solvents containing alcohol would be most effective. Visually my hypothesis was right, because all swatches appeared lighter, especially bleach, rubbing alcohol, and nail polish remover which contain alcohol. The Labquest readings showed all swatches produced darker results than the original. This would imply that the solutions actually made the ink spots darker and not lighter. I was not expecting this, but I think it might have happened because I pushed the ink into the fabric when I scrubbed it. The fabric might have absorbed the ink into deeper layers rather than keeping it at the top where it would be more visible and wash away easier.

NAME(s) **Emily Lang**

PROJECT NUMBER **C09**

SCHOOL Weathersfield School

GRADE 8

TEACHER David E. Lambert

PROJECT TITLE **In A Pinch Penny Power To The Rescue**

ABSTRACT

The problem I chose to study was to see if it was possible to make a battery out of ordinary pocket change. I was interested in something electrical because my dad is in the lighting business. I was looking for something cool, so I looked at different things that generate voltage like potatoes, but the thing that caught my eye was the coin battery. My hypothesis was ôWhat coin, when stacked in a voltaic pile, produces the most voltage? Based on what I found doing my research paper, a voltaic pile using pennies will produce more voltage than voltaic piles using nickels, dimes, and quarters.ö

Here are the steps to make a one cell voltaic pile: First I folded a piece of aluminum foil into a rectangle to use this as my pileÆs base conductor. You will see in my report below I actually started with what I thought were small aluminum bars but they did not work. Then I put some vinegar into a bowl. Next I cut out small square pieces of paper towels. I then placed a piece of folded aluminum foil on the table. Afterward I laid a penny on one end of the aluminum foil. I soaked one square paper towel piece in the vinegar. Then I slightly dabbed off the excess vinegar on another paper towel. I then laid the piece of soaked paper towel on the penny. Next I put a galvanized zinc washer on the soaked paper towel that created a voltaic pile cell. I then created voltaic pile cells in 2, 4, 6, 8, and 10 cell stacks. After the voltaic stacks were created I waited thirty seconds to measure the voltaic piles voltages with a multimeter.

I could not get any voltages to read for my first three voltaic piles. I followed the procedure and re-checked the procedure and then made the first three

NAME(s) **Jared Laroche**

PROJECT NUMBER **G08**

SCHOOL Missisqoui Valley Union High School

GRADE 10

TEACHER Dana Maria Dezotell

PROJECT TITLE **Purifying Water with Coffee Grounds**

ABSTRACT

For my science fair project I purified water with coffee grounds. I used this project to try make water purification easier in areas where itÆs needed. The United States uses a lot of coffee each year. If we collected amounts of the used coffee grounds, we can make peopleÆs lives easier in underdeveloped countries. The pond water is the dependent variable while the coffee grounds are the dependent variable. Distilled water was the control. First I tested the water for different contaminants, such as metals, pH, hardness. After testing the pond water, I discovered that the CaCo3 ppm decreased along with the pH. The water was slightly discolored and smelled of coffee. I was surprised seeing that the coffee grounds decreased the hardness and the pH of the water. This method could be used in Africa for purifying water by using an inexpensive method of filtration with coffee grounds.

NAME(s) Austyn Larson
PROJECT NUMBER B48
SCHOOL Windsor Middle School
GRADE 7
TEACHER Owen Campbell

PROJECT TITLE **What is the Effect that Age and Activity have on Asthma?**

ABSTRACT

○My science fair project is on the effect that age and activity have on asthma. This is a worthwhile project because of all its medical benefits. I hypothesized that middle aged adults would not fare as well as the younger kids I tested because they are not as active as kids. In my study I tested 3 asthma patients and 3 non-asthma patients. Each group consisted of 1 adult, 1 teen, and 1 kid. The person representing the adult/teen/ or kid in each group was the same age and had the same activity level a week. Each participant was asked to perform the same activities on different days. I then tested their lung capacity. I found that growing kids have a good lung capacity but teens are at the peak of a person's lung capacity. Unfortunately, as our lungs age our lung capacity becomes smaller.

This project is important to me because I have asthma and it has been in my family for years. Asthma is a genetic diseases that makes it harder to breathe when the trachea tube contracts. My project would help for those who have asthma. By identifying possible risk, an asthmatic person would be able to use their inhalers at just the right moment.

○If I were to do this project again I would definitely need more people so I could get stronger results and I would like to know the comparison of a non-active asthma patient versus active asthma patients.

NAME(s) Laura Lazzaro
PROJECT NUMBER P16
SCHOOL Milton Middle school
GRADE 8
TEACHER Nathan Caswell

PROJECT TITLE **Sunny Solar Panels**

ABSTRACT

The purpose of this experiment is to see if the amount of volts generated changes when a solar panel is at different angles.

Having the right angle would matter so that the solar panel can produce the best amount of volts. I thought this because if you keep a solar panel at the same angle you will not get as much volts as you would adjusting the angle towards the light. I noticed that all of the pictures of solar panels all faced towards the sun. I thought that if a panel directly faces the light it will generate more volts. In order to test this I attached a solar panel to an adjustable stand that could pivot. I marked four angles (90, 60, 40 and 20 degrees) using an angle ruler to capture the angle of the panel. I then positioned a desk lamp over the solar panel to act as the sunlight. I used a galvanometer to measure the amount of volts produced by the panel at the different angles.

During my experiment I saw that every time I changed the solar panelÆs angle away from the light, the galvanometer would read fewer volts. As I changed angle of the solar panel less light was hitting the panel. The 90 degree angle produced the most voltage and the 20 degree angle produced the least amount and was consistent at any light level. When I increased the brightness of the light the volts got higher.

Based on my results, I now know that 90 degrees is the best angle to position a solar panel for producing the most power.

NAME(s) Nathaniel Lefebvre

PROJECT NUMBER P17

SCHOOL Missisqoi Valley Union High School

GRADE 10

TEACHER Dana Maria Dezotell

PROJECT TITLE **Electromagnetic Radiation from Portable Electronics**

ABSTRACT

This project was to find out the radio frequency given off by portable electronic devices. You're very likely have a cellphone on you right now. Every electronic device gives off a form of radiation. I studied Radio Frequency that was given off by different portable electronic devices. I needed an insulated room that would keep out background readings. Also, I need a Radio Frequency Meter and portable electronics that are used everyday. I went to University of Vermont to get the results because they had an insulated room with a Radio Frequency Meter, but the room was not completely insulated, so we got readings which were the background readings. The readings that I recorded were readings that were given off by the electronic device turned on. The result that I obtained that surprised me the most was when I turned on a Samsung⌐ Flip-Phone, we couldn't pick up the readings because they were hidden in the background readings, but when we turned on a the camera program, we got very clear readings. 1160 MHz was the highest reading that was recorded when the camera program was running. My Science Fair project really helped me see that these devices were giving off large readings, some being over 1 GHz. I did meet my objective, but now I have an even greater question. Is there a way that is effective, but not expensive that will limit the amount of Radio Frequency given off by devices?

NAME(s) Niko Lekkas, Elijah Vincent

PROJECT NUMBER GP04

SCHOOL Christ The King, Burlington

GRADE 6

TEACHER Vidula Srivastava

PROJECT TITLE **The Unseen Majority**

ABSTRACT

The purpose of this study was to investigate the effect of microorganisms in soil, on plant growth.

Microorganisms provide important services such as nutrient cycling, disease suppression and water dynamics.

This study investigated if the plant soil system requires the presence of microorganisms for optimal growth or can the plant growth be sustained by just the presence of nutrients.

For this study top soil was sterilized and was combined with compost, general fertilizer and commercially available microorganisms to create the different types of soils.

Soil trays were planted with spinach or bean seeds at 7.5cm apart and were grown using a plant growth chamber .

Our data suggests that compost added to the soil created a significantly healthier plant.

The results from this study show promising use of sustainable farming in a time where modern farming practices rely heavily on the use of fertilizers for plant growth.

Using compost is economically viable, healthier for humans who consume the plants and the farmers who grow them, and most importantly protects our environment from increased use of agrochemicals

This alternative method of cultivating can be used as a basis for an economical model that can benefit not only developed countries but also developing countries by providing opportunities to develop a sustainable farming industry.

NAME(s) **Magda Lelito** PROJECT NUMBER **C10**

SCHOOL St. Francis Xavier School GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE **Blow Out!○**

ABSTRACT

The purpose of my science fair project was to determine if windspeed affects the speed at which a candle burns at. I chose to do this project because if you have a draft in a room, where candles are burning, most people say that adding more air in the room makes candles burn faster. So I did this experiment to see if that thought is true.

When I started researching I saw the different sizes of the candle and the wick can also effect how quickly the candle burns. I chose Plumber's candles because they have a medium sized wick and candle, in all. Too many variations of candles would throw off my data.

I thought that the candles burning with the fan on would burn quicker. To test this experiment, I got 13 candles, one was a tester. I put them into groups and the first group burned without a fan. The next groups all had the fan on but, the second group was 7 feet away from the fan. For the next two groups I doubled and tripled the distance away from the fan. The doubled distance was 14 feet, and the tripled distance was 28 feet.

My data shows that group 2, the candles closest to the fan, burned the quickest. They burned much way faster than the groups of candles that were farther away from the fan. Candle group 2, burned almost 4 grams more than the group without the fan on.

Based on my results, my hypothesis was correct. Wind speed affects candles and how quickly they burn, so if you have a draft prone room, get bigger candles so they won't burn off to quickly, or solve the problem and block the drafts, so your candles won't burn faster than they normally do.

NAME(s) **Patrick Lepsic** PROJECT NUMBER **P18**

SCHOOL St. Francis Xavier School GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Magnetic Force○**

ABSTRACT

My science fair project determined how pipe diameter affects the fall time of a spherical magnet. LenzÆs Law states that if an induced current flows, its direction is always such that it will oppose the change which produced it. The spherical magnet falls more slowly than it would outside the pipe because the magnetic field creates a current in the conductive pipe as the magnet falls.

Hypothesis: If the diameter of the copper pipe increases then the fall time decreases. I think the magnet will fall faster in a wider pipe because the induced current is smaller, which in turn makes the opposing magnetic force smaller.

To investigate my hypothesis I built a frame that held identical lengths of varying diameter copper pipe. I dropped a spherical magnet down each pipe completing ten timed trials and calculating the average fall time for each pipe. One of the problems I had with my experiment was that the starting holes were too big so the magnet would sometimes hit the copper pipe rather than dropping cleanly. This had the potential to affect my data, so I decreased the hole diameter with popsicle sticks. This revision to the experimental frame resulted in clean releases for each trial. Occasionally, I had a mistrial when the photogates moved out of position. Those trials were repeated to obtain clean data. The standard deviation between trials shows that my data for each pipe diameter is consistent and therefore valid for fall time comparison between pipes.

My Hypothesis was clearly supported by the results of my experiment. The spherical magnet fell faster as pipe diameter increased. The magnet falls faster because the induced current is smaller which in turn makes the magnetic force smaller. The smaller the magnetic force, the faster the spherical magnet will fall.

NAME(s) **Chris LLanos**

PROJECT NUMBER **P15**

SCHOOL St. Francis Xavier School

GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE **Good Morning Sunshine!○**

ABSTRACT

With increased interest in solar panels and their environmental and economical benefits, residents of cold, snowy climates, are unsure whether to make the investment. My project is whether solar panels subjected to the effects of winter, produce the same amount of energy output as a solar panel would during the summer months. This project consisted of 6 different tests 3 times each: 2 cups of snow, no snow, cold temperature, hot temperature, 60 degree angle, and 30 degree angle. I predicted in my hypothesis that a solar panel would produce a greater energy output in summertime effects than it would in wintertime.

In my procedures, I used the same multimeter connected to a solar panel 1 inch away from a 120 volt lamp. The variable I changed was topping the solar panel with snow, a cold environment for the panel, and 60 degree angle of the panel for the winter tests. For the summer tests, no snow, a hot environment for the panel, and 30 degree angle of the panel. I saw the results of each test on the multimeter.

According to the multimeter, the angle test's average for summer was about .53 volt more than the angle test's average for winter, 4.99 volts. The snow tests' averages ended with summer ahead by about .11 volt more than winter's 5.46. For the temperature tests, winter was .07 volt more than summer's 5.51333. I proved my hypothesis, but not all of the tests resulted in summer having a higher energy output than the winter. Summer had a lower output, because as the panel increases to high temperatures the energy output declines. While there is differences in panel output, they are only minor. In conclusion, solar panels are not a bad investment, even in the snow.

NAME(s) **Schuyler Lyons**

PROJECT NUMBER **B18**

SCHOOL South Burlington High School

GRADE 10

TEACHER Jim Shields

PROJECT TITLE **Testing the Legitimacy of Binaural Beats**

ABSTRACT

Binaural beats have been gaining rapid popularity and widespread use in recent years, however, many argue that the so called "effects" users feel after listening to a binaural session are non-existent, the perception of their reality brought on by over thinking. In an attempt to discern if there were any legitimate effect brought on by listening to binaural beats, multiple blind tests were conducted with volunteers from the South Burlington High School student base.
These experiments consisted of the volunteers taking two cognitive tests and a playing a focus-improvement app hosted on Apple services that tracks rapid-eye movements and gives the user a ôfocus-ratingö thatÆs determined by their ability to focus on precise small images located on the screen of the Apple device being used. The results of this test showed a (positive or negative) trend (in/not in) favor of binaural beats legitimacy. There was marginal room for error with these tests, the primary area of concern being that the typing tests contained a large percentage of the same words through both tests, meaning users could have had a progressively stacking advantage. In conclusion *statement on end results*

Binaural beats could and most likely will see widespread use in the upcoming years, as the drastically varying beats could aid a plethora of demographics in a variety of ways.

NAME(s) **Jamison Marcoux, Deanna Dowhan**

PROJECT NUMBER **GP15**

SCHOOL Christ the King School

GRADE 6

TEACHER Mrs.Srivastava

PROJECT TITLE **What Makes Ice Melt Fastest**

ABSTRACT

We decided to experiment with the rate of ice melting using different salts.If we determine something that melts ice really fast the we could treat the icy roads better and prevent accidents.

To start this project we collected the following materials:54 cups (3 cups for each hour), a timer,and a variety of salts such as rock salt and table salt. We took the the cups and put 25 ml of water in each of them. We put the cups in the freezer and waited for them to freeze. Once they froze we put 10 milligrams of each salt in each cup. We took the cups and put them in the refrigerator and waited for them to start to melt. After three hours we measured the amount of ice that had melted with a graduated cylinder.We repeated this three times to find an average.

We found that rock salt melted the ice the fastest and that calcium chloride was the next best material for ice melting. This result tells that people should use rock salt to de-ice the roads rather than table salt,epsom salt,calcium chloride or sea salt.

NAME(s) **Margaret Martell**

PROJECT NUMBER **B19**

SCHOOL St. Francis Xavier School

GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Distracted Reactions○**

ABSTRACT

Living in a world full of distractions it's hard for people to be focused. I wanted to find out what distractions actually affected our reaction time instead of just acting like simple background noise that we could block out.

I wanted to see if music, listening to a conversation, or having a conversation would affect people's reaction time the most. I thought that having a conversation would slow them down more than the other two possibilities. I figured this because having a conversation would engage the person more into listening to the one talking instead of the stick being dropped.

I first took a Drop Stick which is a device that has a sensor on it so it records the time from when someone lets go of it to when someone catches it. I had the first person stand across from me and I told them what a Drop Stick was and how to use it. I had them practice twice so they would know how to use it properly. I then started the first test which was controlled so it had no distractions. The second test was music, the third was listening to a conversation and the fourth was having a conversation. In the second, third, and fourth tests I wouldnÆt give them a warning to when I would be dropping the stick. Each of the four tests had five trials.

In the end I did prove my hypothesis by saying that having a conversation with the people would slow them down the most out of the four tests. Only one person dropped it and only in one trial. The stick being dropped didn't affect my results too much. Other than that one flaw my experiment went well and was very well controlled.

NAME(s) **Paitra Martin**

PROJECT NUMBER **P19**

SCHOOL Woodstock Union High School

GRADE 11

TEACHER Jennifer Stainton

PROJECT TITLE **Does Gas Type Impact Basketball Bounce Height?**

ABSTRACT

Basketball is one of my favorite sports to watch and to play, and over the years curiosity has gotten the best of me, triggering one essential question; how would the height of a basketball be affected by the gas that is in it? To find an answer, I started by finding the bounce of a normal basketball, filled with air which is mostly nitrogen mixed with a few other gases. A local company called Airgas kindly filled three different basketballs with Argon, Helium and Carbon Dioxide. After filling the balls I made sure each weighed 1.2 pounds. I then dropped them from my hip height, 98 centimeters, filmed the results, and put them through a slow motion computer program to compare the height of the bounces, ultimately comparing them to the air filled basketball. The results were not what I predicted. I hypothesized the basketball filled with Helium would bounce the highest because of the effect Helium has in a balloon, making it float. But this didnÆt happen. Once I analyzed the data, I found the basketball with Helium had the smallest bounce. To conclude, I came up with a few ideas about why this would happen. One idea is that Helium molecules are smaller so more of them can pack into the ball, making them have less room to bounce off the walls of the ball and more opportunity to create friction. Another idea is that the different molecules might fit together differently, creating an effect to the height of a basketballÆs bounce.

NAME(s) **Leyla Marzbani**

PROJECT NUMBER **P20**

SCHOOL St. Francis Xavier School

GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Straighten Up, Fly Right○**

ABSTRACT

As an archer I was curious as to why there are different kinds of releases for recurve bows, and I wanted to know why the shooting glove was often used rather than the finger tab. This drove me to want to find the answer to this question that IÆve had for awhile.

I wanted to know whether the finger tab or the shooting glove would give a smoother release (less fluctuation) when releasing an arrow on a recurve bow. I figured that the shooting glove would be better for a smoother release because it would give more stability for your hand. I thought it would also be because it would give more control.

I started by setting up a chloroplast board with a horizontal line grid (three inches apart) as a backdrop. The three people that I tested each had different skill levels with archery. The first person has been shooting for a while, the second person has shot a couple times, and the last person has never shot before. I was testing at an archery range that has a limited amount of time to dedicate to my project so I was only able to test each release twice. I set up a slow motion camera to capture the releases. When I was analyzing my data the main observation that I discovered was that none of the arrows moved upward. It was hard to tell the difference between the movement being arrow fluctuation or the shot just being poor.

I discovered that shooting with the shooting glove caused less fluctuation in the arrow or overall shot and proved my hypothesis correct. This answered what I was hoping to discover and showed that a shooting glove gives a smoother release than a finger tab when shooting a recurve bow.

NAME(s) Gabe Mason
PROJECT NUMBER B49
SCHOOL Burlington Technical Center
GRADE 12
TEACHER Betsy McLane

PROJECT TITLE **The Effect of Self-Myofascial Release on Muscular Activation and Recovery Time**

ABSTRACT

Muscular soreness and tightness are both associated with reaching less than maximal muscular performance. Recreational and professional athletes alike strive to achieve maximal muscular activation, while being able to recover quickly. Self-myofascial release (SMR) using foam rollers (FR) or roller massagers (RM) is employed by these athletes for recovery purposes. The effects of SMR on muscular activation during a workout have been inconclusive. This study focuses on the use of SMR during a posterior chain workout, to improve muscular activation, and soreness. Participants of this study conducted the experiment twice each, using themselves as a control (CON), to compare to the trial with SMR. SMR was targeted on the legs for two minutes during the back-squat (posterior chain) workout that was performed. The CON group did not perform SMR. The number of reps performed was recorded for both, and compared. In addition, a subjective measurement of delayed-onset muscle soreness (DOMS) was recorded the following day for both groups. Results of this study indicate that SMR improves DOMS, while improving muscular activation through the duration of the activity. The number of reps performed was higher with all SMR subjects, while the DOMS tended to be lower with SMR, though it is a subjective measurement. The conclusion of this study is that SMR allows individuals to reach higher standards of muscular performance while aiding in shorter recovery times.

NAME(s) Sean McCormick
PROJECT NUMBER C11
SCHOOL St. Francis Xavier School
GRADE 7
TEACHER Mary Ellen Varhue

PROJECT TITLE **Keep The Heat○○**

ABSTRACT

People always wonder which thermal insulation material is most efficient to put in their house to help them save money on heating and cooling cost. My experiment is to see which thermal insulation material will keep heat contained in a certain area for the longest amount of time.

My hypothesis was fiberglass would keep heat contained in a certain area the for the longest amount of time.

To test this research question I put 169 degree Fahrenheit water into a mason jar, which I then wrapped in one of the 4 insulation materials (cotton, wool, fiberglass, window sealant). Then I put the mason jar into the 2 liter soda bottle so the insulation wouldnÆt fall off the jar. Next I stuck the probe into the water and set the timer. I took the reading on the probe every 10 minutes and wrote it down. I kept doing this every 10 minutes until the temperature of the water reached 110 degrees fahrenheit or lower. For the second test I also checked the temperature periodically depending on the type of insulation and the amount of time it took for the water to cool down in the previous test. I did the same thing for the third test except I checked the timer and recorded the temperature more often. I did these three test for each insulation material and a control group.

My results showed that fiberglass kept the water heated for the longest amount of time. I also found that cotton and wool were the same and the window sealant worked the worst.

I concluded that my hypothesis was correct; fiberglass could contain heat in a certain area for the longest amount of time.

NAME(s) **Zachary McCormick** PROJECT NUMBER **C12**

SCHOOL St. Francis Xavier School GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Pollution Solution○**

ABSTRACT

My project was testing the best natural water filters for removing phosphates and nitrates. Phosphates and nitrates are used as fertilizers and soil very commonly. The pollutants are collected and runoff into the lake allowing algae to bloom. The algae blooms turn water an unnatural color and emit a horrible odor.

I used rocks, gravel, activated carbon, and sand as my filters. All of these filters are easily accessed at home or in nature. I hypothesized activated carbon would be most effective because it is commonly used in fish tank filters. I thought sand would follow with gravel close behind because the two seem to be similar, especially in size. I predicted rocks would be least effective because there is lots of space between each rock, allowing most pollutants to escape some of the filtration.

I polluted 120 milliliters of tap water with a teaspoon of Triple Phosphorus Soil. I used phosphate and nitrate test strips to determine the level of each pollutant in the water. The water ran through a bottomless cup, with a coffee filter containing the filter being tested, and into a beaker. I measured the level of pollutants after filtration and subtracted them from the original numbers to find the total removed.

My experiment disproved my hypothesis, rocks were the best filter for removing phosphorus, with sand second and carbon third. Carbon did have the highest average for nitrate removal but there was not a high enough concentration of nitrates in the water to draw a conclusion. Gravel was the worst filter, adding nitrates to the water in every test. The rocks performance in my testing puzzles me, I believe that the type of rock effects filtration ability. I used limestone rocks, I want to do more testing to determine if rock type does affect filtration.

NAME(s) **Alec McCrae** PROJECT NUMBER **S15**

SCHOOL South Burlington High School GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **The Effects of Music on Running**

ABSTRACT

This experiment tests various genres of music and how it affects a runner's performances. These performance differences are measured through times. The expected results of these tests are that fast paced music will increase the runner's performance and the slower paced music will decrease the runner's performance. Depending on the results of the experiment, music could either increase a runner's performance competitively or simply not have an effect. The experimental design now is a 400 meter trial run. Each of these trial runs are different because of the different genres of music the runner will listen to during these trials. The results of these trials is that the runner will either have a faster 400 meter run or slower 400 meter run depending upon the type of music the runner is listening to during their trial. Because the human body varies from day to day it is hard to collect results that are completely accurate. To limit these factors, before every trial run the runner would rest until they maintain a resting heart rate. The outcome of this experiment will hopefully improve runner's performances so that they are able to have a more successful career and use music as an alternative to hazardous stimulants.

NAME(s) **Trevor McDonald**

PROJECT NUMBER **P21**

SCHOOL Milton Middle School

GRADE 8

TEACHER Janet Smith

PROJECT TITLE **Flowing Electricity**

ABSTRACT

Technology has been developed to efficiently convert energy from renewable sources such as solar, wind, and tidal power into electrical energy. Storage of electrical energy is limited, preventing these power sources from being used to their full potential. Excess energy generated can be stored using the pumped hydroelectric storage method. Here, potential energy in the form of water is stored in an upper reservoir after being pumped from another reservoir at a lower elevation. When needed, electricity is generated after stored water flows between the two reservoirs. The purpose of this investigation was to develop a model to measure energy generated and stored through this pumped hydroelectric storage method.

The kinetic energy generated from the flow of water was determined using two buckets as reservoirs connected by tubing and separated at increasing heights. The electrical power generated from hydropower was calculated in watts. It was determined that as the height difference increased the electricity generated increased linearly over a shorter duration of time. These results matched what I had predicted.

I am interested in the height where the electricity generated from releasing the water is greatest compared to the energy required to move the water to the higher reservoir. This can ultimately be used to determine the placement of the two reservoirs that is most efficient in the hydroelectric storage process. I predict it would be most efficient somewhere midway in height between the two reservoirs. I am currently working on the next step in this investigation which is to calculate the energy required to pump water to the higher reservoir.

NAME(s) **Olivia McGovern**

PROJECT NUMBER **B20**

SCHOOL Missisquoi Valley Union High School

GRADE 11

TEACHER Dana Maria Dezotell

PROJECT TITLE **Testing Pesticide Toxic Longevity on Gryllus Pennsylvanicus**

ABSTRACT

My objective for this project was to test how long different pesticides will remain toxic in a summer environment. My goal was to determine how long pesticides will protect crops. My independent variable was temperature and the amount of each pesticide I used. My dependent variable was how many days the pesticide remained toxic, and my control was a cup with no pesticide and a cricket. I tested two pesticides, Diatect Multi Purpose Insecticide II (pesticide 1) and Dipel Dust Biological Insecticide (pesticide 2) by using Gryllus pennsylvanicus (field crickets). I began by placing crickets in the contaminated soil and recorded the death rate until the pesticides were no longer active. My sample size was three cups and three crickets in each cup for each pesticide; also, each experiment was repeated three times. My data showed that for pesticide 1 the average time that it remained toxic was 3.33 days, and for pesticide 2 the average time it remained toxic was 2.33 days. The results show that the pesticides only remained toxic for a short period of time. My hypothesis was incorrect; I expected the pesticides to remain toxic for a longer period of time (weeks). Using these results, I plan on repeating the testing by using a different soil.

NAME(s) **Colin McKay**

PROJECT NUMBER **C13**

SCHOOL St. Francis Xavier School

GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Go With The Flow○**

ABSTRACT

In Vermont we love Lake Champlain. During the summer we like to go fishing, swimming, boating and do other fun recreational activities. Lake Champlain is currently facing problems with pollution and runoff. Recently the Vermont Legislature has been talking about improving water quality in Lake Champlain, and what they can do to stop nonpoint source pollution. I live very close to the lake and enjoy having fun in the summer, but every summer you see more and more algae. This led me to my experiment - testing three different soils (topsoil, peat moss, and sand) to see if they could filter out phosphates.

My hypothesis was that topsoil will be better able to filter out phosphates because it is denser than peat moss and sand.

I tested the three soil types with different concentrations of phosphates (3 trials each). I used paint trays and filters to allow the phosphate solution to absorb into the soil and drain through the filter for collection and testing. After thirty minutes I tested the solution that drained from the soil. I used a phosphate test kit to measure the starting and ending phosphate for each trial. I also measured the volume of liquid solution that came out.

My data told me that topsoil was better able to filter out phosphates. The first two sand trials didnÆt reduce any of the phosphates; my third sand trial had an error. My data also told me that peat moss was not a good choice of material because it already contained a higher level of phosphate.

In my experiment I proved my research question correct because the three different soils filtered out different amounts of phosphates from the solution. I also proved my hypothesis to be correct because topsoil did filter out the more of the phosphates.

NAME(s) **Brooke McKeen**

PROJECT NUMBER **B21**

SCHOOL Weathersfield School

GRADE 8

TEACHER David E. Lambert

PROJECT TITLE **What To Feed The Seed**

ABSTRACT

My experiment was to see which type of fertilizer grows plants the fastest in 6 days. The fertilizers that I used were, chicken manure, horse manure, rabbit manure, Miracle-Gro. I also had a group of plants with no fertilizer. I chose this experiment because I like to grow plants and in our garden, we use horse manure to fertilize our plants. I wondered if horse manure was the best fertilizer to use on our plants and I wondered if there was a better fertilizer.

Before I came up with my hypothesis, I researched a lot of things. First, I found out that potassium, nitrogen, and phosphorus are the chemicals found in fertilizers and they are what the plant needs for growth. After that, I found out that these chemicals are needed for the plants growth to help with photosynthesis, plant maturity, nutrients, reproduction, and the energy transfer process. I also found that the difference between organic and chemical fertilizers is how much they've been processed. Organic means that itÆs in itÆs natural state and hasn't been refined. Organic fertilizer often comes from plant and animal waste, like animal manure. Chemical fertilizers are not in their natural forms and have been refined and changed from their original state. Some chemical fertilizers are made from rocks, and petroleum sources. My research showed that some of the most popular fertilizers are horse manure, chicken manure, rabbit manure, and Miracle-Gro.

My hypothesis said that if I fertilized the seeds with Miracle-Gro, then the plants would grow the tallest after three weeks. If I fertilized the seeds with chicken manure, then the plants would grow the second tallest. If I fertilized the seeds with horse manure, then the plants would grow the third tallest. If I fertilized the seeds with rabbit manure, then the plants would grow the fourth tallest. I thought that the plants with no fertilizer would show the least amount of growth.

NAME(s) **Katie McLean**

PROJECT NUMBER **G09**

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Water Quality in Potash Brook**

ABSTRACT

Have the recent addition of the settling ponds and catch basins to the historically polluted Potash Brook been successful in removing the high phosphate levels, lowering the pH, turbidity levels and other harmfully high levels of pollutants in the stream? In other words, did the town of South Burlington spend the city budget in good manner? It is hypothesized that the brook will have improved greatly in water quality, as the basins and ponds were added over two years ago, and have proven to be successful based on other previous projects around the area and the country. This experiment is testing water for pH levels, chloride, nitrogen, phosphorous, turbidity to better determine nutrient levels of brook, comparing it to data collected in 2012 and prior. While data has not been analyzed fully, the results should indicate an increase in the overall health of the brook, as the city has expected. In the future this experiment should be repeated exactly to once again compare the previously high levels and see the longer term effects of this addition.

NAME(s) **Keagan McNamara**

PROJECT NUMBER **G10**

SCHOOL Avalon Triumvirate Academy

GRADE 8

TEACHER Amanda Gifford

PROJECT TITLE **Growing Plants In A Field**

ABSTRACT

When plants grow, the orientation of the seed does not matter. The roots will always find themselves growing into the ground and not into the sky. It is though that the magnetic field must have something to do with orienting the plants roots to grow down and the rest to sprout up. The way that scientist believe this works is that a fluid in a plant cell called protoplasm is pulled downward by gravity creating a pressure on the cell walls signaling it which way it needs to grow. A second explanation like the first is that the starch within the plant cell drifts down when gravity is present much like the protoplasm. If the magnetic field helps in the growing of the plant then if a magnetic field is close to the plant the process should speed up. If magnets are an effective way to grow plants quickly it could help with growing more food that could sustain people without the use of genetic modification. In order to test this, plants were grown with one group having a set of magnets in the soil in which they were grown, and as a control, a group of plants grown without a strong magnetic field next to them. The plants with magnets were segregated from the control plants. Both sets of plants received the same amount of water, and grew under the same controlled light source. The plants grown within a strong magnetic field were found to be longer in length and sprouted faster than the control. In conclusion it was found that the set of plants grown in the strong magnetic field grew faster and longer possibly because of the close presence of a magnetic field help them orient themselves faster giving them a longer time to mature.

NAME(s) **Ben Millard**

PROJECT NUMBER **S16**

SCHOOL Windsor High School

GRADE 9

TEACHER Raina White

PROJECT TITLE **Technology and Sleep: How technology affects your sleeping habits.**

ABSTRACT

The purpose of this experiment was to determine whether technology has an affect on your sleeping habits. According to my my research the light from your deviceÆs screen is stimulating to your brain and it suppresses melatonin. My hypothesis is that if you use digital technology right before sleeping then you will experience less restful sleep because your device is stimulating and the light from your screen suppresses melatonin.

○In this experiment I had eight human test subjects that took a preliminary survey and then a survey for five nights afterwards. These surveys asked a variety of questions about the subjectÆs technology use as well as variables such as caffeinated beverages drunk up to three hours before sleeping and stress levels.

○Once I received the surveys I averaged all the variables for each person. Then I put the averages into a data table and graphs. When analysed, the data showed me that there were many interesting correlations between the variables. Including a positive relationship between the number of caffeinated beverages drunk up to three hours before sleeping and your quality of sleep. At the end of this experiment I learned that my hypothesis was supported. I also noticed that there were many new subjects that arose that could be interesting tests for later experimentation connected to this project.

NAME(s) **Kailey Miller**

PROJECT NUMBER **B50**

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **The Effect of Climate Change on Crayfish**

ABSTRACT

This experiment was performed in order to determine whether or not the changing water temperatures due to climate change are going to affect the activity and productivity of crayfish. It was hypothesized that warmer water would decrease the activity and productivity levels of the crayfish. Three tanks were set up with three crayfish in each. The control tank contained water that was kept at room temperature. One of the experimental tanks contained water that was heated to two degrees above room temperature. The water of the other experimental tank was heated to four degrees above room temperature. It was concluded after six weeks of observation that the crayfish in the tank with the warmest water were less active and productive than those in the control tank. It was also concluded that the warmer water had higher levels of alkalinity. The heightened alkalinity may have contributed to the decrease in activity and productivity.

NAME(s) Vincent Moeykens, Ben Meagher
PROJECT NUMBER GP23
SCHOOL Windsor High School
GRADE 9
TEACHER Raina White

PROJECT TITLE **Competing with the Cloud**

ABSTRACT

The purpose of this experiment was to determine whether a home server, or NAS, is a viable competitor to consumer cloud services such as Mediafire or Google Drive. We hypothesized that, because of the lesser amount of users, the home NAS server would be a more viable solution. We defined ôviabilityö in three areas: speed, cost, and ease of use.

To test the consumer cloud services we used three of the largest providers: Mediafire, Dropbox, and Google Drive. For our home server test we used a Raspberry Pi running OpenMediaVault and set up to connect over FTP on port 21. For the upload/download test we created a simple 1 GB dummy file. To test speed, we used 3 trials for upload times, and 3 trials for download times of each service. To control and help make this experiment more conclusive we made sure to upload and download at the same time each night, 5pm for the uploads, 8pm for the downloads. This experiment was also conducted on 2 different networks. For the NAS server we not only tested LAN upload and downloads, but also WAN upload and downloads.

After conducting our tests it was time to draw a conclusion. We looked back to our original definition of viability. We found that speed wise, the NAS was a lot faster on the LAN than any of the other services, and slightly faster on the WAN. For cost, the initial price was higher, but the prices over time were cheaper for the NAS. And finally, for ease of use, we determined that a cloud service would be easier to use than a NAS, at least for now. In the end this research supported our hypothesis that a home NAS service is a viable competitor to consumer cloud services.

NAME(s) Abigail Monahan
PROJECT NUMBER C14
SCHOOL St. Francis Xavier School
GRADE 8
TEACHER Mary Ellen Varhue

PROJECT TITLE **Too Hot To Handle○○**

ABSTRACT

Hand warmers are an important part of outdoor winter activities and can be the difference between a fun day outdoors or being stuck inside. My research question was, Are reusable hand warmers more effective than non-reusable hand warmers?

To conduct this experiment I constructed a simple calorimeter using an Igloo cooler. I used non-reusable and reusable hand warmer brands in the experiment. During the experiment I filled the bottom of the calorimeter with water and activated the hand warmers. At time intervals I measured the temperature of the water in the calorimeter and the temperature of the hand warmer.

Using the temperatures of the hand warmers I determined which brand and type of hand warmer had the highest average temperature, and I used the temperature of the water to determine the amount of heat calories absorbed into the water in the chemical reaction. Organizing my data in different ways allows me to draw different conclusions so I can see the results from different perspectives.

My results showed the reusable hand warmer brand Hot Snapz releases the most heat calories and its heat given off per gram is higher than other reusable hand warmers. I found the reusable hand warmers overall had a higher average temperature, and the Heat Solution reusable brand had the highest temperature overall. I think I came to these results because reusable hand warmers are able to give off more heat faster because they donÆt have to give off a steady flow of heat for up to ten hours like non-reusable hand warmers.

Some conclusions that could be drawn from my experiment are reusable hand warmers have a higher average heat absorbed into the water and higher average temperature, and reusable hand warmers are less effective for releasing heat steadily for longer time periods.

NAME(s) **Harrison Morse, Dylan DeSchamp**

PROJECT NUMBER **GP14**

SCHOOL Windsor Middle School

GRADE 7

TEACHER Owen Campbell

PROJECT TITLE **Maelting Ice**

ABSTRACT

Names: Dylan Deschamp and Harrison Morse Project Number:_____

School: Windsor Sr. Jr. High School Grade: 7

Teacher: Owen Campbell

○○○○Project Title: Melting Ice

○

Our science fair project was about melting ice and which type of salt melts ice the fastest. We thought we could find a safer and more effective alternative to road salt and sand mixture being dumped on the roads around Vermont. The project involves using four different salts: road salt, table salt, sea salt and epsom salt. We used one tablespoon of salt and put it on a single ice cube. We did this for every salt three times and over a course of three days to find an average time. Not surprisingly the sea salt and the table salt took about the same time to melt. This is because they have the same chemicals, sodium and chloride. Epsom salt took almost exactly the same time it took an ice cube to melt without salt. This suggests that the chemicals used to make epsom salt, magnesium and sulfate are not effective and cause very little reaction between the epsom salt and the ice cube. In the end, road salt took the shortest amount of time to melt the ice. This is because road salt is more pure than table salt and sea salt, containing only traces of acids and metals. If we could go back and change the experiment we would grind up the salts into the same size grain. For example the road salt has less surface area causing the times to be more unpredictable.

NAME(s) **Kevin Moyinhan, Eric Benner**

PROJECT NUMBER **GP11**

SCHOOL Christ the King Burlington

GRADE 7

TEACHER Mrs. Srivastava

PROJECT TITLE **Clean and Bright, Fresh and White**

ABSTRACT

ABSTRACT

Our science fair project was to determine whitening power of toothpastes. We chose this as our project because a common question is ôCan you trust the label on your toothpaste?ö This project tested commonly used normal and whitening toothpaste using egg shells and a motorized toothbrush. Our experiment produced data showing the effectiveness of regular and whitening toothpaste on various stains. This experiment did not address cavity protection. Whitening toothpaste claims to be more effective on removing stains from teeth than regular toothpaste. To prove or disprove this claim, we used 18 eggshells to simulate. Three stains were used in the experiment, coffee, pureed berries and tomato sauce. We used a cupcake pan to stain the eggs, one for each stain and toothpaste. The eggs were numbered and dipped in the stain for ten minutes. After ten minutes, we removed the eggs from the stain. We brushed the eggs with each toothpaste for 10 seconds. We graded the stain using a Dental Yellowing Chart before and after brushing.

We saw an average change of 2.39 shades on the Dental Yellowing Chart scale which shows teeth shades from 1 to 11 with 1 as the whitest and 11 as the darkest. Regardless of the stain, there is .83 difference in the shade scale in stain removal between regular toothpaste and whitening toothpaste. Based on the results, there is not a significant difference between whitening toothpaste versus regular. While our results support our original hypothesis, the difference is so minimal that we ask for you to give serious thought about focusing on whitening toothpaste. Whitening toothpaste offers so little more on whitening that maybe you should focus on cavity protection.

NAME(s) **Eadoin Murphy**

PROJECT NUMBER **P22**

SCHOOL Missisquoi Valley Union High School

GRADE 8

TEACHER Dana Maria Dezotell

PROJECT TITLE **Does adding a mirror to an enclosed area increase the amount of light in that area?**

ABSTRACT

Light has been around before man. In 1941, the solar cell was invented, followed not much later by the solar panel. In my analysis, I intended on figuring out if there was any way one could include an assortment of mirrors to focus the amount or intensity of the sunÆs light, and therefore increase the amount of energy gained, as well as taking full advantage of the sun. However, before I began, I figured that this was too much of a job for a mere 8th grader; so I downsized my project to become a simple, yet extensive project: My question was ôDoes adding a mirror to an enclosed area increase the amount of light in that area?ö In the experiment, I used different mirrors (concave, convex and flat) a candle, a fireproof container, and a photometer, a tool that measures amounts light. After doing six trials, I found that in fact, the answer is yes. The amount of light increased by 45 per cent. In the near future, I plan to set up more trials, perhaps using a larger variety of angles with the concave/convex mirrors, and different sizes of all three types of mirrors. In doing so, seeing just how intense I can get the light beam. In long run, these studies could contribute to super efficient light bulbs and/or solar panels, which would then (hopefully dramatically) decrease energy costs.

NAME(s) **Jenna Murray**

PROJECT NUMBER **S17**

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Test Stress**

ABSTRACT

Stress can cause tiredness, excessive worrying, increased infection, disrupted concentration, disturbed sleep patterns, and irregular eating habits. Stress is triggered for many reasons, but academic testing is a major cause for stress in students everywhere. By examining a high school biology class, the effects of test stress will be determined. The students stress will be measured by using vernier probes to measure their heart rate. The students heart rate is expected to rise due to the stress of testing. The testing will be held on two separate dates. On the first day, the subjects will be connected to a vernial probe while they take a survey to get their baseline heart rate. On a separate date the subjects will be connected to a vernial probe and will take a test for their biology class. The results of the experiment will be recorded in logger pro which is a useful tool for analyzing data. The controlled variables for this experiment are participants age, the length of time for each test, and the testing environment. There may be technological errors due to the amount of students that will be tested at once. Heart rates are expected to be faster during the biology test than during the initial survey. If there is a drastic increase in stress, teachers may reconsider standardized testing and changes might be made to lower stress levels in students.

NAME(s) Hailey Napier, Sadie Kuhn
PROJECT NUMBER GP21
SCHOOL Woodstock Union High School
GRADE 9
TEACHER Jennifer Stainton

PROJECT TITLE **Average Annual Precipitation vs. Mercury Concentration; Is There a Correlation?**

ABSTRACT

This experiment assessed whether there is a correlation between average annual precipitation and mercury status in national parks. According to the United States Environmental Protection Agency, wet deposition (when particles of atmospheric mercury attach to precipitation) is the primary mechanism for transporting atmospheric mercury to bodies of water and land. Consequently, it was hypothesized that national parks with greater precipitation should exhibit higher levels of mercury. Dragonfly nymphs (Odonata: Anisoptera) were used as a bioindicator for mercury concentration because they live in a fixed location and they are predators; therefore, mercury from their prey bioaccumulates in their bodies. Citizen scientists collected nymphs in ten national parks from 2011-2014 using standard ôclean hands, dirty handsö technique. Then, at Trace Element Analysis labs at Dartmouth College and the University of Maine, the samples were run through a mass spectrometer to identify the concentration of mercury. These results and precipitation data provided by the national parks were graphed using a best fit line to determine possible links. A six percent correlation existed between the average mercury concentration and the average annual precipitation. This correlation was not strong enough to definitively prove or disprove the hypothesis. The experiment demonstrates precipitation does not have a significant effect on mercury concentration. It is important to understand the risk factors associated with mercury, as it bioaccumulates in food chains, ultimately affecting humans and resulting in neurological deficits. This experiment also stresses the importance of citizen science and national collaboration for public understanding of environmental and ecological issues.

NAME(s) Taylor Nash
PROJECT NUMBER B41
SCHOOL Northfield High School
GRADE 12
TEACHER Amy Urling

PROJECT TITLE **The Effect of Time of Exposure (weeks) on the Growth of Bacteria in Cosmetics**

ABSTRACT

The purpose of this lab was to test whether or not time of exposure has an effect on bacterial growth in cosmetics. Many bacteria found in cosmetics such as Staphylococccus epidermis, Staphylococcus warneri, Pseudomonas aeruginosa, and Methicillin-Resistant Staphylococcus aureus cause serious health issues which may not be able to be treated with antibiotics. This experiment tested if the exposure time (of opened makeup containers) is increased then the growth of bacteria will increase compared to the control of no exposure. Over 3 weeks multiple containers of the same brand of eye shadow were opened and left opened one week at a time. The goal was to see if the longer the cosmetic is open then will more bacterial colonies grow when placed in petri dishes? The growth of bacteria was done in petri dishes using agar. The bacteria grew for 4 to 6 days in an incubator. After the bacteria was grown the number of colonies was counted. The control container (which was open for 0 days) grew an average of 2.66 bacterial colonies over 6 days. The container that was open for 2 weeks grew an average of 6.60 colonies. The container with 3 weeks of exposure grew an average of 7.33 colonies. The trend in this test supported my hypothesis that longer exposure causes more bacteria to grow. It can be concluded that time of exposure has a great effect on the growth of bacteria in cosmetics.

NAME(s) Amanda Nattress
PROJECT NUMBER S18
SCHOOL Burlington Technical Center
GRADE 12
TEACHER Betsy McLane

PROJECT TITLE **The Effects of Canine Assisted Therapy (CAT) On Teen Stress**

ABSTRACT

My study is all about the effects of canine assisted therapy (CAT) on teens in a stressful situation. The purpose of this experiment is to see if there are any direct correlations between CAT and teenÆs emotional and physical well being when stressed.

To test this I took teens from various high schools all over Chittenden County and divided them into two groups. The control group consisted of teens who did not receive CAT. They took a survey, took their vitals (HR, RR) , and sat in a room for 10 minutes without distraction. They then played Bop It (a timed game that includes hitting, twisting, and pulling a device in correspondence to a command) for 10 minutes and tried to achieve the highest score possible, then took a similar survey and vitals were taken after. The experimental group consisted of teens who received CAT for 10 minutes before playing Bop It. They took the same surveys and got their vitals taken before and after. The stress was measured both quantitatively and qualitatively. Quantitatively, they are measured in terms of their vitals, and their Bop It score. Qualitatively, they are measured with a survey where they stated how they felt before and after the experiment.

○

Once the data is collected, it will be used to see if there is any direct correlation between pet therapy and improvement of stress. I hypothesize that if I were to introduce CAT to teens in a stressful setting, then I think that I would see an increase in emotional and physical well being as well as a decrease in stress, respiratory rate, and heart rate. This data could be applied to many real world situations. For example, some colleges have a puppy room during exam week in attempt to reduce stress. The implementation of CAT could be introduced into high schools during exam weeks and or used in a guidance offices for therapy purposes in hopes of reducing stress levels in students.

NAME(s) Madison North
PROJECT NUMBER B22
SCHOOL Milton Middle School
GRADE 8
TEACHER Greer Krembs

PROJECT TITLE **Can You See What I See?**

ABSTRACT

We use peripheral vision every day, especially when playing sports and when driving a car. The purpose of my experiment was to see if peripheral vision depends on eye color. I tested people with blue, brown and, green eyes. I predicted that brown eyes would have the best peripheral vision because in my background research I found that lighter eye color is most sensitive to light compared to a darker color.

I figured out that when people back up they can use their peripheral vision to look to the side. I measured out and marked .5 meter intervals on the floor, and put construction paper on the wall. I had test subjects take steps backwards until they got to the point where they could see all the construction paper without looking directly at the paper or turning their heads, they would tell me, and I would write down how far they backed up.

My results showed, green eyes had the best peripheral vision. The average distances walked back were, blue with 8.5m, brown had 8.3m and, green with 8.1m. The lowest average is the best. So green eyes with an average of 8.1m has the best peripheral vision.

In conclusion there is not a large enough difference to say which eye color has the best peripheral vision. This is because of a .2m difference in the averages. So I cannot say green has the best peripheral vision.

NAME(s) Lily Oliver
PROJECT NUMBER B23
SCHOOL Mater Christi School
GRADE 7
TEACHER Mark Pendergrass
PROJECT TITLE **Sugar and Carbs vs. Glucose**

ABSTRACT

○The question that this project determines is: What drinks have high glucose levels? The hypothesis of this experiment was: If there are high carbohydrates and high sugars, then the drink will produce a higher glucose level. The research showed that the difference between carbohydrates and glucose is,carbohydrates are substances in food that are broken down in the body. However, the glucose relies on different types of enzymes. It also showed how different sugars can have a higher or lower glucose level. Six drinks were tested by two different meters and ketostix. The drinks were measured by a tablespoon, and were tested to determine the glucose levels in the six drinks. After they were tested, the data was recorded into the data table. Next, the data collection showed that the one touch ultra 2 meter and the one touch ultra mini meter were very close or for glucose levels. However, the ketostix were very different glucose levels from the two meters and often times read negative. Also this experiment was to prove that different meters and ketostix are not accurate because they have many different readings. The hypothesis was correct because, the data showed when there was high glucose levels the cause was high sugar and high carbohydrates.

NAME(s) Nathan Oster
PROJECT NUMBER P23
SCHOOL Milton Middle School
GRADE 7
TEACHER Janet Smith
PROJECT TITLE **Arrowhead Accuracy**

ABSTRACT

There are several types of modern arrowheads used for different purposes. Since I have never used a field point or broadhead, I wondered how the various types would differ in their performance, specifically accuracy. I predicted that the Sabertooth broadhead would be the most accurate because it had the longest point and the least amount of wind resistance as it cuts through the air.

The target was a grid made of square centimeter boxes with the center clearly marked. I tested eight different arrowhead varieties. Accuracy was measured based on the average distance from the target center in all four coordinates. They were tested for proximity to the center of a target and how well they clustered. Each arrowhead type was shot five times from a distance of 18 meters and were marked and measured on the target. Kinetic energy and momentum values were calculated for each arrowhead using algorithms. A speedometer was used to determine the velocity of each arrow shot.

The results showed that the Toxic broadhead was the most accurate with an average distance from center of 17.4 mm. The least accurate was the Spitfire broadhead with a result of 47.8 mm. The result of the Sabertooth broadhead was 38.8 mm from center. This did not match my prediction. Interestingly, the Spitfire was the arrowhead that clustered the best.

I think that the Toxic broadhead was the most accurate because the blades are curved and therefore more aerodynamic which allows it to travel in a straighter path. I am redoing this experiment and attempting to eliminate possible sources of error that occurred,including adjusting the sight more accurately. I am curious to see how the results will compare.

NAME(s) **Kyrsten Paroline**

PROJECT NUMBER **B24**

SCHOOL Home School (Randolph Educational Resource Center)

GRADE 6

TEACHER Gina Sweet

PROJECT TITLE **Essential Oil Test**

ABSTRACT

The purpose of my experiment was to see if essential oils changed the effect of test scores on hidden picture puzzles. To do this experiment, I did one set of tests with diffusion of essential oils, and one set without. I put the diffuser in the classroom and turned it on. I did not do this step the first time. I gave the beep to begin tests and again when the time was up. They had three minutes to look for items in hidden picture puzzles. I collected tests and did the test again on a different day. Then I calculated the averages of each test and found my results.

The average correct for tests without essential oils is 8.6 out of 15. The average for the test with essential oils is 10.13 out of 15. Eleven out of fifteen people did better with essential oils while doing tests.

The results show that people do better with essential oils when doing picture puzzle tests. The data shows that my hypothesis is correct.

If I could do my experiment again, I would use a timer that beeped when three minutes is up. That would prevent testers from accidentally having extra time.

From this activity, I learned that people do better with essential oils. I also learned that essential oils affect the way people do tests.

NAME(s) **Madeleine Parzyck**

PROJECT NUMBER **B25**

SCHOOL St. Francis Xavier School

GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Glow Germ○**

ABSTRACT

My purpose was to find out if hand sanitizers remove more germs than hand soap. It is flu season and everyone wants to minimize the germs they spread. Hand sanitizers are everywhere in our school and people push for its use. I wanted to know if hand sanitizer is more effective than traditional hot water and soap. ○Should we no longer use hand sanitizer if it doesn't have any effect? My hypothesis was that regular hand soap and water would remove the most germs. I used SoftSoap, Dial, Purell, and All Natural Hand Sanitizer. I used Glo-Germ (acts as fake germs and glows under a UV light). I put Glo Germ on the subjects hands and examined their hands under a UV light. The subjects cleaned their hands with either soap or hand sanitizer. Subjects who used soap, used warm water, scrubbed with soap for ten seconds, rinsed off, and dried them. Subjects who used hand sanitizer put one squirt of the product on their hands and rubbed it in, I examined their hands with the UV. Using a scale from 1-5: 1 meaning all the germs are removed, 5 meaning none were removed.My results showed that washing hands is more effective that hand sanitizer. SoftSoap averaged 2.15 (the highest ranked of all the cleansers.) After my experiment, my school should encourage hand washing methods rather than hand sanitizers to prevent the spread of germs. My hypothesis was correct. I think this because there was no rinsing involved with the hand sanitizers which I feel makes a big difference in removing germs.

NAME(s) W. Cole Patno

PROJECT NUMBER S19

SCHOOL Frederick H. Tuttle Middle School

GRADE 7

TEACHER Christopher Towle

PROJECT TITLE **Generic versus Brand Name**

ABSTRACT

Is there really a difference between generic and brand name foods and drinks? That was the question that needed to be answered for the project. Both items look alike, and are made of similar ingredients, and so the hypothesis was that people couldn't tell the difference between generic and brand name foods and drinks. The foods and drinks we used were chips, cookies, soda, and lemonade. To ensure that the results were accurate, no one knew which foods and drinks were which. The brand name drinks were labeled ôAö and the brand name foods were labeled ôBö. All of the foods and drinks were bought and the 30 volunteers that took part of the experiment were ready. Then there were questions that were asked to them, which item (A or B) they liked better and which one they thought was brand name. After that, we asked them to rate each item on a scale from 1 to 10. As the data was put together the results were different. Certain foods didn't support the hypothesis exactly. People could tell the difference between both, the generic and brand name foods and drinks but that doesn't mean that they always liked the brand name more. In fact for the chips people mostly couldn't tell the difference between the two. Most of the people had chosen brand name as their preference for the majority of the lab and almost all of the people could tell the difference between most of the generic and brand name items.

NAME(s) Sadie Pierce

PROJECT NUMBER C15

SCHOOL Milton Middle School

GRADE 7

TEACHER Nathan Caswell

PROJECT TITLE **Making a Stronger Battery**

ABSTRACT

The purpose of this experiment was to make a stronger battery out of pennies and nickels. I thought using more pennies and nickels would increase the voltage of the battery.

To make the batteries, I put a penny down, then a paper towel square soaked in a salt and vinegar mix, then I put a nickel down on top of the paper towel. I repeated this pattern to make batteries of different sizes. I created the salt and vinegar mix, using salt as the ions and the vinegar as the electrolyte. I had to use a rubber band to hold the batteries together so when I attached the alligator clips to the top and bottom of the battery it would not fall apart.

My most powerful battery was the 8 pennies and 8 nickels. The mean millivolts produced by this battery was 71mv. My least powerful battery was 6 pennies and 6 nickels. This battery produced a mean of 37mv.

The data partially supports my hypothesis. The largest battery was the strongest but the smallest was stronger than the medium battery. After doing this experiment I learned that pennies made after 1982 were zinc not copper. I think that this might be a source of error in my results. I plan to redo this experiment using pennies made before 1982.

NAME(s) Curtis Plante
PROJECT NUMBER S20
SCHOOL Mater Christi
GRADE 8
TEACHER Mark Pendergrass

PROJECT TITLE **Do You Agree With Only Hands-Free?**

ABSTRACT

The main purpose of this study was to observe how hands-free and handheld devices affect reaction time. The research question was: Does reaction time get slower when talking with a handheld device compared to a hands-free device? The hypothesis stated that the handheld reaction times would be slower than the hands-free reaction times given that, for one reason, using the handheld device leaves the participant only one hand to complete the reaction test on the iPad. During the background research performed, it was determined that the term "handheld" means it is designed to be held in the hand while "hands-free" means it is designed to be operated without using the hands. It was also discovered that a "reflex action" is an action that is not planned or decided beforehand. Before testing began, each subject signed a consent form to agree to participate in the experiment. The participants completed testing individually. Each person completed reaction time testing three times, once with no distraction, once with a handheld distraction, and once with a hands-free distraction. All the individual reaction times were recorded in the data table. During the data collection process, some unexpected factors occurred such as variable amounts of ambient noise as other people were in the room at the time of testing given space constraints. This affected testing as, at times, study participants had difficulty hearing the questions asked of them. In conclusion, the hypothesis was supported, showing that handheld devices affected reaction times to a greater level than hands-free devices. It is expected that a greater number of participants would have added further support of the hypothesis.

NAME(s) Freddy Pohlen, Luke Stevens
PROJECT NUMBER GP06
SCHOOL Christ the King School
GRADE 7
TEACHER Mrs. Srivastava

PROJECT TITLE **Toothbrush Testing**

ABSTRACT

Toothbrush Testing
Freddy Pohlen & Luke Stevens
The objective of this experiment is to measure bacterial growth (after brushing oneÆs teeth) using a capped versus uncapped toothbrush. This experiment applies to the average person because brushing your teeth is a part of daily hygiene. It will also address the following question: Are toothbrush caps actually useful, or not?
We hypothesized that the capped toothbrush would grow more bacteria than the uncapped because the capped toothbrush could not access open air, so moisture is trapped inside which results in more bacterial growth.
To test this, we each brushed our teeth for thirty seconds with two brushes at the same time on both sides of our mouths. We did not brush with the control. Next we put each toothbrush into a test tube containing sterile saline. Next, to dislodge bacteria we drew up ten milliliters of saline and deposited it on agar plates, then spread the bacteria with sterile glass beads. We repeated this procedure, over three separate days, both morning and night.
After collecting our data we found that all toothbrushes grew bacteria. We discovered that different types and numbers of bacteria grew on the two different subjectsÆ toothbrushes. We counted and analyzed the colonies from each plate and found that the uncapped toothbrushes grew considerably more colonies than the capped.
According to the results, our hypothesis is incorrect. Based on the data we would advise capping your toothbrush in between uses.

NAME(s) Elise Prehoda
PROJECT NUMBER B42
SCHOOL Rice Memorial High School
GRADE 12
TEACHER Sharon Boardman

PROJECT TITLE **E. coli Strains Inhabiting interstitial Spaces of Soil Adjacent to Vermont Streams**

ABSTRACT

Fecal bacteria such as E. coli live in the digestive tracts of mammals and birds. When excreted, the bacteria contaminate fresh water bodies, such as lakes ponds, rivers, etc. Over the summer, I was a part of an experiment seeking to establish a strain of interstitial E. coli. This is E. coli which is currently living outside of a host, and in the spaces of soil adjacent to streams. In conjunction with this question, we asked a second question of whether or not these interstitial E. coli could have developed into divergent strains, i.e. strains of E. coli which did not need to live in a host organism. A third question which we asked was whether or not we could discover a procedure for effectively sterilizing the trowels which we used to collect the E.coli samples. We did this by dipping the trowels in ethanol, and then burning off the ethanol with a lighter. Samples were collected by using the trowel to scrape dirt away from a small area about one foot from the stream, until the hole filled with water, and using a small sampling bottle to collect the water. To discover the E. coli within the samples, ribotyping was used. For the first question, we deducted that there was in fact E. coli inhabiting the interstitial spaces in soil next to the stream. For the second question, although the results are inconclusive, we can determine that there are in fact no divergent strains of E. coli. For the third question, we discovered that our method for sterilization was in fact extremely successful, and not a trace of E. coli was detected on our trowels post-sterilization.

NAME(s) Ryan Provost
PROJECT NUMBER C16
SCHOOL Big Picture South Burlington
GRADE 9
TEACHER Jim Shields

PROJECT TITLE **Effects of Different Light on Cyanotype Printing**

ABSTRACT

Effects of Different Light on Cyanotype Printing
Ryan Provost
Big Picture, South Burlington High School, South Burlington, VT

Cyanotype printing, created in 1842 by John Herschel, is how blueprints are made. Historically cyanotype printing has been done with sunlight. The initial idea for this experiment is to look at which type of light works best for exposing cyanotype.

The best light for the cyanotype will probably be natural light (sunlight). The three sources of light to be tested are sunlight, fluorescent, and halogen. Prints will be created on watercolor paper using a solution of potassium ferricyanide and water, and ferric ammonium citrate and water. the solutions are mixed separately and are then combined in equal parts. The researcher used the test strip to cover a strip of the light-sensitive paper in one minute increments.

The best print will be determined by looking at the clarity of the print, and whether or not the print is overexposed or underexposed. In a quality cyanotype print, the image is clearly shown in white on a blue background. Careful mixing of the chemicals will be important so that the experiment will not fail.

Literature predicts that sunlight will be the best source of light to create the best quality cyanotype print. If it were determined that artificial light made a better quality print, the implications could be an easier process for cyanotype printing, since artificial light is portable and more easily available. However, there is a cost involved with artificial light.

NAME(s) **Autumn Ramirez, Emily Euber**

PROJECT NUMBER **GP16**

SCHOOL Windsor High School

GRADE 9

TEACHER Raina White

PROJECT TITLE **Which removes sharpie better: Soap or Hand Sanitizer?**

ABSTRACT

The purpose of this experiment was to figure out if soap or hand sanitizer removes sharpie from skin in the most effective way possible. Our hypothesis was that we thought that the hand sanitizer would get the sharpie off easier than the hand soap because it has rubbing alcohol in it. Also, the hand sanitizer can clean bacteria off easier than the hand soap.

Our project asked participants to scrub a sharpie mark on their hand for 30 seconds and record which one came off better and faster. The number of participants was twelve, five were boys and the other ones were girls. We both enjoyed this experiment because our hypothesis was correct and we worked as a team to get the project finished. The results showed that hand sanitizer more effectively took off the sharpie in the majority of trials with people. Evidence showed that the hand sanitizer had a higher success rate at removing the sharpie then the hand soap did which supported our hypothesis.

NAME(s) **Ari Randall**

PROJECT NUMBER **P24**

SCHOOL Avalon Triumvirate Academy

GRADE 7

TEACHER Amanda Gifford

PROJECT TITLE **Ground Breaking Research**

ABSTRACT

Hundreds of people are killed by earthquakes annually. This test tested what shape of building was most effective to withstand an earthquake. Buildings were built shaped as a four sided pyramid, a tetrahedron, a rectangular prism with the proportions of 1x1x3, and a rectangular prism with the proportions of 2x2x1. The hypothesis was that the tetrahedron would be most effective. Buildings were placed on the shake table, the shake table was turned on and how long they withstood the simulated earthquake was timed. The test was run five times for each building. Every building Except for the 1x1x3 rectangular prism collapsed less than three out of five times. The 1x1x3 rectangular prism collapsed in less than a minute every time. The tetrahedron only collapsed once and withstood the earthquake four minutes thirty seven seconds. Based on this information, the tetrahedron is the most effective and the 1x1x3 rectangular prism is the least effective. A possible problem with this test is that the building was not anchored to the ground, unlike real buildings in real earthquakes.

NAME(s) Cal Rawlings
PROJECT NUMBER B51
SCHOOL Burlington Technical Center
GRADE 12
TEACHER Betsy McLane

PROJECT TITLE **The Effects of Occlusion Training on Enhanced vs Non-Enhanced Athletes**

ABSTRACT

Muscles perform optimally when they have plenty of oxygen and nutrients. These are both things that are carried to the muscle in the circulatory system on red blood cells. When the blood flow to a muscle is restricted, the muscle has less oxygen entering it and enters a state of anaerobic respiration. Anaerobic respiration is the same mechanism that occurs when an athlete sprints, but it is a sprint for only the one muscle that is having its blood flow restricted. This also increases the lactic acid in muscles, the same substance that causes the ôburningö feeling in the muscles and soreness. That lactic acid has been shown to increase muscle mass and strength. The purpose of this study is to see how blood flow restriction would affect an athlete on steroids compared to how it would affect an athlete who was not on steroids.

There have been many studies on how blood flow restriction can benefit muscular hypertrophy, but muscular strength has not been heavily looked into until now. Participants will be using blood-flow restriction during isotonic bilateral seated knee extensions with 50% of the weight that would be their maximum. This will be performed twice every week for six weeks and the participants re-test their maximum weight they would be able to use for a barbell back squat. In theory, restricting blood flow while training would increase muscular performance and strength at the same rate as it increases muscular size.

My hypothesis is actually that this experiment will not work. As I began this research, I strongly believed that this training technique could be a crucially important part of gaining muscular strength. However, as time goes on I have realized that blood flow restriction does not improve long-term muscular size and instead only increases the muscleÆs size for up to 72 hours. This has changed my opinion and I believe that as the results continue to come in, I will see a pattern of blood flow restriction not improving muscular strength.

NAME(s) Ryland Richardson, Hunter Grela
PROJECT NUMBER GP27
SCHOOL Windsor Middle School
GRADE 8
TEACHER Owen Campbell

PROJECT TITLE **Heated Sap Lines**

ABSTRACT

Names(s)○Ryland Richardson and Hunter Grela ○○○Project Number

School○Windsor Middle School○○○Grade○8

Teacher Owen Campbell

Project Title ○○○○ Heated Sap Lines

Maple sugarers reported that their sap lines have been freezing. We invented a heated sap line so that they can make more syrup and more money during the short and crucial sap season. We tested our invention with two types of sap lines. A heated sap line and an unheated sap line. We hypothesized that the heated sap line would unthaw faster than the normal sap line. We powered our heated sap line by a battery and a solar panel to keep the battery from dying. On the heated tape, there is a thermostat, so whenever the temperature dropped below 32 degrees fahrenheit, the power would turn on and unthaw the line.

The sky cover had a significant effect on our results. When it was shady, it took longer for the line to unthaw. Shady days drew more volts out of the battery, so the solar panel had to charge more. When the sun was out, the line would unthaw much faster. For example, our data indicates that it took the line almost half the time in the sun versus the shade to unthaw.

We found the volt difference for 6 feet of line so if someone wanted to buy heated line, they would know how big of a battery and solar panel they would need to power their line. Our invention helps sugarers earn more money and makes sugaring more efficient in the short period of time they have? Well now they can!

TEANAME(s) **Caitlin Roberts**

PROJECT NUMBER **B52**

SCHOOL Windsor High School

GRADE 12

TEACHER Catharine Engwall

PROJECT TITLE **The Effect of the Paleo Diet on Blood Sugar Management**

ABSTRACT

The purpose of this experiment was to observe how a certain diet affects patterns in bloodsugars. The diet used in this experiment is the Paleo diet, in which the participant can only eat fruits, vegetables, meats, nuts, eggs, and in moderation some natural sugars. The hypothesis was that if the participants follow the Paleo diet, their blood sugar control will be improved, because the Paleo diet improves insulin sensitivity and is a low carb diet. Three participants, with varying health conditions participated in this experiment. Participant A has a gluten intolerance, participant B has no significant health problems, and participant C has type 1 Diabetes and Celiac disease (an autoimmune disease affected by a gluten intolerance). For three weeks, the participants monitored their blood sugars to get a basic idea of what patterns their blood sugars follow while not on the Paleo diet. Then, for an additional three weeks, the participants monitored their blood sugars while they were on the diet. Comparing the results of the before and after adhering to the Paleo diet, it is evident that regardless of health, the diet took whatever pattern the participantsÆ blood sugars followed and condensed it. There were still the same original patterns, but they more constantly followed those patterns in a condensed manner, and in some cases the bloodsugars were lowered all together. These are all signs of better control, which supports the hypothesis.

NAME(s) **Megan Roberts**

PROJECT NUMBER **S21**

SCHOOL Windsor High School

GRADE 10

TEACHER Catharine Engwall

PROJECT TITLE **The Asch Experiment: Conformity Among Genders**

ABSTRACT

The purpose of this experiment is to determine how the social pressure of a majority group affects conformity among genders. The hypothesis is that males will conform less than females when asked to state their answers in front of a majority group who previously stated their answers aloud. Women historically tend to keep the peace, while men are perceived as leaders or heads of the household, making individuality more common throughout males.

○In this experiment, the control group and the experimental group each consisted of five people. Four of those people (two males, two females) were part of the majority group (confederates). The other participant was the test subject (gender varied depending on trial). All participants were asked to look at six card trials and determine which line on Card 2 matched the given line on Card 1. In the control, the four confederates were shown the card trials and all stated what they believed to be the correct answer. Then, the test subject was shown the cards last and had to state his or her answer. In the experimental trials, the confederates all gave an identical incorrect answer half of the time, and the other half of the time the males and females split based on gender and each gave different incorrect answers. The test subject, stating his or her answer last, then had to choose whether to conform, and who to conform with.

○In the end, males conformed less when faced with a whole majority group. But, females conformed less when facing the split majority group. So, as a rule will conform less than females in everyday peer pressure situations. But, if the factor of a split majority group is added, females tend to make their own decisions.

NAME(s) Olivia Rooney, Olivia Holmes
PROJECT NUMBER GP07
SCHOOL Cnrist the King School
GRADE 7
TEACHER Mrs. Srivastava

PROJECT TITLE **Cleaning Up with Acinetobacter venetianus**

ABSTRACT

Microorganisms have been used to clean up oil spills, like the spill that took place in the Gulf of Mexico in 2010 and the Exxon Valdez oil spill that occurred off the coast of Alaska in 1980. Bacteria can be used to clean up oil spills via a process called bioremediation. Among the bacteria that can degrade oil and thus clean up oil spills is Acinetobacter venetianus. We hypothesize that this bacterium will digest unused oil better than used oil because there are more energy-storing carbon bonds in new oil than old. We tested the ability of A. venetianus to digest oil by growing it in a minimal salts medium with and without oil as a carbon source. The results showed that A. venetianus degraded used oil more readily than unused oil. We also isolated the oil-degrading plasmids from A. venetianus using a mini-prep procedure and confirmed the DNAs on an agarose gel. We hypothesize that if the A. venetianus plasmids are moved into Escherichia coli, a bacterium that is not capable of degrading oil, then it would gain the ability to degrade oil. The results of this ôtransformationö experiment showed that E. coli can become oil-degrading. In conclusion, A. venetianus can digest both used and unused oil, both of which are likely to be present in an oil spill. In addition, E. coli transformed with A. venetianus plasmid DNA may represent another option for oil spill bioremediation.

NAME(s) Emily Russell
PROJECT NUMBER B53
SCHOOL Home School (Randolph Educational Resuorse Center
GRADE 5
TEACHER Gina Sweet

PROJECT TITLE **Horse Treats**

ABSTRACT

The purpose of this activity was to find the most favored horse treat. My hypothesis was that Skittles will be the most favored treat. To do this experiment, I made treats and fed them to the twenty horses and observed if they liked it or not. If they did not like the treat they spit it out or just did not eat the treat. The kinds of treats that I made were plain, Skittles and beets. The results were that eighteen out of twenty horses chose the Skittles and the plain control treats as their most favored. Sixteen out of twenty horses liked the beets. Skittles and control treats are the most favored. The data does support my hypothesis. If I tested this again, I would pay more attention to the horse eating the treat, and do more research. I would also find more horses to test. From this activity I learned that the most favored horse treat is Skittles and the plain control treat are the most favored treats.

NAME(s) **Emily Russell, Aaron Paroline, Sam McIntyre**

SCHOOL Hoee Schooled at Randolph Educational Resouce Cent

TEACHER Andre St. Denis, Gina Sweet

PROJECT NUMBER **GP30**

GRADE 5

PROJECT TITLE **Operation Ski Machine**

ABSTRACT

Our goal is to design a fast, steerable skiing machine. Our team built three skiing/sledding prototypes to test the various ideas. One prototype had two side skis and a short, central steering ski, but it did not turn. The modified prototype used a longer steering ski and it worked. Another prototype was constructed to see if a sled body or skis would be fastest. A custom made box, with sloped front, was mounted in a plastic sled and its speed was measured. The sled was replaced with a pair of skis mounted to the box and its speed was measured. The results showed that the plastic sled was just slightly faster. A third prototype was made out of a pair of skis and a plastic box on wooden base and its speed was measured. Weight was added (cans of paint, placed in the plastic box) and the speed re-measured and the result showed that the added weight made the sled go faster. We learned that the best design would need a long steering ski, added weight, and could use a ski or sled body. We decided that the first prototype, with the long steering ski, and which is rather heavy because of its wooden construction, is the design which best met our objective.

NAME(s) **Anisha Saini, Danielle Dombi**

SCHOOL Frederick H. Tuttle Middle School

TEACHER Christopher Towle

PROJECT NUMBER **GP37**

GRADE 7

PROJECT TITLE **Audio vs. Visual Information**

ABSTRACT

The purpose of this experiment was to see whether people remember audio or visual information better. After doing a lot of research, the final hypothesis was that a majority of the people were going to remember visual information.

To conduct the experiment, a 20 digit sequence was made consisting of ten numbers and ten letters. The experimented individuals were ten boys and ten girls, from sixth to eighth grade. Initially, one of the students was brought into an empty room. After that, the sequence would be showed to that student for a time limit of 30 seconds. After taking it away, the student would recite the number of digits they memorized. As soon as a mistake was made, or the next digit was not known, the visual section was over, and the data was recorded. Next, the sequence was played on an audio recording, and after it was done, the student recited the digits they memorized - out of 20 total. Again, as soon as a mistake was made, or the next digit was not known, the trial was over, and the data was recorded.

After testing everyone, the tables were formed into four graphs; one for each grade tested, and an average graph. The data varied between the different grades and genders. The average graph reflected that the average amount of digits remembered for visual was 4, and that for audio was 3. The final conclusion made was that a majority of the people remembered visual information better.

NAME(s) Emma Saucier
PROJECT NUMBER P25
SCHOOL Windsor High School
GRADE 12
TEACHER Catharine Engwall

PROJECT TITLE **Load Sensing Walking Boot: Advice to prevent lower extremity injuries**

ABSTRACT

This continuation project is based on an inadequate model of a medical device that alerts a patient when they are exceeding their weight bearing limitations. The purpose of this is project is to design a new medical device that will allow patients with a lower extremity injury to be notified when they exceed these limitations. The current model is inadequate because informs the patient by sound. This does not work for a patient with a hearing impairment. It also attaches to the outside of the cast or walking boot, which makes it insufficient for a patient that has an injury above the knee. The new model is designed using Arduino, an open source coding platform, and FlexiForce sensors. The sensors are wired to turn on a light when the weight limit is exceeded. There is an Arduino Bluetooth board attached as well. This new component allows the user to be alerted via their smart phone.

NAME(s) Eliza Scherzinger
PROJECT NUMBER S22
SCHOOL Milton Middle School
GRADE 8
TEACHER Robert DeCicco

PROJECT TITLE **Distraction and Reaction Time**

ABSTRACT

The purpose of my project was to represent the effect of distraction on reaction time. I was inspired by the hands free law because if you talk on a phone while driving, it is not considered safe. Even when accomplishing a simple task while talking on a cell phone, the brain still has to comprehend the words coming from the phone rather than when you are not distracted.

I predicted that when I drop a ruler through a subjects hands while they are talking on a phone, it will take longer for the person to catch the ruler because the brain has to process the information coming from the phone. With the yardstick in my hand, hovering over the test subjects hand, I dropped it, then measured, in inches, where their hand gripped it. I repeated this test except this time, the test subject was talking on the phone. I test 20 tested subjects this way.

My findings indicated that talking on a cell phone definitely distracts you from doing simple tasks. Overall, 18/20 subjects had slower reaction times when talking on the phone. Some subjects were distracted with a difference of just 1 inch, but the difference for others was up to 23 inches. Even with a difference of just one inch, test subjects are still distracted by a simple conversation on a phone.

NAME(s) Chloe Schiff
PROJECT NUMBER S23
SCHOOL Main Street Middle School
GRADE 8
TEACHER eli rosenberg

PROJECT TITLE **Gender Stereotypes: Does Gender Affect How People Answer Girl Stereotype Questions?**

ABSTRACT

My science fair question was: does gender affect how thirteen and fourteen year olds answer gender stereotype questions? I hypothesized that yes, it does. I predicted that boys are more likely to judge or have mental models about girlÆs abilities and actions. This belief was based on my experience with thirteen and fourteen year old boys. I believe boys often get messages from places like the media that influence their behavior. I also believed boys would stereotype girls more often because I think girls are more aware about stereotyping.

To go about my experiment I created a survey and asked fifteen boys and fifteen girls to take it. The survey contained a few opinion questions, just to get a feel for what people thought, and five questions that had participants choose to stereotype like a girl or like a boy, or say either.

My results were as expected. Thirteen and fourteen year old boys do stereotype girls more, but not by a lot. I also found that boys are more likely to stereotype in general. In three out of the five questions more girls said either than boys. In the other two questions, there was a tie for the amount of girls and boys who said either. Overall, I think that my test went well and I found out that thirteen and fourteen year old boys stereotype girls more often than thirteen and fourteen year old girls stereotype girls.

NAME(s) Kathryn Schmidt
PROJECT NUMBER B26
SCHOOL Milton Middle School
GRADE 8
TEACHER Janet Smith

PROJECT TITLE **Aquaponics - Raising Fish to Grow Plants**

ABSTRACT

Aquaponics is a system of aquaculture in which the waste produced by fish, supplies nutrients for plants grown hydroponically without any pesticides or chemicals. In these systems plants tend to grow faster than plants do without. This experiment was to find out if distinct sized fish would grow the plants at different speeds. Various sized fish tend to produce different amounts of ammonia or waste when they exhale. Later, it becomes nitrate which is the main source of nutrients and something very important for a plant to survive. I thought that the larger fish would produce the most waste, because it has a larger lung capacity and exhales more. Therefore, it would grow the plants at a faster pace than the various other fish used in my experiment. I tested with a Male Veiltail Betta for my small fish, a Four-Line Pictus Catfish as the medium sized fish, and a Oscar Cichlid for my large fish. They were all kept in three individual aquaponics systems. In each system I grew wheat grass, radish sprouts, and red clovers. Over a period of 15 days the plants were measured daily.

I found that the larger fish did in fact grow the plants at a faster rate than the others. This did not surprise me at all, because Oscar Cichlids tend to produce a very high amount of waste every day. The data also showed that the medium sized fish grew the plants at almost a similar pace as the large fish, but the small fish grew the plants almost exactly as slow as they would grow in the ground. This proves that plants grow faster and healthier in aquaponics systems that use larger fish, because they produce more waste to lavish the plants than the smaller fish do.

NAME(s) Mara Senecal-Albrecht
PROJECT NUMBER B27
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton

PROJECT TITLE **The Effects of Bromocriptine on DLPFC functional connectivity**

ABSTRACT

The purpose of this study was to determine effects of bromocriptine on dorsal lateral prefrontal cortex (DLPFC) functional connectivity through the manipulation of the dopamine neurotransmitter in post-menopausal women. Based on previous research that dopamine plays a key role in aging related to functional connectivity, it was hypothesized that bromocriptine, a dopamine stimulant, when compared to placebo, will increase the functional connectivity in the DLPFC. In testing, eighteen subjects, upon undergoing a series of mental stability, intelligence, and hormonal tests, were placed under a series of three tests, each 72 hours apart. The subjects were also required to give a blood sample for genetic and hormonal examination. Each week subjects were given bromocriptine, haldol, or placebo, as a double blind dosage. They were then put under an fMRI scan and functional connectivity was measured over 5 minutes (Julie Dumas, et al. 2013). Preliminary review of the data indicates that there was an increase in concentrated functional connectivity under bromocriptine when compared to placebo. However, it does appear that there may be more connectivity under placebo but further examination is required due to contrast between results in the left and right DLPFC. Also, according the genetic data of the catechol-O-methyltransferase gene, it appears that those test subjects with any Val allele respond with a greater increase in functional connectivity than those test subjects with a homozygous Met genotype. In summation, it appears that bromocriptine only slightly increases functional connectivity and its effect is thoroughly influenced by the genotype of the subject.

NAME(s) Mehul Shah
PROJECT NUMBER B43
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton

PROJECT TITLE **Antibacterial Effect of Spices on Streptococcus pyogenes**

ABSTRACT

The purpose of this experiment is to study the effect of turmeric, ginger, black pepper, holy basil, and garlic on Streptococcus pyogenes. Turmeric, ginger, holy basil, black pepper and garlic are spices that are traditionally used in Indian cooking and are also used to help fight off infections. It was hypothesized that S. pyogenes, will be inhibited by at least one of the essential oils as effectively as it is inhibited by penicillin in primary testing. In addition, out of the 10 possible oil combinations, S. pyogenes will be inhibited by at least one combination of two essential oils as effectively as it is inhibited by penicillin in secondary testing. Blank, 6 mm filter paper disks were soaked in the essential oils of the spices, both individually and in each combination possible of two oils. The oil infused disks and pre-prepared penicillin disks were placed separately on the surface of blood agar plates and incubated at 37 degrees centigrade in a carbon dioxide incubator for 24 hours. After 24 hours, the zone of inhibition on each plate was measured.
Data collection is incomplete at the moment, however it is expected that S. pyogenes will be susceptible to the essential oils of garlic and holy basil. The zone of inhibition of the positive control, penicillin, will be compared against the zones of inhibition of the essential oils.
New discoveries in natural remedies to common illnesses can help reduce the use of antibiotics, before strains of bacteria become resistant to them.

All genes and species names are italicized.

NAME(s) Nisha Shah

PROJECT NUMBER B28

SCHOOL Frederick H. Tuttle Middle School

GRADE 7

TEACHER Amelia Lutz

PROJECT TITLE **Common Drinks and Their Effects on Teeth**

ABSTRACT

Different drinks that we drink have different effects on our teeth. This test was designed to prove that drinks with higher acidity will have a larger negative effect on teeth. Eggshells were used as a substitute for teeth; six commonly consumed drinks- water, coke, orange juice, black coffee, milk, and lemon juice at different concentrates were the independent variables. Small holes were punctured at the top of eggshells to remove the yolks, clean the inside out, and fill with water which acted as a weight to keep the eggshells partially submerged in their respective liquids. At the start of every test, pH of the liquids were measured. Every 24 hours, eggshells were removed from the liquids, rinsed and dried for 24 hours. The loss in mass of the eggshells and changes in appearance of the eggshells were recorded. Then the eggshells were placed back in their respective liquids. This process was repeated so that each eggshell was in its respective liquid for a total of 72 hours. Observations: Water had neutral pH and had no significant change in the mass of the eggshell. Coke, lemon juice, and orange juice were acidic and each eggshell had a significant loss of mass, although eggshells in lemon and orange juice had a greater loss than in coke. Black coffee was slightly acidic and the mass of the eggshell reduced moderately, but the coffee stained the eggshell brown. Milk was more neutral than acidic, and itÆs mass only reduced by a thousandth of a gram. In conclusion, the more acidic a liquid, the greater damage it had on the eggshell. So when acidic drinks are consumed, they will break down and stain the teeth.

NAME(s) Olivia Simon

PROJECT NUMBER C17

SCHOOL St. Francis Xavier School

GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE **Lime Light**

ABSTRACT

The focus of my project was to find efficient and eco-friendly alternatives to power a nightlight. I chose this project because I learned that batteries are toxic to our landfills and I was curious to see if I could use lemons, limes, or potatoes as a biodegradable power source. My goal was to take the potato clock concept to the next level!

As part of my research I took voltage readings for each lime, lemon, and potato and documented my results. The problem I realized was that each lemon, lime or potato averaged 0.8 volts and an LED bulb needed at least 3.0 volts of power. I learned I would need at least 4 limes, lemons, or potatoes connected in a series to effectively power an LED bulb.

Once connected, I also learned it was important to recheck the voltage available because some energy was lost when connected in a series. Another thing that I had to watch out for was supplying too much voltage causing the bulb to blow. Using my results I was able to match the LED voltage requirements and there was enough power for the bulb to illuminate.

For my project Lime Light I hypothesized that I may be able to create efficient technology using a sustainable power source. My¡ idea was to create a nightlight for my bedroom. I learned during my procedure, that adding the right amount of limes, lemons, or potatoes in a series I could effectively power an LED bulb. Using an efficient energy source to power the bulb is a better alternative than batteries which are toxic to our environment. I believe children would be interested in alternative and sustainable power as creative technology to power their own nightlight!

NAME(s) **Noah Simonds**

PROJECT NUMBER **P26**

SCHOOL St. Francis Xavier School

GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Tension Integrity○**

ABSTRACT

Tensegrity describes a closed structural system made up of three or more compression elements within a network of tensile elements. Its structural principle is based on the use of isolated components inside a net of continuous tension. The compression elements (components or rods) do not touch each other and the tensile members (strings) delineate the system spatially. Tensegrity has been utilized to build various structures, such as space frames, deployable moon-base shelters, bridges and tremendous sculptures. In the last few decades, scientists have shown that tensegrity is a fundamental biological design principle of nature, including the spine, where the vertebrae float within the ligaments like a tensegrity structure.

For my experiment, I tested the strength of tensegrity structures under both tension and compression with different types of tensile elements to determine the strongest type of tensile element. I thought that the metal wire would test as the strongest. To test the structure under tension, I attached a force to one side of the structure, pulling until it either collapsed or broke. To test the structure under compression, I placed a tray and small weights on top of the structure until it either collapsed or broke. As predicted, the metal wire tested the strongest out of the other three -- stretch magic, rubber bands, and floss.

Even though the metal wire was the strongest, it was the least flexible. Rigid tensegrity structures are necessary in designs such as bridges or space frames, but in biological designs, elasticity and versatility are necessary. The rubber bands were the weakest of all the tensile elements, but were also the most elastic. The stretch magic cord was both elastic and strong; and the floss was neither elastic or strong. I can can conclude that the metal wire was the strongest tensile element, proving my hypothesis.

NAME(s) **Camden Simoneau**

PROJECT NUMBER **P27**

SCHOOL Milton Middle School

GRADE 7

TEACHER Janet Smith

PROJECT TITLE **Does your home feel like an igloo?**

ABSTRACT

Abstract

Most old homes and trailers do not have a proper insulation for winter. This can have a big effect on heating bills. With the right insulation we can combat this problem in our community.The purpose of my experiment was to find the most effective insulation.

I designed a box to simulate a home where I could swap out different types of insulating materials. I took the temperature inside the box at the start of the test and every four minute while it was in the freezer over twenty minutes. I then repeated this process with a different insulation recording my data along the way.

In my hypothesis I thought that sand would slow the temperature change the most because it is the most dense of the insulation in the test so convection will not occur in the box for the majority of the time it is in the freezer. The insulation that worked the best was sand just as I predicted. Newspaper was the worst out the seven insulating materials. I plan to make a new insulation that has the density of the sand but the lightness of shredded plastic and test that and see how that it stacks up to the other insulating materials.

NAME(s) Ragulan Sivakumar
PROJECT NUMBER S24
SCHOOL Frederick H Tuttle Middle School
GRADE 7
TEACHER Christopher Towle

PROJECT TITLE **The Evaluation of Hydration**

ABSTRACT

The central theme of this project was to see if hydration had an effect on test results. As a student, many had wondered if there was a better way to prepare for a test. It was also known that the brain mainly relied on water to function properly. The project is to see if there is a relationship between hydration and performance. Thus a hypothesis was formed that hydration does effect performance by improving how one functions through a test. Through testing, six students were surveyed to see how hydration would affect their performance on several math tests. In the experimental stage of the project, a series of six tests were conducted in which two tests were the normal results, two tests occurred where the subject ingested more water, and the two final tests occurred where the subject had consumed less water. The students all took their tests at 3:00 in the afternoon and had the same amount of water supplemented or taken away. In the tests, the results found that students do perform under their normal when they consume less water in the day prior to the test. It was also found that students perform above their average when the have more water circulating their body. The results supported the hypothesis. The students do perform better with additional hydration. That is what was found while conducting the experiment.

NAME(s) Sajani Sivakumar
PROJECT NUMBER B54
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton

PROJECT TITLE **The Effects of Vitamin D on Pancreatic β-cells Under Glucotoxic Stress**

ABSTRACT

Pancreatic β cells comprise the central regulatory tissue of the glucose homeostasis system. Glucotoxicity associated loss of insulin producing β-cells is one of the most significant pathogenic factors that causes hyperglycemia and Diabetes Mellitus or DM. Vitamin D3 deficiency is proposed to be linked with the pathogenesis of DM in the literature but a direct effect of the active form of vitamin D3 on pancreatic β cells under glucotoxic condition is not evaluated. The central theme of this research project was to evaluate the effect of vitamin D3 supplementation on the expression of key pro-function and survival marker genes in β cells under glucotoxic stress. The INS-1 β-cells were cultured for 24 to 72 hr under: (i) 5 mmol/L of glucose as a control (ii) 20 mmol/L of glucose to simulate hyperglycemia (iii) 5 mmol/L and (iv) 20 mmol/L glucose both in presence of 10 nM Vitamin D3. The total RNA was isolated at 24 to 72 hr from n=3 samples under each experimental condition, followed by cDNA synthesis and gene expression analysis through real time Polymerase Chain Reaction otherwise known as PCR using FAM-tagged primers for key β cell genes: pdx1 and pparg which are imperative for function and survival, gck which senses glucose, glut2 which functions for glucose transport. The preliminary gene expression results from n=2 samples show a progressive decline of gene expressions of pdx1, pparg, gck, glut2 under hyperglycemic condition compared to the normoglycemic condition 5 mM. Surprisingly vitamin D3 supplementation did not ameliorate the expression of any of these marker genes under hyperglycemic conditions. Currently I am evaluating reasons for the non-responsiveness of β cells toward vitamin D3 under glucotoxic stress.

All the initial primers gck, glut2, pdx1, and pparg are meant to be italicized.

NAME(s) Willem Slade

PROJECT NUMBER P28

SCHOOL Main Street Middle School

GRADE 8

TEACHER eli rosenberg

PROJECT TITLE **What Characteristics of a Board Make it Easiest to Break?**

ABSTRACT

For my project, I am trying to determine which characteristics of a board make a board easiest to break. Within these characteristics, I chose variables such as knots in the board, the grain direction of the board, and if you stack two boards. My hypotheses were that I thought that concave boards would take the least amount of energy to break, that knots in the board would make it harder to break, and that doubling the boards would not actually double the energy needed to break one board.

For my procedures, I took data by dropping a hammer from my pendulum-like mechanism, at different heights, to attempt to break a board clamped onto the front of my device. I would then record the height at which the board broke, whether the board had a knot, whether the boards grain was convex or not, the distance to the breaking point from the center, and notes. I recorded these distances using a tape measure, and enter the measurements into my new google spreadsheet.

Overall, I believe that my data was accurate, and demonstrates a decent representation of which characteristics make a board easiest to break. Although there were a few faults due to knot inconsistency and weak boards, I believe my data turned out to be accurate. I noticed within my data that for every type of board tested, there was always a fairly large range of heights, which relates to the few outliers I mentioned, but mostly, the heights stayed in at around the 12-15 range. After analyzing all data I realized one prominent fact: the characteristics of a board that I tested donÆt tend to make a difference overall in the energy that it takes to break a board.

NAME(s) Samy Slamani, Taylor Metcalf

PROJECT NUMBER GP31

SCHOOL Fredrick H. Tuttle middle school

GRADE 7

TEACHER Amelia Lutz

PROJECT TITLE **Aerodynamics to a shape of an object**

ABSTRACT

We studied what kind of shapes have better aerodynamics then others. Our hypothesis was that if an object has a rounder shape in the front then it will go faster. First without an object on the car weigh it, measure the height and time it going down the ramp and to the end with a stopwatch. Second make a clay shape and weigh it, measure the height and use a stopwatch to time the time. Thirdly put all results into the table, and last, repeat for each shape five times. After the testing we found the average speed for each object, and we found that the fastest one was the triangular prism. Second was the car with nothing, third was the rectangular prism, fourth was the sphere, and last was the cylinder. We can conclude that if the shape has an angle in the front or is low to the ground it usually goes forward.

NAME(s) Emily Smith
PROJECT NUMBER P29
SCHOOL Windsor High School
GRADE 10
TEACHER Catharine Engwall

PROJECT TITLE **Using Cow Manure as a Renewable Resource for Distilling Water**

ABSTRACT

The purpose of this experiment was to produce clean water using a renewable source. One way to do this was to purify the water using the process of distillation. To heat the water, a renewable fuel source was needed. This fuel source was cow manure. If cow manure is baked, it can be used to fuel a fire. That fire is then used to heat the water into vapor. Fresh manure is then used to cool the vapor back into clean water while at the same time baking the fresh manure.

The average family drinks an average of 10 liters of water a day. With the renewable fuel source, the distiller cleaned about one sixth L in an hour. With more room for the water and fire the outcome would be greater. One average cow produces about 50 lbs of manure per day. It takes about 2 lbs to clean one sixth L. To make clean water for one family, 120lbs of cow manure would be needed a day. It would also take around 60 hours. This family would need a bigger distiller or more than one of these distillers to get enough clean water.

The design was successful at distilling, however the manure could not cook fast enough to have a steady source of fuel. This could have been due to the cold weather slowing down the process. The fire had to be constantly fed or it would not heat up enough to boil the water. Because of this, the flow of water was not constant. The fire would have been more consistent if the model was larger. The holes drilled for ventilation were quickly filled by ash. Feeding the fire would not have to be so constant if the model were bigger because more fuel would fit in the fire at a time. If the model were increased, the cookie sheets would have to be too. This is so more manure could dry at a time in order to fuel the fire. It will also increase the amount of water distilled because there will be more room for the water in the device.

NAME(s) Morgan Smith
PROJECT NUMBER B55
SCHOOL Northfield Middle High School
GRADE 11
TEACHER Shane Heath

PROJECT TITLE **The Effect of Magnets on Bruise Physiology**

ABSTRACT

The belief in healing with magnets is an idea thatÆs been around for hundreds of yearsù but recently has become very popular. Rats injected with inflammatory medication and treated with magnetic fields directly after showed reduced swelling. Static magnetic fields increase blood circulation, providing more oxygen to the tissue and reducing inflammation at the site. I produced paired contusions on the lower backs of 3 males and 7 females using a bell jar vacuum. I applied a circular magnet to the center of one of the paired contusions with a bandage and removed the magnet 24 hours later. I compared before and after pictures of each contusion to qualitatively asses if the severity of discoloration in the bruises. My data showed that in 14 out of the 18 cases the magnets were successful in the healing of the contusion, but in others it was not effective. When a magnet was placed on one of the contusions for 24 hours it showed less discoloration and swelling than the contusion with no magnet on it. I compared before and after pictures and looked at the difference in swelling and discoloration to record my data after the 24 hour period. During the contusion process I asked the level of pain they were in on a scale from 1 to 10. All of the females pain scale was significantly higher than the pain level of the males. The level of pain they were in during the process did not effect if the healing of the contusions. On average (14 out of 18 cases) the magnet in fact did lessen the severity of the contusion.

NAME(s) **Andrew Snell, Elliot Limanek**

PROJECT NUMBER **GP29**

SCHOOL Christ the King School

GRADE 8

TEACHER Mrs. Srivastava

PROJECT TITLE **Capture the Rays**

ABSTRACT

The usefulness of solar panels in Vermont, one of the cloudiest states, is highly debated. Our project was to find the best angle to place a fixed panel to utilize the small amount of sun we do get. We hypothesized that putting the panel at 45 degrees to the ground would be the best angle because it allows for the sun to hit it at the most points. Our results show that a solar cell facing south at 60 degrees, not 45 degrees yielded higher milli-amps. We believe that 60 degrees was the best because it allowed the low winter sun to hit the panels perpendicularly. We also found that direct sun, not just daylight, is a must when it comes to collecting energy.

NAME(s) **Meg Snide, Maggie Burns**

PROJECT NUMBER **GP18**

SCHOOL Woodstock Union High School

GRADE

TEACHER Jen Stainton

PROJECT TITLE **Would a site contaminated with mercury in the 70's still have higher levels than a non-con**

ABSTRACT

The question we studied was: ôWould a body of water contaminated in the 1970Æs have higher mercury levels than a non-contaminated site?ö We chose this project because we wanted to know if a contaminated site, now being cleaned through the U.S. GovernmentÆs Superfund Program, would still be contaminated with mercury. Our hypothesis was, if we test mercury levels in dragonfly nymphs found in contaminated and uncontaminated bodies of water, then mercury levels would be higher in contaminated bodies of water because it takes mercury a long time to leave an area. We researched the history of Gorham and its contamination, the comparison of Gorham with the Marsh-Billings-Rockefeller National Historical Park and Saint-Gaudens National Historic Site, and information about dragonfly nymphs. Gorham was contaminated in the 1970Æs from an old chloroalkyl plant, and 45 years later itÆs still a hazard to health. For our project we compared the Gorham Superfund Site, Marsh-Billings-Rockefeller National Historical Park and Saint-Gaudens National Historic Site because theyÆre all similar in the sites that the data was collected from and in their locations. Gorham is in Gorham, New Hampshire, Marsh-Billings-Rockefeller is in Woodstock, Vermont, and Saint-Gaudens is in Cornish, New Hampshire. We used the data from dragonfly nymphs because dragonfly nymphs are an indicator species because they live for a long time in the same place. When we created the box and whisker plots for our data, the data for Gorham was so much higher than the data for Woodstock and Saint-Gaudens, that GorhamÆs lowest point didnÆt overlap the highest points of either of the other two sites. We concluded Gorham was significantly higher in mercury levels than the other two, non-contaminated sites. Therefore our hypothesis was supported.
○

NAME(s) **Noah Spoth**

PROJECT NUMBER **B29**

SCHOOL Avalon Triumvirate Academy

GRADE 8

TEACHER Amanda Gifford

PROJECT TITLE **Carbonated Conundrum**

ABSTRACT

Every year millions of dollars are spent on marketing for Coca-Cola and Pepsi. This could be fixed by the soda companies marketing more effectively towards their respective markets, spending the money elsewhere. Differentiating in senses along the lines of gender is not unheard of. For example, women can differentiate colors better. Therefore, it would make sense that different genders could better differentiate between all the different flavors. From the background research, it is hypothesized that the female subjects will garner more correct guesses. Each person is given three cups of cola, and must determine whether it is Pepsi or Coca-Cola. Each correct guess is written down and at the end of the testing the amount of correct answers are added up to determine which gender is better at telling what is Coca-Cola and what is Pepsi. In between each tasting, the subject cleansed their pallet with water. When all the results were added up, the female subjects ended up with one more correct answer than the male ones. The result of the testing does not show a significant difference and therefore means that, neither men nor women are better at tasting the difference between Pepsi and Coca-Cola.

NAME(s) **Hannah St. Denis**

PROJECT NUMBER **S25**

SCHOOL Homeschool Randolph Educational Resource Center

GRADE 8

TEACHER Gina Sweet

PROJECT TITLE **Color Taste Confusion**

ABSTRACT

The objective of my experiment was to figure out if the color of a cup would affect the taste of the cola. I hypothesized that more people would prefer the red cup, because coke bottles normally have a red label. My experiment did not support my hypothesis. More young people preferred the red cup, while the older people chose white and blue equally and liked the red one less. There was no was no significant difference between genders.

- For my experiment I took three different colored cups, red, blue, and white, and pored Coke into each of them. I then handed them to my subjects along with a survey with three different questions on it. How old are you? Male or female? Which cup tasted the best? Between each cup of Coke I had my subjects drink water so the taste of the cup before would be rinsed off their pallet.
- I did discover the perception of the taste did change. Many people thought the beverage was Pepsi or some homemade thing. So my conclusion is that the color of the cup does not change the taste, but can affect the perception of the beverage.

NAME(s) **Emma Stephens**

PROJECT NUMBER **B30**

SCHOOL Northfield Middle/High School

GRADE 10

TEACHER Shane Heath

PROJECT TITLE **The Effect of Different Nutrient Ratios on the Total Leaf Area and Mass of Strawberry Plan**

ABSTRACT

The nutrient balance in the soil makes a great impact on the growth of plants. Plants not only need water and carbon dioxide, they need the essential nutrients Phosphorus, potassium, and nitrogen. The three nutrients that will be tested are arguably the most important to the growth of the plant as the plants cannot survive long without any of them. The purpose of this lab is to test if the physiological needs of strawberry plants are similar to those of tomato plants and to determine which nutrient balance grows the healthiest strawberry plants, based on leaf area index and plant mass. In order to conduct this lab strawberry plants were grown in four hydroponic solutions that contained different ratios of phosphorus and potassium. These solutions were (1) the control (full nutrients), (2) a solution of double the necessary amount of potassium and half the amount of phosphorus, (3) a solution of double the phosphorus and half the amount of potassium, and (4) double amounts of both nutrients. Three plants were grown in each solution for four weeks. The control plants had an average leaf area change of 47 cm2, solution B had an average change of 37.6 cm2, solution C had an average change of 59.6 cm2, and solution D had an average change of 61.6 cm2. This data shows that plants grown with double the phosphorus and double the potassium will grow healthier plants, in a measure of leaf area, than those grown in other solutions. This has a real world application because, as we continue to push EarthÆs population limit, humans will put increasing amounts of energy towards creating more food. Any way that can be used to grow healthier plants and therefore create more food will be necessary when facing this problem.

NAME(s) **Katie Sweet**

PROJECT NUMBER **B31**

SCHOOL Homeschool Randolph Educational Resource Center

GRADE 11

TEACHER Gina Sweet

PROJECT TITLE **EMF Exposure to Plants**

ABSTRACT

In my experiment, I wanted to see whether EMF (Electromagnetic Force) would affect plant growth, to see if the EMF would create the plant to grow faster or to grow slower. The reason I choose this experiment is that there are a few farms near EMF facilities, which create electric waves, and flow into the farm field. This could be the reason behind bad plant growth. My hypothesis was that the EMF would not affect the growth of the plants. However, I was wrong. What I did in my experiment was get four sets of plant, two flowers, and two cucumbers. I had one of each set put by an area with EMF radiations and the other two in an area with no EMF radiations. The cucumber plant that was exposed to EMF had an average of 2.9 cm growth of the root, while the cucumber that was not exposed to EMF had an average of 2.8 cm growth of the root. However, the Morning Glories that were exposed to the EMF had a slight growth defect (1.6 cm) while the one that was not exposed to EMF grew like the cucumbers (2.7 cm). The physical changes were clearer than the growth changes; the roots of both plants that were exposed to EMF were thicker, they had more little hairs on the roots, but the roots of the plants not exposed to EMF had thin, short roots, with little to no hairs at all. Briefly, the results came out to be that the EMF had an effect on the cucumber plant and the morning glory. While the non-EMF effected plants had little to no effect at all. In conclusion, I found out that EMF does affect the growth of plants.

NAME(s) **Sebastian Thomas** PROJECT NUMBER **B56**

SCHOOL Frederick H. Tuttle Middle School GRADE 7

TEACHER Mr. Towle

PROJECT TITLE **Which Genre of Video Game Affects Heart Rate**

ABSTRACT

The problem is that kids are playing all types of video games and when they plays that the find it hard to fall asleep when they have to go to bed. The question is which type of video game causes someone to have the highest heart rate? A hypothesis is that the more violent video games will create a higher heart rate because in the background research stated that the less often time spent playing violent games causes a rise in heart rate. Some procedures involve sitting down for 5 minutes and then measuring the beats per minute other whys other heart rate would be slower than another. Another procedure is playing every video game for 15 minutes and measure heart rate because it would be unfair to play each game a different length. As well making sure the participants sit still otherwise results will be changed. Also another procedure is to average each video games heart rate. A final procedure is have them play on the same environment because if one person plays a game during the day and another plays it at night it might cause a higher heart rate. According to the results the findings are that the first person shooters cause a higher heart rate. A conclusion from the result is that first person shooters cause a higher heart rate because there is more violence and action and stress involved.

NAME(s) **Kaitlyn Tice** PROJECT NUMBER **G11**

SCHOOL Milton Middle School GRADE 6

TEACHER Janet Smith

PROJECT TITLE **What Stops Erosion?**

ABSTRACT

Erosion is when wind, water or rain pushes dirt around and takes dirt away from land. Landowners and farmers worry about erosion since it affects their crops or land. Erosion is stopped when soil is held in place; therefore, my project is about stopping erosion. I tested to see what material best stops erosion: rocks and leaves, plants, or just soil. I predicted that that dirt, leaves, and rocks would work the best to slow erosion because the leaves would catch the water and the rocks would stop it.

I placed soil, rocks and leaves in one container, plants and soil were in another container, and a third one had only soil. I poured 125 milliliters of water into each container and collected the water that was run-off. I repeated this with 250 milliliters of water. This water was filtered and the material that eroded with the water was collected and weighed. I found that the least amount of soil that eroded was in the container with the plants at 0.05 percent. The most soil eroded in the container with only soil at 0.66 percent. The container with rocks and leaves eroded 0.24 percent of the soil.

I was surprised by my results and realized that the roots from the plants were better at catching the water and slowing it down so less soil was eroded. There was nothing to prevent the soil from eroding in the container with only soil. I learned that rocks and leaves slowed down erosion only partly. This showed that rocks and leaves are not the best choice out of the three options. By adding plants and trees to their land, farmers and landowners may slow down the process of erosion.

NAME(s) Tatum Turner

PROJECT NUMBER B32

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Does Brushing Really Matter?**

ABSTRACT

Presently this study is to determine whether or not brushing with a toothbrush and toothpaste is sufficient in protecting teeth from harmful bacteria such as bacteria that causes tooth decay or periodontal disease. The concept of the study was to swab 25 people and question them on their daily dental hygiene routine. Those who brushed, rinsed, and flossed everyday were asked to just brush for a week. That group of participants was swabbed again after a week. The results of this study are expected to be as follows, people who brushed, flossed and rinsed everyday have less bacteria in their mouth than those who did not brush, floss or rinse everyday. After a week of merely brushing, those who were asked to only brush for a week would have more bacteria growing in their mouths than before, implying the lack of their usual hygiene caused the growth of this bacteria. The analysis or conclusion of this experiment would then go on to prove that the recommended brushing and flossing twice daily with a mouth rinse truly are cleanly habits to get into for the better of oneÆs health. To limit variables all participants were asked and tested merely on the number of times they brushed, flossed, and rinsed. The implications of this study would be to inform the public of beneficial healthy dental hygiene habits, which in turn promotes healthy personal healthcare.

NAME(s) Melissa Valgoi

PROJECT NUMBER B44

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Effect of Soap and Water vs. Acne Wash on Facial Bacteria**

ABSTRACT

Over a hundred different types of bacteria thrive on the surface of our faces. In this experiment, two different types of face washes will be tested. Soap and water and an acne face wash containing 2% salicylic acid will be compared. It is hypothesized that the acne face wash will work better at removing and resisting the return of bacteria longer than soap and water. Each subject will have their forehead swabbed before, after, and two hours after washing their face. On a separate date, the other face wash will be tested in the same manner. Each test subject will be their own control. The constant variables are the age, gender, type of wash used, amount of time between wash and second swab, and the amount of time that the forehead is washed for. The independent variable is the type and amount of face wash. The dependent variables are how much bacteria is present after the face has been washed, and how much bacteria returns after two hours. All data collected has yet to be analyzed for results. The data will be analyzed by determining the percentage of bacteria present at each stage. It is unknown if either soap will be more effective at removing and preventing the return of facial bacteria, but background research suggests the acne wash will be more effective. By knowing which soap is the most effective, one can make informed decisions on their facial care and prevention of acne.

NAME(s) Caitlin Varin

PROJECT NUMBER B57

SCHOOL Missisquoi Valley Union High School

GRADE 11

TEACHER Dana Maria Dezotell

PROJECT TITLE **What Effect Does The Stage Of Lactation Have On The Protein Composition Of Milk From Bos T**

ABSTRACT

Farmers are paid by their quality of milk and production rate. Milk is measured by SCC, protein, and fat. Bos taurus have 4 stages of lactation: colostrum, early lactation, mid lactation, and late lactation. I wanted to find out which stage has the highest level of protein. To achieve this goal, I choose 4 Bos Taurus from each cycle to collect milk vial samples from. I had 16 samples total that I diluted to test in a spectrophotometer. The substances I used to dilute my samples were PBS, Coomassie Brilliant Blue dye, and distilled water. The dye bound to amino acids and resulted in a blue color. Each sample was tested for a quantitative reading of absorption at 595 nm in the spectrophotometer. I found a Bos taurus in the early lactation stage to have a high protein rate for that stage, which was 90. This showed me that protein levels are still high even after the colostrum stage. My independent variable is the lactation stages. My dependent variable is the protein content. My potential variable is the breed, which was holstein. It is important for farmers to know which stage of lactation produces the highest level of protein. Farmers can control the genetics, season when Bos taurus are bred, and management of SCC in regards to their herd to achieve better milk quality.

NAME(s) William Wagner

PROJECT NUMBER B33

SCHOOL Saint Mary's School

GRADE

TEACHER Sara Abbott

PROJECT TITLE **Comparison of Natural versus Commercial Fertilizer in Radishes**

ABSTRACT

There are advertisements everywhere for commercial fertilizers such as Miracle Grow, however, often you can find natural fertilizers in your own back yard. In fact, natural fertilizers can be even better than commercial fertilizers for small projects. I planted radish seeds in four different containers. Each container had a soil with or without a different fertilizer. I added nothing to the first container, manure to the second, NeptuneÆs Harvest Natural Sea Fertilizer to the third, and Miracle Grow to the last container. I then planted two previously germinated seeds in each of 6 containers per soil type at a precise depth of ¼ inch. I maintained the containers in good sun and water exposure and allowed them to grow for 3 weeks. I then pulled each plant out of the soil and measured the growth from the root to the top of the leaf. My experimental results support my hypothesis that natural fertilizers are superior because, depending on how the data were evaluated, either manure or NeptuneÆs Harvest were the best at encouraging plant growth.

NAME(s) **Eli Wakeling**

PROJECT NUMBER **P30**

SCHOOL South Burlington high school

GRADE 9

TEACHER Jim Shields

PROJECT TITLE **Mass and Gravity**

ABSTRACT

The purpose of running the simulation is to see if mass affected the gravity of an object in space.
By changing the moonÆs mass the tester found that for example when the mass of the moon was multiplied by 2, the moon formed a lopsided orbit around earth. when the mass of the moon was increased to that of the sun it was flinging away planets and asteroids when they got relatively close to the moon, When the mass of the moon was increased to 100 suns It made the solar system collapse and having all the planets fly away. The possibility of error mainly is the fact that the experiment was mainly run on observations by a single observer in the future to do this experiment with more accuracy the experimenter needs to include more observer. The experiment proves the hypothesis of mass affecting gravity to be correct. The reason it is important to know about this is because in order to do interstellar travel we would need to take advantage of gravity.

NAME(s) **John Waligory**

PROJECT NUMBER **P31**

SCHOOL Milton Middle School

GRADE 8

TEACHER Janet Smith

PROJECT TITLE **Tracking the Sun - Does it Make Solar Cents?**

ABSTRACT

Solar power is an alternative source of clean energy that does not burn fossil fuels. There are many residences in Vermont that use solar power technology. In my community, negotiations are underway to build one of the largest community solar parks in the nation by 2016. Living in the northeast United States we experience many cloudy and snowy days. The primary goal of this project was to investigate two different models for more efficiently capturing this clean energy source.

I was interested in determining whether a fixed solar panel or a solar panel attached to a solar tracker is more cost efficient. I hypothesized that a solar tracker would be more productive than a fixed solar panel because it has optimal time facing the sun. I built a solar tracker and solar panel to test this hypothesis. This solar tracker was specifically designed to follow the brightest light source.

I used an arch with tape marks every eight inches to consistently know where to collect my voltage output values and to also represent the hours of the day. For each model, I then moved a 100 watt light bulb along the arch, stopping at each tape mark to observe and record the voltage reading from the solar panel. As predicted, I found that the output voltage of the solar tracker was consistently higher than that of the fixed panel, thus creating more electricity.

Next, I converted the voltage produced from each model into wattage. The wattage was then converted into dollar amounts based on current Green Mountain Power rates. Lastly, I projected the value of energy produced over time in comparison to the cost of making each model. I discovered that the solar tracker took twice as long as the fixed panel model to regain the cost of producing each.

NAME(s) **Owen Waligory**

PROJECT NUMBER **P32**

SCHOOL Milton Middle School

GRADE 6

TEACHER Janet Smith

PROJECT TITLE **How Much do you Truss your Roof?**

ABSTRACT

I observed that most houses in Vermont are built with roofs that slant. Vermont is known for large amounts of snowfall that can cause roofs to collapse. I therefore questioned if the style of roof truss was related to the amount of weight it could withstand.

I hypothesized that the common roof truss design would hold the most weight, the in-attic design would hold the second most weight and the barn design would hold the least. Based on different designs, I was able to build and test three roof trusses and analyze the data to determine which would hold up best under the greatest amount weight. Each design was built using balsa wood and glue. Two trusses were constructed and tested for each design. A device was constructed from duct tape and cardboard to distribute the weight across the top of the truss. A rope was attached to the weight distribution portion of the device with a bucket hanging below. Water was slowly added to the bucket until the truss failed. The bucket and water were weighed to determine how much weight the truss withstood until failure.

My hypothesis held true for the common roof design since it withstood the most weight. The common roof design held 4.50 pounds before breaking. The barn design held 3.93 pounds and the in-attic design held 3.39 pounds. I am continuing to test these designs for additional trials. I am also testing two more roof truss designs: a polynesian truss and a king post truss. I think that the polynesian will hold the most amount of weight since it has multiple ways for energy to be dispersed.

NAME(s) **Kyle Weirether, Rory Haff**

PROJECT NUMBER **GP20**

SCHOOL Woodstock Union High School

GRADE 9

TEACHER Jennifer Stainton

PROJECT TITLE **What is a Bigger Mercury Threat: Coal Fired Power Plants or Volcanoes?**

ABSTRACT

The purpose of this experiment was to help inform the public about mercury levels near coal fire power plants and volcanoes. The question driving the experiment was, ôWhich has the greater effect on mercury concentration, proximity to coal fired power plants, or the proximity to volcanoes?ö It was then hypothesized that, ôIf the mercury levels of national parks across the U.S. are tested, then the levels will be higher in parks closest to coal fired power plants because they produce the most mercury that stays local.ö In this experiment, dragonfly nymphs were collected from participating National Parks and sent to the Trace Element Analysis Lab at Dartmouth College to be measured for mercury content. Locations of all volcanoes, coal fire power plants, and participating National Parks in the United States were found and distances between all points were recorded. The distances taken were then compared to the dragonfly mercury levels to see if there was a relationship between the two. After analyzing and graphing the data, it was concluded that linear regressions of the data showed lines with such a low slope that there was almost no real trend in the data, and no scientific inferences could be drawn from the data. Therefore the data neither supported nor refuted the hypothesis, and could be considered inconclusive. Using this data, it appears that the proximity to either a coal fired power plant or a volcano have little to no effect on the mercury levels in that place.

NAME(s) **Eliza White** PROJECT NUMBER **B34**

SCHOOL St. Francis Xavier School GRADE 8

TEACHER Mary Ellen Varhue

PROJECT TITLE **Can You See It?○○**

ABSTRACT

The color of your eyes is like a fingerprint, each unique, and one of a kind. My experiment was to see if eye color affects a person's peripheral vision. I did a lot of research on eyes, eye color, and peripheral vision, and all of the websites said the exact same thing. Lighter colored eyes are more sensitive to light, they tend to have more eye problems, and you see more people with lighter colored eyes wearing eye glasses. I hypothesized that the lighter colored eyes would have worse peripheral than darker eyes, due to the research I had done.

○I took a left over science fair board and cut it into the shape of a protractor. I then took a bright colored tack and put it in the person's line of vision for them to study while I tested them. After that I sat a middle schooler down and tested them by placing the protractor on their nose underneath their eyes, while I went around the outside of the protractor with a straw. Using the straw I had them inform me at which degree they could see the straw. When I had finished this I decided to do another test doing the same thing, but this time I had them identify a color and shape when they could see it. I did this to see if their was a significant change in the data when asked to identify an object without actually looking at it. My results proved that my hypothesis was correct, blue eyed people have worse peripheral vision. I would definitely want to conduct this experiment again on a larger amount of people to verify my results.

NAME(s) **Bentley Wilking** PROJECT NUMBER **B35**

SCHOOL South Burlington High School GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Would an Inflation of Desalination Help the Nation?**

ABSTRACT

This experiment tests the efficiency and effectiveness of three methods of desalination to determine which method would be the most effective for use on a large scale. The second portion of the test is determining whether or not methods of desalination could also cleanse grey water effectively. It was hypothesized based on research that reverse osmosis has the best combination of energy efficiency, speed, and effectiveness to clean salt water and grey water. The thermal and solar still methods both involve turning the saline water into gas, condensing in a dome, and collecting the run off in a separate enclosed container. The reverse osmosis system contains a semipermeable membrane and a pump to drive the water across the membrane. Preliminary results support the initial hypothesis, although there is a drawback in that the saline water has to pass through many filters in reverse osmosis in order to thoroughly desalinate the water, which takes a lot of pressure to do quickly. The solar method is effective but extremely slow, while the thermal method is effective and desalinates at a good speed but is not energy efficient. The biggest source of potential error so far has been that steam appears to escape the thermal method, producing much less water than was initially being heated. This would be limited on large scale systems with much more carefully sealed environments. The Lack of availability in some regions around the world of clean water has increased demand of a resource that desalination plants help supply.

NAME(s) **Max Wolinsky**

PROJECT NUMBER **S26**

SCHOOL Big Picture South Burlington

GRADE 9

TEACHER Jim Shields

PROJECT TITLE **How long does human eyes adjust to the dark.**

ABSTRACT

This science experiment tested how long it takes for your eyes to adjust to the dark. It can be used for medical use.

The hypothesis is that the eyes of the younger people will adjust faster to the dark than older people. The subject walked in and researcher explained the procedure. While the researcher explained the procedure, the eyes of the subject adjusted to the light. The lights were turned off, the researchers started recording the time on a stop watch. A white board with a word on it in black text was placed in front of the subject. When the subject correctly reads the word on the board aloud, the researcher stops the timer. One flaw that could go wrong is getting the time down wrong, by either forgetting to start or stop the stop watch, or writing down the wrong time.

The data could potentially be useful for medical research, military research and driver safety studies.

NAME(s) **Thomas Wolosinski**

PROJECT NUMBER **P33**

SCHOOL Saint Mary's School

GRADE 5

TEACHER Craig Hill

PROJECT TITLE **Fruit Power**

ABSTRACT

Have you ever considered charging your electronic devices with a fruit!?

In this project I measured the voltage output of various fruits to see which one might best charge a Kindle Fire. If this project is successful people will be able to cheaply charge almost any electronic device with fruit power. By the end of this project I will be able to use the fruit that generates the most electricity to charge a Kindle.

I predict that lemons will produce the most electricity (measured in volts) because of the concentration of citric acid in them.

I tested 12 different fruits with a voltmeter. I noted the fruit that gave the most volts and then tested it to see if it could charge a Kindle Fire.

Apples had the most electricity with 1.02 volts. A lemon was second best with 1.01 volts. Last was a strawberry with 0.80 volts.

This science project contributes to society by showing an easier, cheaper, and an eco-friendly way to charge an electronic device. I rejected my hypothesis because lemons did not produce the most electricity. Apples did, possibly because of their density and natural juices. I wasnÆt able to charge by Kindle with less than twelve apples because of the resistance in the wires, but I did get 5 volts with all twelve.

NAME(s) Chelsea Wright
PROJECT NUMBER B58
SCHOOL South Burlington High School
GRADE 10
TEACHER Curtis Belton

PROJECT TITLE **Effects of Homeopathic Treatments On Sputum and Phlegm**

ABSTRACT

Excessive phlegm production is common in COPD as well as Cystic Fibrosis patients. It is also regularly associated with the common cold and flu. Excessive phlegm production is regularly caused as a result of disease, sickness, allergies, smoking, and indigestion. The amount and thickness of phlegm can cause irritation and respiratory difficulties. Currently, several pharmaceutical treatments are available to the public although many of them have negative side effects and risk factors, in some cases containing known carcinogens. The purpose of this experiment was to identify natural and safe alternatives and test their effectiveness in reducing the viscosity of phlegm, thus eliminating the potential risks involved in utilizing current pharmaceuticals. This experiment was performed by combining identical phlegm samples with each of the potential homeopathic remedies. The mixture was then incubated for a designated period of time, and pipetted down an inclined plane to determine the viscosity of each varying sample in comparison to the control. It was shown that the homeopathic herb turmeric was the most effective at decreasing the viscosity of phlegm in comparison to all other homeopathic remedies tested. Rite-Aid severe congestion and cough, a generic form of Mucinex, was found to increase the viscosity of the control. These data indicate that medicine commonly used to clear congestion may be less effective than homeopathic remedies in reducing viscosity, therefor lessening congestion of phlegm.

NAME(s) Morgan Wrigley
PROJECT NUMBER B36
SCHOOL Northfield High School
GRADE
TEACHER Shane Heath

PROJECT TITLE **The Effect of Nutrient Deficiencies on Specific Quantitative and Qualitative Facets of the**

ABSTRACT

Humans first began to grow plants in a controlled way more than 10,000 years ago. Now the human population has exceeded 7 billion and providing food to this growing population is a significant challenge. I tested nutrient baths devoid of phosphorus, potassium and zinc while also testing a control to determine if I could observe physiological differences in strawberry plants. 48 strawberry plants were grown hydroponically and I observed differences in plant height, stem number and leaf number. Unexpectedly, my control batch of plants had the lowest amount of growth. Within the treatment batches, Zinc experienced the highest amount of height growth after two weeks of growing time at 1.4 centimeters difference; the number of stems are all relatively close at 0.3, 0.3, and 0.2 stems difference; the zinc and the potassium treatments were the highest of the leaf number increase at 0.9 and 1 leaves difference. Discrepancies in leaf coloration (intervenial chlorosis) were not evident during the first two weeks. It is unclear as to why the control is doing the poorest, it is possible that the pH of the water is causing a problem.

NAME(s) **Kelly Xu**

PROJECT NUMBER **C18**

SCHOOL Frederick H. Tuttle Middle School

GRADE 7

TEACHER Mr. Towle

PROJECT TITLE **What Materials Best Insulates A Cup of Coffee?**

ABSTRACT

The main focus for this experiment was to find out which materials insulated coffee the best. The hypothesis was that paper would insulate it the best because they both have low thermal conductivity. The experiment was conducted by heating up coffee to 65 degrees Celsius, then pouring it into three different cups insulated with different materials. The temperature for each cup was recorded every 5 minutes for 40 minutes. Cloth insulated the cup the best, with a final average temperature of 43 degrees. Although this insulated the original cup the best, a store-bought insulated mug insulated it even better, with a final temperature of 55.4 degrees Celsius. Surprisingly, paper towels also worked relatively well, with an average of about 39.7 degrees. Plastic didnÆt insulate well at all, probably since it is so thin and has a high thermal conductivity. The average for plastic was around 35.6 degrees at the end of 40 minutes. The major conclusions from this lab was that cloth insulates a cup the best, while plastic doesnÆt work well at all. If people were to choose what kind of cup they should choose, the recommendation would be to insulate it with either cloth or paper towels, since those work the best.

NAME(s) **Katherine Yang**

PROJECT NUMBER **M05**

SCHOOL South Burlington High School

GRADE 10

TEACHER Curtis Belton

PROJECT TITLE **Gender and Math Skills in Vermont School, Grades 6-16: A Statistical Study**

ABSTRACT

This project focuses on discovering which gender is better at math in Vermont schools and whether this would change as both math level and age increased. It was hypothesized that there would be no significant difference between the scores even as math level and age increased. For the project, approximately 5000 units of data were obtained from high school math teachers from across Chittenden County as well as teachers from Frederick H. Tuttle Middle School and the University of Vermont. These teachers provided the class level, the gender of the student, and their final grade for said class. Final math grades were used rather than giving a single math test to a random group of selected students because this would allow the gathered data to be more widespread and provide a more accurate conclusion. The data was then sorted into middle school, high school, and college, and also by math level. Each set of data was analyzed in a variety of ways including averaging the scores and applying the t-test. It was concluded that as the students grew older, girls consistently maintained a higher average than the boys. As the math level increased, about half of the t-tests applied showed no significant differences in the means, while the other half indicated that girls had higher averages. These conclusions disproved the hypothesis by showing that girls usually had higher means.

NAME(s) **Raymond Zheng**

PROJECT NUMBER **C19**

SCHOOL Milton Middle School

GRADE 8

TEACHER Nathan Caswell

PROJECT TITLE **Melting Styrofoam Cups**

ABSTRACT

The purpose of this experiment was to figure out if polystyrene would go into liquids if they were hot enough. I wanted to do this because many of the things that we use to hold beverages are polystyrene. I tested cups with water at three different temperatures: 25 degrees Celsius, 75 degrees, and 100 degrees. I predicted that the 100 degrees water would melt the polystyrene cup the most. I predicted this because I found in my research that the melting point for the polystyrene is around 100 degrees.

For each test I weighed a polystyrene cup before anything else, poured hot water into it, waited 10 minutes, poured out the water out, and waited a day for drying. The next day I weighed the cups and recorded my results. Then to ensure accuracy I took the cups from the same group and weighed them together. The first time I did this experiment I did not use an accurate enough scale and got not very accurate results. So I redid my experiment with a scale that measured in tenths of a gram and got a more accurate answer.

I found out that quite a bit of the polystyrene went into hot liquid. On average 7 percent of polystyrene went into the hottest water, 3 percent with 75 degrees, and no mass was loss with 25 degrees.

My results showed that there is a loss of mass with the hotter water but not with the cold water. This is what I was expecting since my research pointed to this conclusion. This information is important because if we are drinking water with potential polystyrene in it then we might as well be eating the cup. Polystyrene contains styrene, that chemical can be potentially harmful.

NAME(s) **Andrew Zierak**

PROJECT NUMBER **P34**

SCHOOL St. Francis Xavier School

GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE **Crashin', Bashin,' and Smashin'○○**

ABSTRACT

A car accident is always going to be dangerous, no matter what happens. My experiment involved measuring the energy absorption of various barriers. I did my experiment on a small scale, expecting the results will translate to real life. My hypothesis was that sand would be the best barrier. The barriers tested were: sand, water, ice melt, an empty cup, a granite block, a wooden block, and no barrier. My test setup used a 5 oz model car rolling down a fixed incline into the barrier, with five trials each. The barrier consisted of two paper cups half filled with each substance placed in a ziploc bag to contain spills. The energy of the car at the point of impact was measured by how far it displaced a block of wood. The effectiveness of each barrier would be measured by the reduced displacement of the block compared to the control when a barrier is placed in front of the wooden block. The data showed that water was the best barrier tested absorbing 60 percent of the energy. In descending order was sand, granite block, ice melt, empty cups, and wooden barrier with 50, 47, 43, 23, and 0.6 percent, respectively. The data for the granite block was more variable because the block would rotate by varying amounts depending on the point of impact. The more the block rotated, the more energy absorbed. My hypothesis was disproved. I thought that the sand would be the best barrier but, it turns out water is 10 percent better than sand. The most surprising results were that the empty cups absorbed 23 percent of the impact energy, and the block of wood only 0.6 percent of the energy.

NAME(s) Matthew Zuk

PROJECT NUMBER P35

SCHOOL St. Francis Xavier School

GRADE 7

TEACHER Mary Ellen Varhue

PROJECT TITLE Up On The Rooftops!

ABSTRACT

People are always looking for better ways to build and more information on solar panels.

My project question was which roofing material produces the most energy for solar panels? I chose this project because I wanted to know if my family got solar panels one day what roofing material would be best. I also wanted to know what the expense would be for everything and if that would affect the roofs. My hypothesis was that roofs with shingles would produce the most energy because they are black and black absorbs the sun.

When I first started researching solar panels, there were lots of websites. Then I came across this article on how the electrons inside solar panels are affected by how hot it is outside and thought that was as neat as could be. I had a problem though, I didnÆt know which roofing material would get hotter or colder. I decided this would be a good focus for my project.

My testing was done in my basement so each material could get the same amount of light. I first put down the Grace underlayment and then put the material down in the middle of this material. I did three trials for each material going one at a time from metal, to wood, to shingles. The first time I did this experiment I had the light too far away from the solar panel so after I did the experiment again I got more accurate results. I would further investigate this topic by testing it against weather conditions.

My experiment disproved my hypothesis because overall metal actually resulted in the highest voltage. . This happened because the metal conducted the heat away so the solar panel still sucked up the light.