



Pittsburgh Regional  
**SCIENCE &  
ENGINEERING** Fair  
powered by **CARNEGIE SCIENCE CENTER**

# **78th Pittsburgh Regional Science & Engineering Fair**

## **Intermediate Division**

### **Student Project Abstracts**

#### **March 31, 2017**

# Notes to Judges

Students prepare Abstracts limited to 100 words that include the following:

- Purpose of the experiment
- Procedures used
- Data
- Conclusions
- Possible research applications
- Minimal reference to previous work
- For continuation projects, the abstract should focus on work done since the last PRSEF
- Should not include: a) acknowledgments, or b) work or procedures done by the mentor

Many students continue their research after the Abstract is submitted, and therefore the Abstract may not fully represent the Project.

Abstracts are available to the Judges prior to the Science Fair as an aid in pre-screening the Projects. Judging is to be based on the actual Project as presented by the student.

Project Numbers are assigned as XYYABC

- X: M – Intermediate Division (7<sup>th</sup> and 8<sup>th</sup> grade)
- YY: Category Name
  - BS – Behavioral and Social Science
  - BI – Biology
  - CH – Chemistry
  - CM – Computer Science and Math
  - CS – Consumer Science
  - ES – Earth/Space/Environment
  - ER – Engineering/Robotics
  - MH – Medicine/Health/Microbiology
  - PH – Physics
- ABC: Project number
  - 1xx or 2xx – Individual student projects
  - 3xx – Team projects (2 or 3 students)

# Table of Contents

Behavioral and Social Science (MBS).....	1
Biology (MBI).....	9
Chemistry (MCH).....	18
Computer Science / Math (MCM).....	30
Consumer Science (MCS).....	32
Engineering / Robotics (MER).....	37
Earth / Space / Environment (MES).....	44
Medicine / Health / Microbiology (MMH).....	50
Physics (MPH).....	55

## **Behavioral and Social Science (MBS)**

### ***MBS100: A Spark of Motivation***

For my project, A Spark of Motivation, I'm trying to see if there is a relationship between mood and productivity during a working day. Also, what makes people feel negative and affect their productivity. I evaluate this by asking 30 different people to fill out a survey. I maintain anonymity by referring to them as Participant A, etc.. The survey has questions about job, mood, and productivity. I hypothesized that if I asked 30 people to complete a survey, then the data would tell me that people do indeed work better when happy.

### ***MBS101: The Relationship Between Eye Color and Sight***

Are the colors you're seeing the same as the person next to you? The project I am conducting is testing the relationships between eye color and sight. The purpose is to see if eye color changes the shades of color seen. This could further help eye specialists make special glasses to make it possible for everyone to see the same shade of color. Among the fifteen subjects tested, there were 5 with blue eyes, 5 with green, and 5 with brown eyes. After removing the blindfold, the subjects had to immediately identify the colors of the paper shown to them.

### ***MBS102: Eye Spy***

The purpose of my project was to determine if eye color affects peripheral vision. After researching, my hypothesis was that brown eyes would have better peripheral vision than blue or green eyes due to brown eyes containing more melanin, and wider pupils. To test this, I created a vision protractor. I also used five human test subjects per green, blue, and brown eye colors. After conducting my experiment, I concluded that my hypothesis was correct with brown eyes having better peripheral vision.

### ***MBS103: Does Movement Effect Memory***

My project purpose is to test which studying method is better, memory or movement. To test this, I made pairs of colors and shapes to quiz my participants. For the memory group I listed the pairs and I had them repeat the pairs back to me. For the movement group I made up hand movements to do with the pairs. I gave them a quiz to test which group remembered best. The movement group had a lower average of incorrect answers than the memory group that led me to accepting my hypothesis that movement helps with memory.

### ***MBS104: Are Childproof Containers Really Childproof?***

The purpose of my experiment is to let parents know what containers are safe to leave within children's reach. I will give each child a minute to open a bottle. I will use three bottle cap types that I got at a pharmacy: push and pull, squeeze the sides, and align the arrows caps. I learned that push and pull is easiest, then align the arrows, and finally squeeze the sides. Experiments I researched came to the same conclusion. My results show that parents should not trust childproof bottles and shouldn't leave them where children can reach them.

### ***MBS105: How your choice is affected by variety.***

Does having more variety increase your happiness? Some research suggests that the answer should be yes. This question, however, has not been explored in depth for tweens and teens. I conducted an experiment where I gave each person a menu of choices and measured how difficult it was to choose as well as how satisfied they were with their decision. I conducted a separate analysis for females and males. The results show that more options may reduce our happiness but the magnitude is different for both genders.

### ***MBS106: Symbolic Left or Creative Right***

Many people believe that male and female brains function differently. Most think that women are better creatively and men are better problem solvers. The purpose of my project was to find out if this was true. I used a test that determines if you are left or right brained. The right side of your brain controls the left side of your body and is used for creativity. The left side of your brain controls the right side of your body which is responsible for problem solving. My results proved that there is no difference.

***MBS107: what way will students remember their sight words better playing a game or reading flash cards.***

Memorizing things can be hard. My experiment researched if playing a game or reading sight word cards would help students learn the words more. I separated a class into groups. For the game group I laid the sight word cards on a table and timed how long it took for them to find a card. For the reading group I would flash a card and time how long it took the student to say the word. The data showed the game group had the best memory which supported my hypothesis. My experiment will help teachers develop new techniques.

***MBS108: Blood Simple All Day Everyday***

My purpose for my project was to determine what sponge would give me a more defined pattern of blood spatter. Depending on how much blood each sponge absorbed at what area I smacked the sponge. My data included my mixing of ingredients to make simulated blood to which the splatter is represented, cutting out a cardboard box and using 8.5x11 inch paper inside the box for the interior corner. Then, smacking my sponges with a hammer while they were moist with blood I concluded my observations and data. I enjoyed this experiment because of how much detail was included.

***MBS109: Can Adults Pass a 7th Grade Science Test***

The purpose of my project was to see if an adult could pass a 7th grade science test. Also, to see how much they remember from their middle school years. I chose 6 adults and six 7th graders to take the test. I then graded/scored on a private school grading level. Adults got better scores due to one perfect paper by a male nurse.

***MBS110: The Stroop Effect!***

The purpose of my experiment is to test my participants of two age groups by making them read flashcards while being timed. To conduct this experiment I'll make flashcards and time them. Then I'll see if they have more trouble reading the conflicting colored words. The results were measured by the times of reading the flashcards. The results of my experiment should not be rejected because in my hypothesis I stated that my older age group would have steadier times than my older age group. The younger age group had more trouble with the conflicting colored words than the black words.

***MBS111: Do Left or Right Brained People Yawn Quicker When Stimulated By a Person Who Is Yawning?***

Purpose: To determine if left/right brained people yawn quicker when stimulated by a person yawning.

Hypothesis: Right brained people yawn quicker than left brained people when stimulated by a person yawning.

Procedure: 1. Randomly select a seventh/eighth grade test subject. 2. Collect the parent permission/release form from test subject. 3. Explain directions to test subject. 4. Using a computer show the test subject a video of various people yawning. 5. Determine/record the length of time before the test subject yawns. 6. Repeat steps 5-6 four more times and determine the average for the 5 trials. 7. Repeat steps 2-7 with 29 more test subjects. Conclusion: Final results available at fair.

***MBS112: How does light color, age, and gender affect flicker fusion frequency?***

A light may look like a solid beam, but it could be flashing many times a second! Flicker fusion frequency is the fastest you can see a light flash on and off without it looking like it is constantly on. In this experiment, I used my Arduino to control how fast a red or green light was flashing so I could measure participants' flicker fusion frequency. My data show that light color and gender, but not age, affect flicker fusion frequency. New computer screen designs should be tested by people of both genders using different colors on the display.

***MBS113: Don't drop it!***

Please visit student's exhibit.

***MBS114: Cognitive Testing and the Effect on Alzheimers***

The purpose of my experiment was to determine if cognitive testing helps to improve short term memory and cognitive ability on early onset Alzheimer patients. I performed a Mini Mental State Examination to determine their cognitive ability. Then, I performed the cognitive test four times over a span of four weeks to determine if their cognitive ability improved or decreased.

***MBS115: Do Males and Females Remember More Objects Associated With Their Gender Than The Opposite Gender?***

Purpose: To determine if males or females will remember more objects associated with their gender than the opposite gender. Hypothesis: Females will remember more pictures of objects associated with their gender than the opposite gender. Procedure: 1. Randomly select a test subject. 2. Randomly select the pictures of objects the test subject will be shown. 3. Show the test subject the pictures for 30 seconds, then take them away. 4. Then ask the test subject to list as many pictures as they can from the list. 5. Repeat Steps 2-6 for a total of 30 test subjects. Final Results at fair

***MBS116: The Rush of Video Games***

Are video games bad for your health? I measured my participants' heart rate and blood pressure before, while, and after playing Splatoon on my WiiU. I chose this topic because I am an avid video gamer. I found that everyone's blood pressure and heart rates vary. I would be interested to try it again using different types of games.

***MBS117: The Bouba Kiki Effect***

The purpose of my experiment is to see if different ages effect the results in the "Bouba-Kiki Effect". To conduct this experiment, I will show two different age groups index cards with "Bouba" and "Kiki" shapes on it and ask them to tell me if it is a "Bouba" or "Kiki" shape. The experiment results were measured by how many "expected" and "unexpected" answers I got. The results indicate that my hypothesis was correct because the ages of my participants did effect my results. My experiment proved that my hypothesis was correct.

***MBS118: Locked and Loaded: Who's Really Pulling the Trigger***

This experiment was designed to see if people actually make decisions based on the content of a position statement or if people rush to judgment based on who is releasing the statement. By participating in this experiment, each participant was willing to read a short position statement, complete a survey and sign a consent form. In the end, 111 participants stated their decision to agree or disagree with the position statement was based on content; only out of 114 people stated that the author releasing the statement influenced their decision.

***MBS119: How Does Color Affect Memory***

My project consists of a black marker, flash cards, and colorful markers. This experiment takes 2 days to complete. If you are interested in doing this experiment, I would recommend finding uncommon facts so your participants will not already know the answers. My hypothesis was right. I guessed that it's more likely to retain information using colorful words rather than black. I inspired myself to do this project. I decided to take notes with a blue pen, and I retained more information that way.

***MBS120: Gender & Stroop Effect***

My project is called 'Stroop Effect vs Gender.' I wanted to do this experiment to see if men or women have a better psychological capacity, so they can go into a field with psychology for a career. With knowing the greater capacity, you can apply to a job that you will succeed in. I found out if being a man or woman gives you a greater psychological capacity. I found that the men were 17.58 seconds while the women were 18.21 seconds. That concludes that my hypothesis was wrong about women having a higher psychological capacity.

***MBS121: Live Longer: Dog Therapy***

This experiment was conducted to measure blood pressure and heart rate while petting a dog. The participant sat for one minute and had their resting blood pressure and heart rate recorded. After twenty minutes, the participant petted the dog for five minutes and blood pressure and heart rate were recorded. Systolic and diastolic blood pressure increased by 1.296 and 1.67 millimeters of mercury. Heart rate decreased at an average rate of -0.815 beats per minute (BPM). My hypothesis was not supported. There were no stimulants to raise heart rate and the subjects were stressed and/or weren't given time to relax.

***MBS122: Does Temperature Effect the Way You Think***

The purpose of this experiment was to see if temperature can effect our bodies. The procedure was to give everyone a spelling test. Put them in a room that is 85 degrees F. Test them both times. Wait two hours until the room changes temperature to 65 degrees F. After that see how everyone did and collected your data. I observed that everyone did better in the cold. When it's hot you focus more on your sweat rather than what you're doing. In conclusion, I learned that more people do better in the cold than the heat.

***MBS123: Team Work Makes the Dream Work***

The purpose of my project was to prove that introverts and extroverts will work better together to complete a task. This project can help teachers and employers to group workers in a more effective way. I predicted that the group with introverts and extroverts would work in a more effective way. I proved my hypothesis that the mixed group would be more efficient. I used a personality test to determine different people's personalities. The mixed group worked the most effectively.

***MBS124: Eye Color and Reaction Time***

My experiment tested the relationship between the eye color and reaction rate. I tested this by showing different colors to different people with different eye colors. I then recorded how long it took them to say the name of the color shown. My hypothesis was "If eye color affects reaction rate, then the darker color eyes will have a faster reaction because it has more melanin, and melanin allows light to pass into the retina." I found out that light eye colors can see most colors faster, with the exception of white.

***MBS125: Stress vs. Body Temperature***

The purpose of this experiment is to see if stress affects your heart rate and temperature. Participants will take a math quiz while being timed for 1 minute. Their temperature and pulse rate will be taken before and after the math quiz. Once they finish, the researcher will analyze the data to see if this hypothesis, which states that stress will increase heart rate and temperature, is correct. Results will be available on fair day.

***MBS126: How Plate Size Effects Portions***

The title of my project is "How Plate Size Effects Portions". I wanted to see if this could be a simple solution to obesity. I decided to test in fact how plate size effects portions and gave children smaller and larger size plates to get portions on and concluded that plate sizes does affect portions. I did find that the portions shrunk significantly and by around 25% with the smaller plate. I did meet my objectives and tested everything accurately and feel that my results could be used elsewhere to contribute to any other studies.

***MBS127: No Longer Handy***

The purpose of this project is to figure out whether the dominant or non-dominant hand is more sensitive. The subjects of the experiment were asked to put their hands in the ice cold water, in order to see how long they can last. Hands entered the water at the same time, but were timed separately.

***MBS128: The Color Trio***

1. Obtain written consent forms (all under 18 participants were obtained at East Catholic School). 2. Create the testing boards (piece of poster paper with brown, yellow, and orange duck tape). 3. Encourage participant to close eyes for 1 minute. 4. Place board in front of participant. 5. Direct participant to open their eyes. 6. Ask which color did they see first. 7. Ask them the survey questions (favorite color, if they have Pokemon Go, and etc...). 8. Repeat 2-7 for each group but change board colors after the first two . 9. Graph data. 10. Collect and analyze data.

***MBS129: Unwired***

The purpose of this project is to quantify the effect of frequent use mobile devices on the user's reaction time. I will measure reaction time as the time taken to solve a KenKen number/logic puzzle. Participants will be randomly assigned to work with mobile devices before attempting to solve the puzzle.

***MBS130: Is smiling or yawning more contagious?***

Are smiling and yawning contagious behaviors? I tested this theory to determine which, if either, was most contagious or mimicked. I showed participants two videos, they read the actual words “smile” and “yawn”, and they watched me. Although there were outliers, I have found that the videos caused the most mimicking of expressions instead of watching me or simply reading the words of the expressions, themselves. I believe that the video was most contagious because it was the most consistent. I hypothesized correctly when I said that females would mimic behaviors more often and smiling would be more “contagious”.

***MBS131: The Effect of Ballet on Different Types of Memory***

The purpose of this project is to investigate the effect that ballet exercise has on visual memory, numerical memory and musical memory. 20 ballet dancers will participate in my study. I will compare their scores on visual, numerical and musical tests before and after dancing.

***MBS132: Racial Bias in Today's Youth***

Though there has been progress with racial equality, many recent events have demonstrated that racial bias is pervasive. I conducted an experiment to see if racial biases existed in students ages six to nine. I created a facial representation of people of different races and asked participants to select the face that they thought most adequately answered the question. I found that though statistics showed that the majority of participants held preferences towards the lighter end of the spectrum, it was almost completely balanced by the number of participants that selected the neutral tone or explaining that it doesn't matter

***MBS133: Does Listening to Music Make You Run Faster***

My project was to see if music had an effect on running I took fourteen participants and split them up by grade. One day I took one group and made each person run around the gym five times, without music, timed them, and had them rate it from one to ten. The next week I took the same groups and had them do the same thing but with music and compared the two times to see if the participants speed increased with music. The results were that ten out of fourteen participants ran faster with music. Music did not appear to help runners make it feel any easier.

***MBS134: Yeah, Baby! Gender Stereotypes***

In this project, I tested gender stereotypes in young children. To do this, I first did research to make and support a hypothesis. I then performed my experiment. To do this, I showed a child a picture of a baby, told the child the baby was a girl (or boy), asked the child to describe the baby, and recorded their answers. I studied how the answers differed when I told them the baby was a girl versus when I told them it was a boy. In my findings, I found that there was not much different. However, more children described the girl as cute, silly, and well-behaved. More children described the boy as happy, tough, and small. The differences were not very drastic. In my research paper, you will see every step of my project, as well as graphs to help you visualize the results.

***MBS135: Font and Memorization***

The purpose of doing my experiment was to see if there are certain fonts that help you remember things easily. I made a word list of ten different words and compared six fonts for students to study over. I gave them a few minutes to look at the lists and then gave a break before asking them to write down as many words as they could remember. I found that the participants remembered the Century Schoolbook font the most compared to any of the other fonts. In future experimentation, I could make the words harder to see if I got the same results.

***MBS136: Educating Students On Nutritional Facts - An Interactive Website***

Last year, I examined the effects of a nutritional facts label on students' lunch choices. It was evident from the results that students were unaware how to interpret these facts with their choices. I wanted to further examine this phenomenon. In this experiment, I will examine if through interactive website, with games and facts, help students learn better about nutritional facts, through the use of a preliminary and final quiz to analyze results. Experimentation is ongoing.

***MBS137: How to Cheat a Polygraph Machine***

My purpose was to see if more people in a "relaxed" state could outsmart the machine on the question "Have you ever lied to someone in a position of authority?" than a person who was just asked the questions. My hypothesis is that more people in a relaxed state would be able to outsmart the machine more than a not relaxed person. My procedure 1) Build the polygraph machine 2) Split the test subject into two groups 3) Ask each group nine questions 4) Record the number of lies detected only on question nine

***MBS138: How does stress affect memory?***

My science fair project is on the effects of stress on memory, here is some background information on this. Our ability to retrieve memories can be influenced by a number of factors. Fatigue, preoccupation with other thoughts, aging, and stress are but a few of them. Long term memory is usually more stable and resistant to such factors. However, short-term memory is much more vulnerable to such factors. In this experiment, you will create a mildly stressful situation for the participants, as well as focusing their attention. The pressure on the participants to do well, and having to concentrate on instructions, will impact their ability to remember a sequence of tasks.

***MBS139: Do video games affect the process of thought?***

The purpose of my experiment was to prove whether or not video games make children unfocused in school and other activities. My first, second, and third subject all proved my hypothesis to be correct. Therefore, with all my data considered, I have decided to accept my hypothesis. Video games are not always bad, they have been proven to make people more creative and increase hand-eye coordination.

***MBS140: Animal Stroop Test***

Have you ever heard what the stroop test is? This project will test and time new readers versus experienced readers using the animal stroop test. This will help determine when the processes in the brain that control reading and perception begin competing words against pictures.

***MBS141: Athletics vs. Grades***

For this test, the researcher will study if athletics affect participant's grades. The researcher, based on return of consent forms, will gather times participants received on the mile they ran for physical education class then rank by time and compare to their GPA. The researcher's hypothesis is that the group that ran the mile under 8 minutes would have a higher average grade than those who run above. Their results will be ready at the time of the fair.

***MBS142: Sleep Deprivation and Motor Skills***

Sleep deprivation impairs various cognitive functions and behavior, including arousal, attention, cognitive speed, memory, emotional intelligence, and decision making. the purpose of my experiment was to show how sleep deprivation can affect you fine motor skills. 11 participants performed a baseline test, recorded results and then were sleep deprived and repeated the task and recorded. 7 participants did worse two stayed the same and two did better. Overall participants performed worse after being sleep deprived. My hypothesis was correct after being sleep deprived the average of my participants performed worse than when having 8 to 12 hour night of sleep

***MBS143: How does color affect mood?***

The purpose of this study was to find if different colors can cause different moods. I hypothesize that color will cause a difference in mood throughout test subjects. Procedures: 1. Gather materials 2. Have test subjects sit facing a Tri-Fold board 3. Have subjects complete a short questionnaire on how the color makes them feel 4. Repeat steps 2 & 3 for each test subject, showing them each color 5. Collect data and analyse 6. Graph data according to the percentage of people that felt a certain way according to color 7. Draw conclusions

***MBS144: How fast is your reaction time?***

The purpose of my experiment was to see if 10 through 14 year old kids have a faster reaction time than 5 through 9 year old kids. I did this science fair experiment because i wanted to see when you're too young you don't have lots of experiment to catch a ball or anything that goes fast. But when your smaller and you're playing with someone your same age, it's easier to know when it's coming I used a ruler and made 1st graders through 8th graders catch it with their pointer finger and thumb. The results were when I had 5 through 9 year old kids they could not catch it most of the time, but 35% of the time they could catch it. When I tested 10 through 14 year old kids, they could catch it 95% of the time.

***MBS145: Crossed Up?***

The purpose of this project is to quantify the effect of crossed hand eye dominance on percentage free throw success. The sample size will be 50 participants, each will shoot 10 free throws. Hand Dominance and eye dominance will be evaluated. Data will be displayed graphically.

***MBS146: Do Music Lessons Help SAT Score?***

This project explores the effects of music lessons on cognitive abilities of an 8th grade student by comparing SAT Reading Comprehension Test scores obtained with and without preceding music sight-reading lessons. This 'The N of 1 Trial' type of research has an advantage for this project as it avoids challenges of individual development and socio-economic bias. After twelve tests taken, the average score of the tests taken after music sight-reading is 7% higher than the average score of the tests taken without preceding music sight-reading lessons. The data and the statistical analysis will be presented at the meeting.

***MBS147: Processing Information Differently***

The researcher will determine whether males or females process visual information differently. The researcher's hypothesis is that females will remember more, and males and females will remember different things. To investigate, the researcher will show a PowerPoint with numerous objects, letters, and numbers. After the researcher showed the students the PowerPoint, they will be asked to write down what all they remembered and to recall if images appeared on the PowerPoint or not. By doing this, the researcher will be able to determine whether or not males or females process information differently. The results will be available on fair day.

***MBS148: Does Breathing Techniques Affect Test Anxiety***

Please visit student's exhibit.

***MBS149: Better Game Better Brain***

Do you enjoy video games? Are you tired of having people tell you that they're bad for you? Well my experiment proves them wrong! The purpose of my experiment was to prove that playing more video games can improve your logic and puzzle solving abilities. I split the participants into three groups based on how much they played video games and the people in the group who played the most had the highest average score on both logic tests they took at about 76 points! The other two groups scored lower showing that video games can improve logic abilities.

***MBS150: Does Music Converted to a Light Show Affect Emotions?***

Problem: To determine if light shows of happy songs are preferred more often than a light shows of sad songs.  
Hypothesis: People will select light shows of happy songs more often than light shows of sad songs. Procedure:  
1. Randomly select a test subject and explain the directions  
2. Show the test subject the light show randomly selected  
3. Have the test subject complete a questionnaire in order to determine how it affected their emotions  
4. Repeat steps 5-7 using the light shows for the other songs  
5. Repeat steps 2-8 for 39 more test subjects  
Conclusion: Final results available at fair.

***MBS151: Are All Colors of Sleep Equal?***

This project addresses the question what conditions improve the length and quality of sleep. Lighting, specifically color of light will be investigated. A prototype mat will be constructed and two participants will evaluate each night of sleep though a series of color changes.

***MBS152: The Effects of Cell Phone Usage and Reaction Time***

This experiment explored how talking on a cell phone influences a person's reaction time. This is an important research experiment because people might use cell phones while doing things that require concentration, like driving. 480 reaction times were measured from 12 people (240 undistracted measurements and 240 measurements taken while talking on a cell phone). Reaction time was measured using the ruler method and a computer-based method developed by the University of Washington. Both measurement methods confirmed that a person's reaction time increases when talking on a cell phone. This increased reaction time can have dangerous consequences when doing tasks that require full concentration and a quick reaction time.

***MBS300: Music In Your Blood***

Our project deals with blood pressure and how music affects it. Many people in America and even around the world struggle with either high or low blood pressure, so they take prescription drugs. What if people around the world could easily fix their blood pressure problems by just listening to some music? We had people listen to four types of music (jazz, classical, pop, and rock) after we took their baseline blood pressure. We wanted to see how music would impact it. As you look deeper into our project, you will see how and if it affects someone's blood pressure.

## Biology (MBI)

### ***MBI100: Strawberry DNA***

My science project is “ Will you be able to extract more DNA from a ripe strawberry, An under-ripe strawberry, or an over-ripe strawberry. I choose this experiment because I wanted to learn more about fruit DNA. After I extracted the DNA from the strawberry mixture I used a paperclip and bet it to look like a hook to fish out the DNA from the plastic cup. After I got all of DNA off and into a weigh boat I weighed it on a digital scale. There was very little DNA in the ripe strawberries but a lot more in the under-ripe and ripe strawberries.

### ***MBI101: Do Antibiotics Affect Bacteria***

Bacteria and fungi are found on many common surfaces. I will first test how much bacteria is grown on 5 determined surfaces after 5 days of incubation. I will then go back and reswab the same surfaces, but this time I will have a variable, antibacterial solutions. I will test the antibacterial solutions in terms of effectiveness by adding paper disks soaked in different antibacterial solutions to the bacteria cultures. I will test the effectiveness by the radius around each paper disk.

### ***MBI102: The Best Temperature***

The purpose of my experiment is to find out at what temperature seeds germinate the soonest while indoors, because I like to garden and want the soonest germination for my plants while raising plants inside. In my experiment, I will use different types of seeds such as tomato. The seeds will be in unsealed containers on heated mats. I will compare my results with a control group and average them. The results of my experiment will be available on competition day.

### ***MBI103: The Effect of Caffeine and Nicotine on Mung Bean Plants***

The purpose of this experiment was to determine if caffeine and nicotine could help plants grow. The reason I chose nicotine is because I wanted to find a different use for tobacco. The reason I chose caffeine is because you could use it to grow plants instead of coffee. The Bean sprouts were planted, watered with 5 water/chemical solutions, and growth was monitored and measured daily. The result was nicotine and caffeine both helped the bean sprouts grow, yet Miracle Gro was hurtful in excess quantities. My conclusion on this project is that nicotine can help plants grow but is addictive, also Miracle Gro in excess quantities hurts plants.

### ***MBI104: Caffeine and Plant Growth***

Have you ever wondered if coffee would make plants as perky as it does with humans? Well, the experiment answered that very question. For my experiment, 10 mung bean plants were watered with 5 g and 10 g of coffee powder and 50 mL of tap water mixed together to see if caffeine boosted the energy of the plants. An additional 5 mung bean plants were watered with 50 mL of tap water to compare results. It is hypothesized that the 5 g of coffee powder and 50 mL of tap water would grow the most in height. The mung beans watered with 50 mL of tap water showed the most growth in height. The 10 g of coffee powder and 50 mL of tap water did not grow at all. In conclusion, the hypothesis was not supported with the results of the experiment.

### ***MBI105: The Effect of pH on Tadpole Development***

Pollution and acid mine drainage could affect the pH balance in the ponds. My experiment is designed to determine whether pH affects how bullfrog tadpoles develop. I'm going alter the pH in small amount of water and test the rate at which the tadpoles develop.

### ***MBI106: Tomato Tomatoes***

Can different sources of water effect the growth of a tomato plant? I hypothesized that rainwater will be the best source of water to grow a tomato plant. I picked this project to see what will make a tomato plant grow better with different types of water sources. Gather 3 pots and fill to the top with soil. Place cherry tomato seeds in each pot. Water each pot every other day. In conclusion my hypothesis was incorrect, saltwater grew the tomato plant best. If I were to do this project again I would change the kind of salt I used.

***MBI107: The Effect of Muscle Tissue Tearing on Human Performance***

The purpose of my project is to determine the ideal number of days after lifting weights that peak muscle fiber growth, and thus peak human physical performance, is achieved. I will also determine the number of days after lifting weights, that muscle gains are lost to atrophy. My hypothesis is that it will take 6 days to recover from muscle damage incurred as a result of lifting weights and reach peak muscle gains. Atrophy will set in after 10 days. Procedure: 1. Record initial 50m dash times. 2. Cycle sessions of lifting and timing, varying the number of rest days.

***MBI108: How Does Varying the pH of Acid Rain Affect the Growth of Wheat Grass?***

Acid rain is a growing problem in the United States and all around the world. The problem to be investigated is: how does the pH of soil and water affect the growth of wheatgrass? Acid rain occurs when sulfur dioxide and nitrogen oxide react in the atmosphere with water and oxygen, which creates toxic emissions. These stem from areas where transportation, industry, power generations, ore smelting and power plants burning fossil fuels contribute to acid rain. According to a Penn State University report on the atmospheric deposition in PA, acid rain in Western PA has a pH of 4.3. The pH of acid rain in other areas of the country was also researched. It was decided to also test greywater, which is filtered, used water from household dishwashing, showers, etc. The procedure consisted of the following steps: First, fill each container with the same amount of potting soil, Then, label one set San Francisco A, Denver A, Pittsburgh A, Normal Rain A, Greywater A, and distilled water A, Next label another set San Francisco B, Denver B, Pittsburgh B, Normal Rain B, Greywater B, and distilled water B. Add sulfuric acid solution to the soil in set A (to simulate acid rain soaked ground with acid rain precipitation). Next, plant wheatgrass seeds in each container. Water wheatgrass with correct acid rain solution. (Acid rain solutions were made in the following way: Add drops of sulfuric acid to 3.8 liters of distilled water and label it Pittsburgh. Next, measure pH level. Repeat last step for other cities and label accordingly. To make the greywater solution, add drops of dish soap to 3.8 liters of distilled water, filter, and label it greywater.) Document growth in centimeters each week. Average growth at end of all of the trials. This experiment was conducted for 8 weeks. The hypothesis was partially supported: the plants watered in acidic soil and watered with acid rain (to simulate acid rain soaked ground with acid rain precipitation) experienced lower growth, but the plants planted in acidic soil and watered with neutral pH water (to simulate improved acid rain conditions with a higher pH) had the highest growth. The control group which was the distilled water and neutral soil did not grow as high as the variable groups. Greywater had a slow start, but eventually had a more successful growth rate. Further research showed that wheatgrass needs slightly acidic soil to grow. This experiment showed that wheat grass does grow best in slightly acidic soil.

***MBI109: The Effect of Temperature on Painted Lady Butterfly Metamorphosis***

Temperature change in the spring and summer can affect the growth and development of butterflies. My prediction is that the larva in the warmer climate will have the fastest or most effective kaleidoscope of butterfly larva. I think the kaleidoscope in colder weather will take longer to develop and will have fewer butterflies survive.

***MBI110: Photosynthesis versus Cellular Respiration***

I performed an experiment on two types of plants to determine if plants rely more on cellular respiration or photosynthesis. The two types of plants were grass and sage. Three were put in bags to limit cellular respiration, two were placed under a box to limit photosynthesis, and two were left alone as control plants. The grass which has tall, thin, horizontal leaves allow easy flow of carbon dioxide while the sage has the short spread out leaves allowing light to easily filter in. I've noticed that the grass prefers air and the sage prefers sunlight.

***MBI111: Holding Hands With Books***

Germs and bacteria are all around us. My experiment provides us with a way to find out how many germs are on a very popular book. I decided to do this experiment because my mother is a librarian and I thought it would be cool to see what is lingering on different types of books. The first thing I will do is create an agar mixture and prepare petri dishes. I will then swab each book and see what grows on the petri dishes. The results will be available at the science fair.

***MBI112: Does water or Propel make a plant grow higher?***

The purpose of my research project was to investigate what liquid would help a plant grow tallest. I hypothesize that the plants that are watered with water will grow larger than the plants that are watered with Propel. Procedures: 1. Place 8 soil cups in each Jiffy plant tray. 2. Follow the directions on how to hydrate the soil cups (8 were hydrated with water and 8 with Propel). 3. Plant the pea seed an inch deep in each soil cup. 4. Water the plants 10 ml every other day (8 with propel and 8 with water). 5. Record the height of each plant from the soil to the tip of the plant every other day (opposite of watering). 6. Completed over a 3 week period.

***MBI113: Ripen that Fruit***

The purpose of this project is to find the reason for accelerated ripening of fruit that is stored adjacent to other fruits. My hypothesis is that storing fruit next to apples will increase the rate of ripening. I will make observations and measurements of fruit over time.

***MBI114: The Effect of Nitrogen Fertilizer on Bean Plants***

The effect of nitrogen fertilizer on bean plants was investigated in this experiment. The effect of nitrogen on the environment is very severe: runaway nitrogen is suffocating wildlife in lakes and estuaries and contaminating groundwater. Many scientists say that nitrogen is overused as much as 30%-60%. To test how much nitrogen is needed for optimal plant growth, I grew twenty bean plants from seeds, then watered ten of the bean plants with tap water, and ten of the bean plants with tap water mixed with nitrogen fertilizer. The plants received the same amount of water, or water with nitrogen fertilizer throughout the experiment. They were planted in identical containers and the same type and same amount of soil, in exactly the same way. All plants were in the same environment throughout the experiment. The growth of the plants was measured over a three-week period. This investigation found that the plants watered with tap water grew the highest, and the plants watered with tap water mixed with nitrogen fertilizer grew the least. Further research found that the overuse of nitrogen fertilizer can cause plants that have lower nitrogen needs to die, according to the Ecological Society of America. Also, if nonnative grasses grow with this fertilizer, they can be flammable and so increase the chances of wildfires. When excess nitrogen gets into rivers and streams, it can result in overgrowth of algae. Oxygen is used up when the algae dies and decomposes, causing fish and other aquatic life to die.

***MBI115: Are Fingerprint Patterns Inherited***

The purpose of my experiment was to discover if fingerprints are inherited by a parent. Some procedures I used are/were to have the person place each persons finger on a ink pad then piece of paper 6 times, then to analyze to see if the fingerprint patterns are inherited. Some data I've collected is that the Females (related) I tested both had Loops, and the Men (related) I tested were both Whorls. My conclusion is that fingerprint patterns are inherited.

***MBI116: Fruit Fly Traps***

I chose to do my science fair project "Fruit Fly Traps" to try to help people in their homes. Fruit flies can be a nuisance year after year, and there seems to be no way to easily get rid of them. I tried to find which liquid out of water, milk, orange juice, Gatorade, and apple cider vinegar would be the best trap. To experiment, I trapped fruit flies in an aquarium and let them "pick" a liquid. Apple cider vinegar won with twenty-four fruit flies. I contributed to finding a solution, but there is still much to discover.

***MBI117: Are Enzymes in Laundry Detergents Effective Stain Removers***

I tested if enzymes in laundry detergents are effective stain removers. I tested a laundry detergent with enzymes and a laundry detergent without enzymes. I did this project because I wanted to show what laundry detergents are more effective, the one with enzymes or the one without enzymes. I took 3 stains, then the laundry detergent, and put it in the dryer for 27 minutes, and dried it for 7 minutes. In conclusion, my hypothesis was correct because the laundry detergent with enzymes was more effective.

***MBI118: Pensieve: Analyze the Genes that Affect Memory***

The purpose of this project is to find genes in the brain that affect memory, and by extension, Alzheimer's. I will compare gene expressions in the human hippocampus through different age ranges using data publicly available through the Allen Brain Atlas.

***MBI119: What Effect Does Smoking Have on the Lungs and Which Brand is Most Damaging?***

The purpose of this experiment was to determine which brand of cigarette was the most damaging to human lungs. My hypothesis is that Marlboro will have more tar than Newport and Camel. To test that use 9 empty bottles fill each with bottle  $\frac{3}{4}$  water. Make a hole in the cap, place cigarette one inch down from the cap. Light the cigarette as the cigarette burns make 4 small holes using thumbtack. After 3 trials of each brand Newport had the most tar. The results didn't support my hypothesis Newport had the more tar than Marlboro and Camel.

***MBI120: Which Disinfectant Works the Best at Killing Bacteria?***

My project "Which Disinfectant Works the Best at Killing Bacteria?", focuses on comparing different disinfectants. I took a piece of bologna and wiped a divided surface evenly. After 24 hours, I swabbed each divided are with a disinfectant, let dry, then used a Q-tip to swab the area and applied the bacteria from infested surfaces to agar. Then, I calculated the number of colonies and the surface area of each plate. After averaged, I found which disinfectant works best. The Clorox was the most effective in killing bacteria, and Lysol was the least effective.

***MBI121: Which Disinfectant Works the Best at Killing Bacteria?***

My project "Which Disinfectant Works the Best at Killing Bacteria?", focuses on comparing different disinfectants. I took a piece of bologna and wiped a divided surface evenly. After 24 hours, I swabbed each divided are with a disinfectant, let dry, then used a Q-tip to swab the area and applied the bacteria from infested surfaces to agar. Then, I calculated the number of colonies and the surface area of each plate. After averaged, I found which disinfectant works best. The Clorox was the most effective in killing bacteria, and Lysol was the least effective.

***MBI122: How Do Stimulants Affect Flatworms***

Hypothesis: If flatworms are given distilled stimulants then they will display pain reaction most frequently when the stimulant nicotine is distilled to 10%. Conclusion: My hypothesis was mostly correct. The nicotine, on average displayed the most indicators of pain, but it did not stay curled. The alcohol stayed curled for a longer period of time, and if I were to count each second it stayed curled as a response, the alcohol would have a greater number than the nicotine. As it is, I would say that the alcohol worms and the nicotine worms are currently tied for greatest response number. Following them is caffeine, in second place. Lastly, in last place there is sugar. From this experience I have learned how flatworms respond to pain, a quick jerk into a "c" shape. I also learned how dangerous stimulants can be. If they cause that much pain, imagine what would happen if we had some ourselves. This applies to the real world since I know not to use stimulants. All in all this is a useful experience as it was interesting and has a useful real world application.

***MBI123: How will giving radish seeds differing amounts of water affect how they grow?***

If I plant three radishes in cups and give one 1 tablespoon of water, one 2 tablespoons of water, and one 3 tablespoons of water, then the one with 1 tablespoons will grow the best, because 2 and 3 tablespoons will be too much and likely drown the radish. Engineering Goals: Some engineering goals for this project are to help determine how much water should be given to radish seeds for optimal growth in enclosed conditions. Expected Outcome: I expect that the radish given one tablespoon a week will grow the best, as I think that two and three tablespoons will be too much water and drown the radishes. Risk and Safety: There are no major safety risks present in the procedures of this experiment. Data Analysis: The procedures I will use to record data are how healthy the plant looks (healthy, unhealthy, dead, ect) and how many plants are still alive after the six weeks for each group to determine which amount of water is the right amount in these conditions.

***MBI124: Does Cold Water Make Crispy Potatoes?***

The purpose of my project is to determine if you soak a cut up potato then bake it will it be crispier than not soaking it in cold water. The purpose for me to do this assignment is to learn new things in cooking. I became interested because I enjoy very much to cook and bake and I thought this experiment would open me up to new things. Also I picked this is so other people will know a way that they can make crispy potatoes. I think that when I try the experiment is that when I see which one is crispier, the ones I soak in cold water will be crispier because when you cook foods that has to do with water, most people start off with cold water so all the flavors would be still there.

***MBI125: The Effect of Temperature on Algae***

Have you ever wondered if climate change affected the growth of its plants? My experiment was designed to see if climate change had an effect on algae bloom like the one that happened in Lake Erie. We grew algae different temperatures, then took samples and tested them to see which temperature promoted the most algae growth. The results will be available at the science fair.

***MBI126: Do Cricket Chirps Change by Air Temp.***

Purpose: To determine if crickets can determine air temperature based on the number of chirps they make in one minute. Hypothesis: Air temperature can accurately be determined by counting the number of chirps a cricket makes in one minute. Procedure: 1. Determine multiple weather assets using weather.com. 2. Place centigrade thermometer on ground of testing area, record temperature after 15 minutes. 3. Select a cricket and record number chirps produced in 1 minute. 4. Repeat last 3 steps after 15 minutes. 5. Determine average of 4 trials. 6. Repeat process 19 more times. Conclusion: Final results available at fair.

***MBI127: Colored Growth***

This experiment was conducted to test the efficiency that light can give to a plant. The following steps were used: craft a wooden box with specifically measured planks of wood, plant the grass seeds with the soil and river rocks, place the plants into the box (each into a different section), connect the lightbulbs to a power strip and reflect the lights towards the plant, and place one plant on the windowsill. To conclude, the red light grew the best, and the orange light grew the worst with the smallest height.

***MBI128: Microwave Radiation***

The purpose of testing microwave radiation is so people can visibly discern the effects of exposure. I conducted this experiment by testing five groups of six seeds and exposing them to radiation. They were tested in my microwave for various amounts of time. I saw that the plants with the least amount of exposure all germinated. In the group with the greatest amount of exposure, only three out of six plants germinated. I can conclude that radiation does have an effect on plant germination. For a future experiment, I would expose my plants to longer amounts of radiation.

***MBI129: Wi-Fi vs. Plants***

The reason I decided to do this project is because I was looking up some cool things to do for the science fair, and found a project. This project was about planting plants from the start and putting it in a room with a Wi-Fi router in it. The article about the project discussed how Wi-Fi affected the energy of people through the day when they were near a router. So I got to thinking, and began to wonder, could a Wi-Fi router affect a plant I didn't think a wireless Wi-Fi router would affect plant growth. This was a month long project, I needed to make sure to keep a close eye on my plants, I would water every week and keep track of the data. My conclusion results were that the Wi-Fi did indeed affect the spider plant

***MBI130: Evaluating a relationship between diverse pigmentation in algae species and concentrated oxygen production***

For my experiment I measured the Oxygen level of water with algae in it. I had three different bowls with water in them, and in each of the bowls I also had different types of algae. I used green, red, and brown algae. I completed the experiment three times, and every time the experiment went on for three days. I measured the PPM, which is the Oxygen level, twice every day, once in the morning and once in the evening. In the end, the Green Algae's PPM levels, were lower than the other algae's PPM levels.

***MBI131: How long has the body been there?***

Do you know long the body has been there? No, well with my experiment you can find out. I used oranges to simulate human core temperature. my hypothesis is that the oranges in ice water will cool faster. the oranges are placed in different temperature water to simulate different environments. The oranges were in the water until they reached a temperature of 26.6 degrees Celsius and were taken out. the conclusion reached was that oranges in ice water cool faster. the ones in room temperature took twice as long.

***MBI132: Plant Growth***

The purpose for this experiment is to find out what liquid works the best for watering plants. It is hypothesized that the Gatorade will work the best for watering the plants because of the many vitamins in the liquid. The types of liquids used are water, gatorade, warm tea, iced tea, diet pepsi, lemonade, and apple cider. I watered the liquids with 25mL. At the end of the day I measured how much the plant grew. To find out which liquid works the best I watered the plants once daily. In conclusion the diet pepsi worked the best for watering the plants. It worked the best because of the artificial sweeteners like aspartame. The coffee, iced tea, and water also grew. The other liquids did not grow due to the acidity in the drinks.

***MBI133: Effects of Pollution on Plant Growth***

With growing pollution every day, plants get affected in every way; so I strived to understand how exactly they are affected. The approach was to place the same species of plants in different kinds of soil pollution. We can use the data we obtain in practical ways, such as deciding what types of homemade or store bought fertilizers to use.

***MBI134: "A Bit Of Sugar"***

Horses are important animals in PA for work, farming, competition, and pleasure riding. Equestrians communicate with horses using a mouth bit, without which they cannot safely ride. Since horses resist the bit as a foreign object, this study investigated potential ways to make the "mouthing" process more enjoyable for horses and time efficient for riders, by applying sweet substances to the bit. The time to mouth the horse was calculated and compared for honey, corn syrup, and a control condition. The averaged results from 3 trials showed that horses preferred corn syrup, an artificial sweetener, rejecting the null hypothesis.

***MBI135: Basil Basics***

People around the world use basil every day for cooking, and other things. Instead of buying pre-dried basil, now you can do it yourself! For my project, I decided to find out the fastest method for drying basil. Many people think that the process of drying basil is long, but they are wrong. I tested seven different ways to dry basil five times each. Microwaving turned out to be the fastest way as I predicted. My testing can help anyone dry basil efficiently and fast.

***MBI136: Got Greens***

Can the temperature of water affect plant growth? What temperature of water is the best for the plant? I hypothesize that the water at 10 degrees Celsius will be the biggest affect on the plant. First I used the coldest water 10 degrees Celsius. Next on plant two the water was 21 degrees Celsius. Last the water was 32 degrees Celsius. Plant one grew the tallest at 12 cm., plant two grew 10cm, and plant three grew 6cm.

***MBI137: Macro Invertebrates: what do they like?***

The purpose of this experiment is to determine if more aquatic organisms are attracted to live or dead leaf packs in a creek. The leaf packs had the same mass and were placed into the stream for one month and then taken out to be counted and examined. The leaf packs contained all of the same species however the amounts of species per pack we drastically different. The data showed that the live leaf packs contained more macro aquatic invertebrates. The hypothesis was refuted because there were less invertebrates in the dead leaf packs compared to the live.

***MBI138: Man vs. Wild***

What do I think about genetically modified crops? I believe that they are not as healthy as wild crops. I did this project so I could test out my theory using corn. I predicted that the wild corn plants would be shorter and thicker compared to the genetically modified plants. I potted all the pots to the top with organic fertilizer and planted the seeds two inches down. The results supported my hypothesis; the genetically modified grew plants much taller, and thinner, compared to the wild plants; the wild plants were short and thick.

***MBI139: Will a plant grow better in sunlight or light bulbs?***

The purpose for this experiment is to find out where the best place to grow a plant. The hypothesis is that the plant under sunlight will grow the most because the sun give off nutrients that help the plant grow. I had three light boxes which I put one pot in each. Each box had a different light bulb (LED, Incandescent, and Fluorescent). I let them grow for about 2 weeks and water when needed. The final results were that the sunlight grew the most and that was supported the thesis statement.

***MBI140: Which Plant Will Prevent Erosion the Most?***

The different plants being tested in this experiment are grass, radish and beet plants. The purpose for this experiment is to show what plants can prevent the most erosion. Studies show that damage from soil erosion worldwide is estimated to be \$400 billion dollars per year. As a result of erosion over the past 40 years, 30% of the worlds land has become unproductive. Grass, radish, and bean plants were grown with equal amounts of soil in aluminum pans. All growing conditions: amount of light, temperature, type of soil and amount of water were held constant. After 21 days, I cut down the side of the aluminum pans and watered the plants to simulate erosion on a hillside. I next took the mass of the soil, and the plant with the least amount of soil residue will be the plant that prevents erosion the most. The grass had the least amount of soil residue, therefore making it the plant that had prevented erosion the most. The radishes came in 2nd and the beets came in 3rd. Research showed that the grass prevented the erosion the most because it has fibrous roots, unlike the beets and radishes that have taproots.

***MBI141: Can Soils Make a difference?***

This experiment is “does topsoil, compost, sand, or rocks is best for scallion regrowth.” The purpose for this experiment is to see which soil is the best for vegetable regrowth. The hypothesis of this experiment is compost. The hypothesis in compost because it is rich of nutrients, high fertility, and high organic matter. Topsoil is the top layer of soil located on the A horizon. Compost is natural organic matter. Sand is weathered material created by waves and erosion. Rocks are naturally occurring soils found on earth's surface. In conclusion the hypothesis is supported. The compost had the most effect on scallions because it has high nutrients, high fertility, high organic matter, and fine texture. The rocks had the least effect on scallions. The averages for compost was 24.48cm, topsoil was 22.86cm, sand was 13.46cm, and rocks had an average of 4.28cm.

***MBI142: The Effect of Free Range on the Viability of Chicken Eggs***

Hatching rates of cooped vs free range red sexlink chickens. My experiment will test the viability of cooped and free range chickens. They all will receive the same nutrients and habitat except for time outside. My hypothesis is that the cooped chicken eggs hatch out more than the free range. I believe the breeding cycle will be easier for the hens and rooster and cooped chickens can not eat anything that it shouldn't. So far my hypothesis has been correct by a long shot ( Free range hatched more) but for my final results check out my project at Pittsburgh

***MBI143: Lima Bean Respiration Rate***

The purpose of this experiment is to see how the respiration rate of germinated lima beans is affected by the pH of their environment. I completed this experiment by preparing solutions of varying pH (4, 5, 6, 7, 8) and added a germinated lima bean to each solution. In order to measure the respiration rate, I looked for a change in the pH of each solution due to the release of CO<sub>2</sub> during respiration. The data showed that the more acidic the environment, the less respiration occurred.

***MBI144: Tablet or Capsule: Which Makes Me Feel Better?***

The purpose of this project is to find whether acetamin pain reliever, branded as Tylenol, dissolves faster from a tablet or capsule delivery system.

***MBI145: Is Fertilizer Environmentally Friendly?***

In this project, daphnia will be observed to assess the impact of Ammonium sulfate (fertilizer constituent) Three trials with five groups per trial. Each trial had 0.02%, 0.03%, 0.04%, 0.05% fertilizer, and a control group.

***MBI146: Will Saltwater Impact Seed Germination and Plant Growth?***

Various concentrations of salt water will be used to determine their impact on plant growth.

***MBI147: Talking Dirty?***

How much bacteria is on smart phones. After researching why the common cold was being inflicted on me so often in a small time period, I found that the bacteria on your smart phone could be causing it. I used ten agar plates for ten random phones that belonged to my family and friends to have a visual of the bacteria growth. The bacterium grew differently on each agar plate. Most had yellow mold spores ranging from .5mm to 2.54cm in diameter. Seeing this made me much more aware of my surroundings, because everything on the planet has bacteria.

***MBI148: The Effect of Colored Lights on Photosynthesis***

My project determined the effect of different light colors on the rate of photosynthesis in spinach leaf. I hypothesized that the rates, in declining order, would be: white, red, blue and green. Uniform size leaf chads sank in bicarbonate water at room temperature, but then floated after exposure to light (which produced oxygen by photosynthesis). The time at which five of the ten chads rose was recorded for each light three times. The experiment was terminated at thirty minutes. The data was tabled and graphed. The results confirmed the hypothesis.

***MBI149: Are You Really What You Eat?***

The purpose of this experiment is to figure out whether eating sugary foods will affect performance. I hypothesize that the group that is eating sugary food will do the very worst performance-wise. Put a layer of bedding in each cage. Place four mice in a cage. The mice will have unrestricted access to food and water. Feed group A regular mouse food. Feed group B vegetables. Feed group B sugary cereal. Construct a maze from foam board and hot glue. Place them daily in the maze and time how long it takes each mouse from each group to find its way out of the maze. Clean the cages twice a week.

***MBI150: Investigating Ant Repellent***

The purpose of this experiment was to determine which household materials can be used as an ant repellent by studying 6 groups of around 10 ants each. Each group was placed in a plastic shoe box for testing and a strip of paper was soaked in the tested substances and placed across the box. Ipads on ring stands recorded a video to document the number of ants crossing the paper strip in 20 minutes. Of the materials tested, vinegar and Dawn soap worked the best while water (control), hydrogen peroxide, ammonia, and a salt solution ended up being less effective.

***MBI151: Lead: older houses versus newer houses***

This experiment was on drinking water in older houses versus newer houses. You mainly find lead in solder, a binder for pipes. I tested four different houses. Each house had the same result: little to no lead, before and after testing with the Brita Filter. My hypothesis: If older houses have older pipes then that house will have lead. My research showed that my hypothesis is right, but my testing showed otherwise. I now understand more about pipes and lead in pipes.

***MBI152: Effect of Salt on Ice and Germination***

Cars and ice are a dangerous combination. Salt has been the traditional tool to combat this situation during bad weather. I was interested in the effect salt might have on the environment. My study compared the effects of two de-icer salts on both ice melt rate and grass seed germination. A study measuring change in the mass of an ice cube with and without salt was performed. The resulting liquid was used to germinate grass seed. Both salts clearly accelerated ice melt, but had an adverse effect on grass seed germination. Replicate trials completed by 3/1/17 with results at Fair.

***MBI153: Can Termites Be Used To Repel Insects?***

Problem: Determine if termite-solution filtrate will repel insects the best. Hypothesis: As the concentration of termite-solution filtrate increases its ability to repel insects will increase. Procedure: 1. Construct "T"-shaped testing-apparatus. 2. Mix termites in 25 ml's distilled-water, blend them. 3. Prepare a 0% (control), 25%, 50%, 75%, 100% termite/water solution using the filtrate. 4. Dip a sterile cotton-ball into the 0%(control) termite/water solution and place it at 1end of the "T"-shaped-testing apparatus. 5. Place 10 dumpy-winged-fruit-flies at the starting point of the "T" shaped testing-apparatus. 6. Determine/record the distance/direction the fruit-flies have gone away from starting-point. 7. Repeat 3 more times. 8. Repeat that using other solutions. Conclusion: Available at fair.

***MBI300: Different composts' effect on peas***

Compost can be added to enrich soil with nutrients from the breakdown of organic material. Our school composts biodegradable cafeteria wastes by two methods, a roller bin method and a wooden bin method. These composting methods produced very different-looking composts, with the roller bin compost being less broken down. The purpose of these experiments was to test the hypothesis that peas shoots grow better in compost mixtures than standard topsoil. Our results show that the wooden bin compost resulted in better plant growth than standard topsoil, but the roller bin compost actually resulted in poor pea shoot growth.

***MBI301: Mint: Cool or a Fool?***

Our project was titled Mint:Cool or a Fool? Our purpose of our experiment was to see if mint are false advertising. Our hypothesis was that if we tested Altoids, Tic-Tacs, and Lifesavers in different liquids, then the Altoids would cool down the liquids the most. We tested our hypothesis by boiling our different liquids to the same temperature, equally putting them into two glasses, and recorded the temperature every five minutes while we added 5 of each mints to one of the glasses. Our results were that in our experiment mints did not make any liquids cooler. We think this is because many people believe that mint is just a cooling sensation and there was nothing but sugars in the mints we used. In conclusion, our hypothesis was incorrect and we found out some very interesting information about mints.

***MBI301: Mint: Cool or a Fool?***

Our project was titled Mint:Cool or a Fool? Our purpose of our experiment was to see if mint are false advertising. Our hypothesis was that if we tested Altoids, Tic-Tacs, and Lifesavers in different liquids, then the Altoids would cool down the liquids the most. We tested our hypothesis by boiling our different liquids to the same temperature, equally putting them into two glasses, and recorded the temperature every five minutes while we added 5 of each mints to one of the glasses. Our results were that in our experiment mints did not make any liquids cooler. We think this is because many people believe that mint is just a cooling sensation and there was nothing but sugars in the mints we used. In conclusion, our hypothesis was incorrect and we found out some very interesting information about mints.

## Chemistry (MCH)

### ***MCH100: Utilizing Super Absorbent Polymers for Novel Wastewater Treatment***

Super Absorbent Polymers (SAP) are substances that can absorb and retain extremely large quantities of water. Created through the polymerization of Acrylic Acid, the substance has many practical environmental uses today. The purpose of this project is to evaluate the absorbing characteristics of a homemade SAP, based off of cornstarch, and compare it to a commercial SAP called Sodium Polyacrylate. The absorbing characteristics are being measured by finding the volume of the free flowing water that was not absorbed by the SAP. In addition, the project evaluates the possible water purification applications that an SAP can have. By placing an SAP in a contaminated solution, not only can it be stabilized for easy transportation, but the liquid can also be evaporated and collected from the solution creating purified water. The project utilizes a Litmus test to evaluate the water purity of the evaporated water compared to the contaminated solution. It was hypothesized that because the homemade SAP is based of a cornstarch, a naturally absorbent substance, it would show greater water absorbing characteristics. However, it is hypothesized that when comparing the water purity between the home made SAP and Sodium Polyacrylate there will be no difference. This is because cornstarch is neutral and is thought to have no affect on the evaporated water. By utilizing SAPs we might not only have a stable way of transporting contaminated water, but could also find a way to purify it.

### ***MCH101: The Buoyancy of an Egg***

The purpose of this experiment was to see the relationship of salt and buoyancy. My hypothesis was that the salt would make the egg float, but the heat will not. I put the eggs in a cup and put salt in to see if it would float. I also put an egg into a pot and put salt in to see if it would float. The egg in the heat did not float. In conclusion, my hypothesis was supported by my project.

### ***MCH102: Plop Plop Fizz Fizz***

The purpose of this experiment is to determine which antacid is the most effective and efficient. The experiment was conducted by using a pH meter to record the amount of change in the lemon juice after an antacid was placed in the liquid. The antacids used were Tums, Mylanta, Gaviscon, and Rolaid. After completing the experiment, Gaviscon was shown to be the most efficient; however, it was the most expensive of the antacids. In conclusion, Gaviscon is the most effective antacid, but Rolaid is the best if cost is taken into consideration.

### ***MCH103: How Effective are Flame Retardants***

My project is: How Effective are Flame Retardants on Children's Pajamas? The project's purpose was to determine if harmful flame retardants become less effective after washing. After the pajamas were washed according to manufacturer's instructions and washed opposite to the manufacturer's instructions, they were cut into squares and burned. Unwashed pajamas had the slowest combustion speed meaning they were the least flammable, but after being washed the pajamas' combustion speeds became faster and more flammable than the control. The washed pajamas' combustion speeds were different by a second or less, meaning that flame retardant efficacy was reduced by the washing.

### ***MCH104: The Incredible Rising Egg***

Did you ever wonder if changing the number of eggs would change how brownies rise? I did and found it to be an interesting project. I hypothesized that the more eggs I used to bake brownies, the more the brownies would rise. In each trial, I used a different number of eggs for each brownie batch. After the brownies were cool, I took a ruler and put it in the center and measured how high the batter rose. In conclusion, my hypothesis was right because the more eggs I used made the difference in how high the brownie batter rose.

### ***MCH105: What Organic Fuel Produces More Heat: Corn or Wood?***

The purpose of my project is to find out if different bio-fuels can produce the same heat as our natural gas furnace and which bio-fuel generates more heat. Based on my research, I hypothesize that the wood pellets will produce more heat when burned in the pellet stove than the corn. This hypothesis will be tested by securing our home furnace and recording temperatures (inside rooms and outside) while burning different ratios of bio-fuel (wood pellets or corn) in our home pellet stove. Temperatures will be measured every hour for four hours and fuel ratios will be tested three times.

***MCH106: Which Soda Has the Worst Effect on Teeth***

Soda is harmful to dental health but which soda is the worst for teeth? This experiment shows which sodas are worse than others. For this experiment I used Coke, Grape Sunkist, Orange Crush, Ginger Ale, Sprite, and water. Then I found the pH of each liquid. Then I put 15 g of chalk into each liquid. Then I weighed each piece of chalk after being in the sodas. Coke had the biggest difference between the chalk's original weight, and the weight after. Sprite had the least difference. The more acidic each drink was, the worse the effect on the chalk.

***MCH107: Flaky Acid***

This experiment was observing which liquid would make the #0000 steel wool rust the most in three days. My hypotheses was that If the steel wool soaks in lemon juice, cranberry juice, tap water, distilled water, soda, and bleach then lemon juice will then make the steel wool rust the fastest in the given amount of time because it has the lowest pH level. My research was seeing different ways to effect the rusting process like different temperatures and different ph levels. The distilled water and the bleach made the steel wool rust the most but, the bleach ended up rusting the more than the distilled water. As I expected the lemon juice to have a lot of rust it had one of the least while the cranberry juice and cherry Coke barely rusted.

***MCH108: What Candy has the most Acid in it?***

The purpose of my experiment is to see which candy has the most acid in it. This is important because sour candies can ruin tooth decay. To conduct this experiment I will turn them into powder and add it to baking soda and water and measure the circumference of the balloon.

***MCH109: Analysis of Active Ingredients in Whitening Toothpastes on Stained Teeth***

Please visit student's exhibit.

***MCH110: Shaking For Suds***

The purpose of my project was to see what water is the hardest. My procedure was to put distilled, mineral, and tap water into three different jars, then you put dish soap in them and shake them. This was done three times. My hypothesis was that mineral water would be the hardest. My results proved that true.

***MCH111: Sweet Tooth***

The purpose of this experiment is to find out which candy dissolves faster in which liquid. The procedures I used included pouring equal amounts if liquids into containers and then dropping candies into each container. The Skittles dissolved the fastest with a time of 140 second in vinegar. The Sweet-Tarts dissolved with a time of 170 seconds in the lemon juice. in conclusion, the Skittles and Sweet-Tarts dissolved the quickest because of the acid in the liquids and because the Skittles and Sweet-Tarts have the least amount of mass.

***MCH112: Gelatinous Growth***

The purpose of this experiment is to test the properties when placed in liquid. First, I filled four glasses with 15ml. of each of the four liquids (distilled and tap water, ginger ale, and vinegar). Then I recorded the growth of the Gummy Bears by sets of 12 hours intervals using a centimeter measuring ruler. In this experiment, the results were, Gummy Bear A, which was treated with distilled water, had expanded the most. Gummy Bear D expanded the least; it was treated with vinegar

***MCH113: Self-Inflating Balloons***

Balloons inflate on their own when they are in an enclosed area and when an acid and a base mix to make a gas. The acid is vinegar and the base is baking soda so they make a gas. This gas that causes the balloon to inflate is called carbon dioxide.

***MCH114: Do Gas Stations Cause Soil Pollution?***

The purpose of this experiment was to find out if gas stations were affecting pH levels of soil. People deserve to know if their soil is being contaminated by a local gas station. I collected samples of soil from 4 different gas stations. Soil was also collected from places away from gas stations for comparison. The results from the areas away from the gas stations have an average pH of 7. The older gas stations' soil were at levels of 6 pH and above. In closing, I verified that the soil at gas stations will have an unhealthy pH level.

***MCH115: Does Greater Sunscreen SPF Mean Greater Protection?***

Sunscreens with a range of SPF values will be tested by coating Solar UV Sensitive Beads and exposing to sunlight. The change in bead color will indicate level of protection from UV rays.

***MCH116: Effect of Coolant on Rate of Soda Temperature Drop***

The purpose of my experiment is to figure out how to cool a room temperature can of soda. I chose this project because I don't like drinking warm sodas. I did my experiment using 3 stainless bowls. I put a room temperature can of soda in each. One had ice, one ice and water and one ice, water, and salt. I took digital temperature of each after 5 minutes. The salt cooled it the fastest. The ice and water was next and the ice only was the slowest.

***MCH117: Soda and Corrosion***

How often do you drink soda? Do you know what this drink does to your body? Well, now you will have an idea based off of my experiment. If soda can eat the rust off of nails, imagine what it does to your body. As you read this report, you will see what five different sodas can do to rust covered nails. I guarantee you will be surprised by the results.

***MCH118: Can Fabric Softener Compromise Children's Safety?***

This experiment tested if fabric softener impacts fire retardant. First, cut the material into equal pieces. Then, place five strips in a dryer with a scented sheet. Repeat this procedure with an unscented sheet, and again without one. Take samples outside, hold with metal tongs, and light on fire with adult supervision. Let fire burn until it goes out. Finally, weigh the samples. Data showed unscented fabric softener burned most with a 16.25% decrease in weight. The scented fabric softener burned the least, with 6.25% decrease in weight. The hypothesis wasn't supported; the unscented fabric softener burned most.

***MCH119: What Material is the Best Insulator?***

The project is what material is the best insulator. How the project was performed was by stuffing a mason jar full of insulation and putting a test tube with water and a thermometer inside to keep a constant temperature. The hypothesis was that fiberglass would do the best because it is used by contractors in homes. The results showed that fiberglass was the best. In conclusion, the hypothesis was supported and the other insulators were better than expected.

***MCH120: How Do Crystals Grow in Different Environments?***

The purpose of my experiment is to see where crystals grow the best. I predicted that the crystals placed in the warmer environment would grow the best. Procedure: 1. Pour 120 ml of boiling water into a jar. 2. Add alum to the boiling water. 3. Small Crystals will form; these are the seed crystals. 4. Tie a seed crystal to the end of a piece of nylon thread. 5. Hang the seed crystal in the jar containing the solution. 6. Place jars in different environments - the refrigerator, dark room, in room temperature and by the furnace.

***MCH121: Which Substance Prevents Rust the Most?***

Please visit student's exhibit.

***MCH122: Fun Under The Sun***

Ever gotten sunburn? This experiment Fun Under the Sun determined which sunscreen brand would be most effective in protecting human skin. An ultraviolet detector was utilized to indicate the ultraviolet index and irradiance. The ultraviolet detector was placed inside a transparent bag covered with sunscreen. The detector revealed the ultraviolet index and irradiance. Ten trials were conducted for the ten types of sunscreen. The Coppertone Sport sunscreen was most effective having an ultraviolet index of 0.6 and irradiance of 11.9 mW/m<sup>2</sup>. The Banana Boat sunscreen was least effective obtaining the highest ultraviolet index of 1.1 and irradiance of 31.5 mW/m<sup>2</sup>.

***MCH123: How To Make My Clothes More Vibrantly Colored?***

My experiment purpose is to test how different concentrations of dye affect the amount adsorbed by the wool-felt. The reason I chose this experiment, is that I have always wondered why darker clothes are heavier and to know the process of how the wool adsorbs the dye. I hypothesize that the concentrated dye solution will saturate the wool-felt fabric more, for both Red and Blue dyes. I will make different dye concentration solution using 1:4 ratio of water and vinegar solution adding 15.6 grams of dye and using a spectrophotometer, I will measure the concentration of the dye solutions.

***MCH124: Electrolyte Up Your Game***

A conductance sensor was constructed and connected to a multimeter to determine the amount of electrolytes in sports drinks head at 18 degrees Celsius and -1 degrees Celsius. 100mL of Vitamin Water, Body Armor, Gatorade, Powerade, and Propel was poured a glass culture dish. A multimeter was set to 200 milliamps and the electrolytes were measured. Each sports drink was tested 10 times each for refrigerated and room temperature. The room temperature drinks had more electrolytes than the refrigerated drinks. However, Body Armor had the most electrolytes for both temperatures and Vitamin Water had the least.

***MCH125: What rock dissolves the fastest?***

Please visit student's exhibit.

***MCH126: Does Temperature Affect Battery Life?***

Standard AAA batteries will be subjected to a variety of temperatures. The current generated by the test batteries will then be measured for each temperature setting. Battery life also will be evaluated using small flashlights.

***MCH127: Which Thermocouple Will Produce the Highest Voltage?***

Metallic bonds give unique properties to metals. The property of conductivity of heat and electricity will be utilized in this project in which a variety of thermocouples will be constructed. The potential difference of the various thermocouples will be compared and evaluated.

***MCH128: Can Liquid Crystals Make Gloves Better?***

In this project I will study the influence of external temperature difference on thermotropic liquid crystals. The purpose of this knowledge is to design gloves that can accurately notify notify the wearer with a color change when the gloves loose their ability to protect the wearer from extreme cold.

***MCH129: Vitamin C Fraud***

Do you know how much vitamin C is in the refreshing glass of orange juice that you drink? My experiment compares the amount of vitamin C that is in a vitamin C tablet to the amount of vitamin C that is in Premium, concentrated, and fresh squeezed orange juices. First, I created a starch solution, which I added to each orange juice sample. I mixed an Iodine-water solution, which I titrated into the orange juice. When the iodine reacts with the juice-corn starch solution, it will change color. The amount of iodine titrated indicates how much vitamin C present.

***MCH130: The Effects of Antacids on pH***

The purpose of my experiment was to find the best antacid and compare it to the generic version. I used Logger Pro software and a vernier stirring station and pH probe to collect my data. I dropped an antacid tablet into 100 mL of 0.01 M hydrochloric acid and recorded the pH for 20 minutes. My results showed that of the 8 different brands of antacid I tested, that Alka-Seltzer worked the best (shortest neutralization time and least acidic ending pH) followed by Tums-types, then Rolaid-types, and finally Gaviscon-types.

***MCH131: Drink Showdown***

The makers of sports drinks spend tens to hundreds of millions of dollars advertising their products each year. Among the benefits often featured in these ads are the beverages' high level of electrolytes, which your body loses as you sweat. In this science project, you will compare the amount of electrolytes in a sports drink with those in orange juice to find out which has more electrolytes to replenish the ones you lose as you work out or play sports. When you are finished, you might even want to make your own sports drink.

***MCH132: The Fire Weigh In!***

Papers have a huge part in our daily lives. My project involves a substance that I put on the paper that makes the paper inflammable then after I burn the paper I'll test the strengths of each paper. I had to use three different types of paper. I had to test the strength of each of the papers before I burn them. Then I burned the papers and after they were burned I tested the strength. My hypothesis was correct because the construction paper was the strongest before and after being burned.

***MCH133: Got Juice?***

This project involves the outcome of which juice is most easily removed from carpeting. The goal of this project is to help mothers and fathers who have kids and tend to be messy and chaotic. By finding the result of this project, organic juices that do not contain artificial flavoring have been separated into beakers by 15ml and poured onto a piece of carpeting. The juices apple, grape, pomegranate, cherry, and blueberry will sit and soak into the piece of carpeting for 30 minutes. Two paper towels and 5 kg of books will be placed on the carpeting for one minute.

***MCH134: Which Absorbent is Most Effective for Waste Paint?***

Disposal of waste paint means adding a hardening agent prior to disposal. A commercial waste paint hardening agent will be compared to sawdust, conventional cat litter and "lightweight" cat litter to determine which absorbent is most effective at hardening waste paint.

***MCH135: How Does Fabric Softener Affect Flammability***

The purpose of this project is to test if it is safe to add fabric softener to different types of fabrics. To test this fabric softener was added to four different fabrics, one patch of each fabric was not washed with fabric softener. Each patch is set on fire and results are recorded. In the data collected, silk was the most affected by the fabric softener and was the fastest to ignite, while wool was the slowest to ignite. In conclusion each fabric was affected by the fabric softener in a way that it made each fabric less flammable.

***MCH136: Vitamin C in Oranges: Organic vs Conventional***

Please visit student's exhibit.

***MCH137: The Chemical Pump***

In my project, I was trying to find out which chemical reaction would inflate a rubber balloon the most - baking soda and vinegar, Coke and a Mento, or water and an Alka Seltzer tablet. I hypothesized that the baking soda and vinegar would inflate the balloon the most. I let the two substances mix in a graduated cylinder. I waited two minutes for each reaction to occur. Then I measured the balloon and recorded the data. In conclusion, I found that in all three trials, the baking soda and vinegar expanded the balloon the most. My hypothesis was correct.

***MCH138: What Drinks will Have the Highest Glucose Concentration Level After Adding the Enzyme Invertase?***

The purpose of this experiment is to see which drinks will have the greatest amount of glucose in them after the enzyme invertase is added. To conduct this experiment, I will add invertase to drinks and measure the amount of glucose in them. The experimental results were measured by seeing how much glucose was in the drinks. The results of the experiment was that Coca-Cola and Gatorade had the highest average of glucose in them. The results indicate that my hypothesis is correct because Coca-Cola had the highest glucose average along with Gatorade.

***MCH139: How Acids Affect the Rate of Corrosion***

Please visit student's exhibit.

***MCH140: Acid Orange Juice***

In my project I wanted to test which orange juice has the most nucleic acid. My hypothesis was Sunny D orange juice would have the most nucleic acid out of the three orange juice's. What I did was poured each of the three orange juice's into three different cups. I put the pH strips in the three cups with the orange juice. Recorded the data. In my final results I saw that most of the results were similar but Langers orange juice was the highest in nucleic acid.

***MCH141: Electrolyte Concentration and Conductance***

Electrolytes are salt ions that carry an electric charge through the cell and neighboring cells. They are especially important for muscle contraction and nerve impulses. A person loses electrolytes through sweat and body fluids. The problem studied in this experiment was, "Which sports drink, orange juice, milk drink, or homemade drink contains the most electrolytes?" The electric conductance of the ions in each drink was measured in milliamps (mA) using a multimeter. Ten drinks were tested three times each, and the results were averaged. Pedialyte had the most electric conductance and chocolate milk came in second. I believe Pedialyte did the best because it contains: sodium, potassium, and chloride, these are all important electrolytes. These results are useful to athletes who want to stay hydrated, as well as those who are sick and looking to replace lost electrolytes.

***MCH142: Antacid Potency***

The purpose of this experiment was to determine the antacid potency of different over the counter antacids and to determine if one worked better. I hypothesized that Pepto Bismol would be the most effective. Procedure: 1. Add ten drops of grape juice to each test tube. 2. Rinse eye dropper thoroughly. 3. Add ten drops of lemon juice to each test tube. 4. Label each test tube with the name of one of the liquid antacids that you are testing. 5. Add the antacid, drop by drop, to the first test tube. Stop as soon as the solution changes colors. A color change means that the antacid neutralized the acid in the lemon juice. 6. Record the number of drops of antacid that it took. 7. Repeat this process with the remaining antacids. 8. Record all data.

***MCH143: The Science of Spherification***

The purpose of my experiment was to find out at what pH level will spherification occur and not occur. When I did this I had to I had to make a sodium alginate and food solution, and a calcium chloride and water solution. With the food I will make drops in the water solution then after 60 second I would take them out. Using my data I found that the pH level must be at least a 4 and at the highest 6 for at 7 spheres will never form.

***MCH144: Baking Soda + Vinegar = Liftoff***

I wanted to know what the best measurement mixture of baking soda and vinegar was to make a canister rocket go the highest. To do this, I needed to put a mixture of water and baking soda in a cap, fill a canister with vinegar, and snap the lid on. The canister then launched. I launched three different measurements of baking soda (1mL, 2mL, 3mL) three times each. The 2mL baking soda went the highest. Based on these results, my hypothesis is rejected because the 3mL baking soda didn't go the highest.

***MCH145: The Crystal Competition***

The experiment I have done for my project is what type of crystals would grow faster between using Aluminum Potassium Sulfate, chromium potassium sulfate, and copper sulfate.

***MCH146: The Specific of Specific Heat***

This experiment was conducted to determine the specific heats of water, vinegar, and vegetable oil. Knowing these specific heats is useful for cooking. Similar experiments can find the specific heat of other substances. The liquids were heated, and the temperature was measured every 15 seconds. They were moved off the stove when they reached 80 degrees Celsius. The data showed that vegetable oil has the lowest specific heat and vinegar has the highest specific heat. This happened because vegetable oil is a lipid and vinegar's molecule is large.

***MCH147: The Effect of Fertilizer on The Vitamin C Content of Spinach***

Is eating organic really healthier? Many nutritionists encourage people to eat organic foods to maintain their health, but does it really matter? In my experiment, I will grow spinach applying no fertilizer to my control group. One experimental group will receive a natural fertilizer, while the other will receive a commercial, chemical fertilizer. I will then pulverize the spinach and use ascorbic acid test strips to measure the amount of Vitamin C.

***MCH148: Now You See It, Now You Don't!***

Limestone is common construction material, however, acid rain dissolves calcite in limestone. This study examines how much acid is needed and the rate to dissolve limestone under different acidic conditions. Limestone rocks were soaked in acidic solutions of vinegar and distilled water, and rocks' masses were measured over 21 days, along with each solution's pH. The limestone in 100% vinegar dissolved faster than the 50% and 25% vinegar solutions, while limestone in 25% vinegar solution dissolved slowest. The pH of 100% vinegar neutralized. Acid rain, even low acidic concentrations, eventually dissolves limestone. Considerations to preserve limestone structures should be given.

***MCH149: Which Antacid Will Have the Greatest Impact on pH?***

Simulated stomach acid will be used to evaluate the impact that both solid tablet and liquid antacids have on pH levels.

***MCH150: Sugar Rush***

I conducted this experiment because energy sources have been problematic in recent years. Glucose is a natural energy producer, so I decided to test different sugars with sulfuric acid to measure the energy produced. My procedure is as follows: pour sulfuric acid into granulated sugar, observe reaction, repeat twice, repeat twice, repeat steps for powdered sugar, measure KJ/Mole/second of AA battery, record results. In the experiment, I found that powdered sugar produced the most energy with an average of 9.17659358776 KJ/Mole/second, while batteries produced only 0.1105 KJ/Mole/second, proving that sugar produces more energy than batteries.

***MCH151: Elect "Rust" Ity***

My investigation was looking at answering the question of can you remove rust with electricity. Through the process of electrolysis I believe that this is possible.

***MCH152: What Will Make Ice Melt Faster***

I wanted to find out whether or not salt or another substance may be used to melt ice on roads more quickly so that we can have safer roads in the winter. I tested salt, sugar, sand, and had a control, in order to complete my investigation. I place each substance on each bowl, except the control, and placed them in the refrigerator. I monitored the melting ice over four hours three times. I found that my hypothesis was correct, that salt is the fastest substance to use on our roads to keep us safe.

***MCH153: Got Milk?***

A variety of milk products will be tested for glucose before and after adding the enzyme lactase. Subsequently, the lactose levels also will be measured and evaluated.

***MCH154: Rust Do It***

For my project, I tested metals to see which one rusts the quickest or the slowest. I did this by putting one piece of seven different types of metal each in their own water filled glass container. The metals I tested for my project were stainless steel, carbon, aluminum, brass, nickel, carbide, and titanium. I let them sit in the water for four weeks, and took notes during those four weeks to keep track of which ones showed signs of corrosion first. The final result was that they did not corrode in the order I predicted.

***MCH155: Which Liquid has the Highest Viscosity?***

The purpose of my experiment was to find out which liquid has the highest viscosity. I did this experiment because I wanted to determine how the viscosity of the different liquids would affect the results of my tests. In this experiment, I dropped a marble into a graduated cylinder filled with different liquids: Water, Olive Oil, Ginger Ale, and Honey, then I measured how long it took for each liquid to get to the bottom. I did this ten times. My experiment showed that honey was the most viscous liquid, proving my hypothesis.

***MCH156: Self Inflating Balloons***

This experiment is about chemical reactions between various substances and vinegar. The experiment testing which substance(s) will react with vinegar. The substances are baking soda, baking powder, and flour. It is hypothesized that baking soda and baking powder will react, for they have sodium bicarbonate. I tested each substance by doing five trials. The balloon at the top of the beaker that the chemical reaction is in will inflate if there is a chemical reaction. Mark down the diameter in your data table. The hypothesis is supported because baking soda and baking powder reacted and the balloon had the largest volume and diameter when tested for those substances.

***MCH157: Impact of Temperature on the Viscosity of Motor Oil***

The viscosity of motor oil will be evaluated at three different temperatures.

***MCH158: Rusting Rates of Nails***

Rusted iron is commonly seen. The goal of this experiment is to study the effect of 5 liquids (tap, purified, salt, acid, base water) and 3 nail types (steel, zinc-plated, stainless steel) on rusting speed and amount. I conducted the experiment with testing tubes for 4 weeks. Base water and stainless steel didn't rust. The others all rusted on the first day except that acid water rusted a few days later, but rusted the most. It suggests that stainless steel is the best resisting rusting. Regular steel and zinc-plated steel rust, especially worse in acid water.

***MCH159: what will melt ice the fastest?***

The purpose of my experiment was to find what substance would work best on ice. First I put 2 teaspoons of salt on 5 ice cubes and I did that with sand sugar and flour. Salt got the least amount of time with 3 hours and 8 minutes, flour took the most amount of time with 4 hours and 22 minutes. My hypothesis was correct because I said that salt would melt ice faster than any of the other substances.

***MCH160: Do You C It?***

The hypothesis for this project is that when exposed to heat, the rate of loss of Vitamin C will be different for different fruits and vegetables. Also, the rate of loss of Vitamin C will be higher for cooking methods utilizing water. The procedure is as follows: - Obtain fruits and vegetables for experiments. - Prepare fruits and vegetables for experiment. - Prepare titration solution. - Expose fruits and vegetables for controlled amounts of time, temperature, and added water content using boiling, steaming, and/or microwaving. - Measure Vitamin C level by titration kit. - Plot results. - Analyze Results. - Form Conclusions.

***MCH161: Stain Intensity***

Category: My project falls under the topic of chemistry. I will be comparing the stain intensity that is left on enamel. However, I will you be using eggshells instead of human teeth. Purpose Statement: What is the effect of various beverages on eggshell enamel based on the intensity of stain that is left? The strength of the stain will be compared for the duration of the observation time. Hypothesis: My Hypothesis is that the Mountain Dew will leave the greatest stain because it is known to have a very negative effect on enamel. Materials: Eggshells (as many as there are drinks, I will be using 5 eggshells) Various beverages (as many as necessary, Possible beverages include tea, coffee, Mountain Dew, Coca Cola, and Hawaiian Punch) Cups/ containers (as many as there are drinks) Camera tweezers Pen notebook/ notepad The only variable that will be present during the project are the drinks that will be involved. All of the other aspects of the project will not have any change to them. All subjects will be kept in the same condition, the eggshells are all the same brand, etc. Procedure: Clean the inside of the eggshells from all substances. Be careful not to break the eggshell. Put the liquids inside of the cups or containers. Place the drained eggshells in separate drinks. Record all findings and data. Keep subjects in stable conditions while monitoring.

***MCH162: Does Water Type Affect the Temperature in an Endothermic Reaction***

I test if different types of water when mixed with Ammonium Nitrate, will affect how much the temperature drops in an endothermic reaction. My result supported my hypothesis because salt water had the largest temperature drop. The data answered the testable question and proved my hypothesis.

***MCH163: Decomposition: Disposable Plates***

Purpose: To determine which fast food plate would decompose the fastest. Procedure: I collected 5 materials, cut them into 5 cm squares, and weighed them. I put the soil test samples into containers and watered them daily. I put the weather samples in mesh and exposed them to the weather. After 45 days, I removed the samples and let them dry. I weighed all samples and compared them to their original weights. Data: The data collected showed that the uncoated paper plate decomposed the most. Conclusion: The data supported my hypothesis because the uncoated paper plate decomposed the most.

***MCH164: Temperature's Affect on Acidity***

For my project, I tested how juices are effected by temperature. I chose this project because I remembered using pH indicator paper in school and wanted to use it again. To do this, I measured the pH of the liquids at a room temperature, then put them in a refrigerator until they reached a certain temperature and measured them, then boiled them until they reached a certain temperature and measured them. My results showed that the juices generally weren't effected by the heat and were effected by cold. I concluded that the juices had similar reactions to the temperature changes.

***MCH165: Calorimetry - Finding Calories in Food***

A calorie is a unit of energy that you need to survive. Anything with energy has calories. That includes coal, food, and paper. A food calorie is really 1000 calories, not one calorie as the package claims. One of the ways to measure calories is to burn the food to heat up water and using the heated water, calculate the calories in the food. A way to measure the amount of energy in food is calorimetry. I constructed a homemade calorimeter. I measured the energy released when burning different foods. I also studied the foods with a microscope before and after burning. My conclusion is that fat content and dryness of the food are the biggest factors involved.

***MCH166: Creating a Bicarbonate***

Creating a Bicarbonate is an experiment to prove whether or not a balloon will expand when one teaspoon of baking soda is added to 236.59ml of vinegar. The hypothesis for this experiment is pouring one teaspoon of baking soda into a container with 236.59ml of vinegar will cause a chemical reaction, releasing a gas strong enough to inflate a rubber balloon. To prove this hypothesis three separate experiments will be conducted. The first experiment will be mixing 1 tsp. of baking soda with 236.59ml of vinegar. The second will be mixing 2 tsp. of baking soda with 118.29ml of vinegar. Lastly, the third will be mixing 1 tsp. of baking soda with 118.29ml of water and 118.29ml of vinegar. After all three experiments will be recorded, the hypothesis will be proven true.

***MCH167: Get the Lead Out***

It is common knowledge that there is lead in Pittsburgh drinking water. I wanted to test 50 houses in 50 different neighborhoods for lead, but that turned out to be impossible. I realized this after I collected those 50 samples. I changed the direction of my project, and surveyed 50 people about what they knew about the lead issue. From all the conversations I had with the 50 people, they knew little. So I put it into a survey to prove it. I learn that the whole situation is confusing, and it is hard to follow the whole situation.

***MCH168: Color Burst***

One day I visited a snack shack and bought some Starburst candy. When I opened them, I noticed one color was more melted than the others. I wondered if this would happen to the same color every time. I tested four colors; red, pink, orange, and yellow to see which one would melt the fastest. I proved my hypothesis that stated red would melt the fastest. Red melted the fastest at 248.7 seconds. Orange melted the slowest at 306.63 seconds. This information can help candy makers choose colors that make their candy last longer on hot days.

***MCH169: Which Lotion Retains the Most Moisture***

My experiment is "Which Lotion Retains the Most Moisture?" This experiment is important because during the dry winter months many people struggle with dry skin. I used gelatin in petri dishes to replicate skin. Then, I spread lotion over the gelatin and measured how much moisture the gelatin lost over 10 days. I did the same with 4 other lotions in separate dishes. The gelatin that lost the least moisture had a layer of Vaseline on top. In conclusion, Vaseline is the best moisturizing agent to choose because it works well and is inexpensive.

***MCH170: Which Wood Has the Most Energy***

Purpose Find what wood has the most energy. To find what wood has the most produced heat. Procedure Burn wood then measure heat in calorimeter. Data Pine had the most energy Cedar had the second most energy and Oak had the third most energy Maple had the fourth most energy. Pine constantly had a high change of temperature. Conclusion My hypothesis was wrong I thought Oak would be the best. Overall pine burned the hottest and it was one of the longer burning ones so this would be the best one to use according to my research.

***MCH171: Candy pH***

Ever wonder how the pH of water changes whenever something is dissolved in it? This experiment was conducted to determine whether or not the water's pH (7) would change whenever sour, sweet, and chocolate candies were dissolved in water. The results of this experiment were that the pH of water changed whenever the candies were dissolved. I conclude that the pH of water changes whenever the candies are dissolved inside various aqueous solutions. Sour Patch Kids changed both types of water's pH to the same level (3); the Smarties changed it to 4, and the chocolate changed it to 6.5

***MCH172: Lead In H<sub>2</sub>O Filtered by Plants***

Lead in water is difficult to detect and is harmful to humans. This experiment is to test plants that can effectively remove lead from water. The chosen plants were dehydrated, grounded, and added to water with lead. The water was passed through a 0.45 microns filter inside a vacuum box. Using a AA-Graphite Furnace, the sample was hit with a flame and the machine measured the wavelength given off by lead. Cilantro, parsley, and fennel can absorb lead at different levels. The results show that parsley and fennel can absorb more lead in water than cilantro.

***MCH173: Vitamin C Content in Organic and Non-Organic Foods***

The Vitamin C content of organic and non-organic produce will be evaluated.

***MCH174: Cleaning coins***

Have you ever wondered how to clean a tarnished or oxidized coin. Acidic substances work more effectively at removing the oxidized stain from the coin. Any acid that does not cause corrosion can be used as the substrate. In this investigation lemon juice, orange juice, and cola were the weak acids used to clean the coins. The method was simple a tarnished coin was added to 20 ml of these weak acids individually for 12 hrs. The results obtained indicated that cola was more effective than orange juice and lemon juice. If I were to repeat this experiment i would include other coins. The hypothesis was proven correct with respect to acids being used to clean tarnished coins.

***MCH175: How does different amounts of gluten affect food?***

The purpose of this experiment is to find out if different amount of gluten will increase the amount of height the muffin will have when it comes out of the oven. The batter with no gluten was my control, and four other measurements were used. The muffins with no gluten in them came out to be the ones that rose the most. The other muffins were all smaller. This means that adding gluten did not make them rise as much as the ones without gluten.

***MCH176: What brand of gummy bears expand the most in water?***

My project is to see which gummy bear will expand the largest. I want to do this project because I used to always mess around with gummy bears and put them in water. I wanted to know fully why the reason they expand in water. I am going to test out different brands and see which one expands the most. My prediction is that the gummy bear with the most gelatin will expand the largest. In the end the "Trolli" expanded the most.

***MCH177: Red Hot Metals!***

Thermal energy is defined as the total kinetic energy of all the particles in an object. Thermal energy can be transferred from one point to another by a means called conduction. Conduction occurs when a "hotter" material with faster moving molecules makes contact with a "colder" material with slower moving molecules. This project will be about heat conduction between metals. My procedures will include heating a brass piece in the center of my metal rods and pouring wax on the end of each rod. I do not have many procedure steps, but this is not a very complicated experiment. I will be testing how fast the heat reaches the end of each rod. Copper turned out to be the fastest-heating metal.

***MCH300: Growing Gummies***

Our science fair project involves the chemical reaction between the sweet gummy worms and basic, neutral, and acidic liquids of bleach, water, and lemon juice. We researched the two significant topics of osmosis and the ingredients of gummy worms. The results differed from growing almost three times its size, or dissolving totally into the liquid. Take a deeper look into our project by glancing at our tri-fold! Our determination has been very helpful towards our project.

***MCH301: Tooth Decay***

A greeting to whomever is reading this, my partner and I have been studying and observing tooth decay. To test this we have put two human teeth in two substances. Those substances are soda and milk. We are also trying to discover if soda is bad for your dental hygiene, and if milk strengthens your teeth. Our results, as expected, were that soda damaged and stained the tooth black while the milk caused the tooth to stain yellow.

***MCH302: Can a Liquid Catch Fire?***

The purpose of our experiment was to find a better substitute for lighter fluid. When lighter fluid is alone, it is not flammable. We tested bacon grease, nail polish remover, and hand sanitizer. Our hypothesis was incorrect, thinking that nail polish would burn for the longest time. Bacon grease lasted the longest, we think because it has so much fat.

***MCH303: Color Mania***

In our project, we're going to be dyeing three different fabrics with four different colors. We're doing the project because Rachel is in charge of dyeing camper's shirts every year and it never turns out correctly. We soaked every fabric in each color in 15 minute intervals. We then analyzed them when they dried. Our hypothesis was incorrect, silk had the brightest effect on green, cotton had the brightest effect on red, and all around fleece had the brightest effect on purple and blue. In conclusion, fleece had the brightest effect on the colors then the other fabrics.

***MCH304: Bath Bombs!***

Our experiment was to see if baking soda was the cause of a chemical reaction when dropped into a bowl of water. To start, we made two batches of different colored bath bombs. One batch of bath bombs had one cup of baking soda and the other batch had two cups. We then tested our experiment by dropping both into water and rated them on a scale of one to ten depending on their amount of fizz. The bath bomb with more baking soda fizzed less.

***MCH305: Candle Chemistry***

The purpose of this project was to find out if the color of the candle affected how much wax was burned for three hours, in one hour increments. Our hypothesis is: If two candles—one with color and one without color—are burned, then the candle with no color will burn the most wax because there aren't any dyes that can get in its way. To do this project, we set up three candles (white, red, and green) and lit them all at the same time. Then, we set a timer and let them each burn in one hour increments for three hours. After each hour, we measured the wax using a measuring spoon with the measurement of 1 tablespoon. We recorded our data in a table. In the end of our project, our hypothesis was supported and the white candle burned more than the red and green candles did.

***MCH306: Making a Homemade Smoke Flare***

If we mix 60 grams of potassium nitrate and 40 grams of sugar, then we will have a more smoke-producing substance than other concentrations. We chose to do this experiment under the supervision of my father, a chemist.

***MCH307: GC jello***

The purpose of my project is to determine how does the temperature of water affect how quickly jello gets solid. I became interested because I like Jello. Our hypothesis is that if we use different temperatures of water to make Jello then our jello will take different amounts of time to set. We think that cold water will work faster because after Jello is cooked using the directions on the packet, it needs to be refrigerated. We will test this by making Jello with boiling water, room temperature water and cold water and time it to see which one becomes solid first.

## Computer Science / Math (MCM)

### ***MCM100: License to Scan***

The purpose of this project is to create zero-risk storage for driver's license numbers in a mobile app designed for cellular phones. My plan is to share my proposal with PA DMV and gather recommendations for app design. The ultimate measure of success will be the count of customers who download the app.

### ***MCM101: Designing Exercise Programs for the Sphero***

A big problem in America is obesity. With my project I am trying to make the world a healthier place. I believe that we should do as much as we can to ensure that we all have a healthy lifestyle. I thought that the best way I could achieve this through the science fair was by developing a robot program. In my project I programmed different activities for the Sphero to do that a person would follow. During my research I learned how to program a spherical robot and how to design a user-friendly device to address a health concern.

### ***MCM102: P Versus NP***

P versus NP is a major unsolved question in computer science that asks if every question with a solution that can be quickly verified by a computer can also be quickly solved by a computer. P stands for polynomial time, which includes problems that can be quickly recognized and solved by a computer. NP stands for non-deterministic polynomial time, which includes problems with solutions that can be quickly recognized by a computer but not quickly solved.

### ***MCM103: "BEAUTY IS IN THE PHI OF THE BEHOLDER"***

I selected my project because it was math-related and interactive. The project tests whether the "Golden Ratio" or phi (1.618) is a true measure of beauty when found in facial features. I selected 10 celebrities, graded them on 7 facial ratios and ranked them. I developed a survey, asking 14 students to rate the celebrities' attractiveness and ranked those results. When comparing the two rankings, 80% of the time they agreed, proving that the ratio is a true measure of beauty. In the future, I might apply the same project to other things in nature, art, or structures.

### ***MCM104: A Computer Program that Simulates Newtonian Physics***

My experiment is about testing computer programs written with three different kinds of code to assess which code is the most efficient for writing programs. The three types of code I will be attempting to use are Java, Python and C++. The program I am writing with these codes is called a physics engine. The physics engine is used to demonstrate the simplest physical motions, such as dropping a ball from a certain height. So far, my data is inconclusive due to limitations on my part. The procedures I am using are too long to add to this abstract due to my instruction to make it 100 words. Therefore, the procedures I used can be found in the notes I took during and after the experiment and can be found attached to my research paper. As a hypothesis I stated that the type of code used, depending on quantity, will not matter. The physics engine will function as accurately as possible due to my abilities as a programmer. Continuing on procedures, or what I can include, I used a reference book for each respective code. If there was time to write the other engines in the other code, there will be noticeable changes to my project or I have found a way to translate the specific code into the other codes. This will also be included in my research paper.

### ***MCM105: Do Original Movies or Remakes Make More Money in the Box Office?***

A movie's profit is determined by its budget subtracted from its growth, adjusted to inflation according to the year it was made. But, does an original movie or a remake make more money in the box office? The experimenter did the aforementioned work with a movie and its remake's budget and gross, then found the percentage of difference between them. It was found, when discounting data with significant outliers, that original movies made significantly more money in the box office based on reliable data, with original movies' average profit being \$5,296,015.44 more than the remakes' average profit.

### ***MCM106: Do Sides Matter? In Craps they Do!***

Do the number of sides on a die increase or decrease the win/loss probability in a game of craps? The experimenter tested a 12 sided die, two-6 sided dice and three-4 sided dice. The hypothesis was that the three-4 sided dice would increase the win/loss probability and the 12 sided die would decrease it. The experimenter rolled each set 360 times each to get an average sample set. The hypothesis was supported because the three-4 sided dice increased the win/loss probability, two-6 sided dice stayed the same and the 12 sided die decreased the win/loss probability.

***MCM107: Dimensions affecting average***

My experiment is to determine how baseball stadium dimensions affect a player's batting average. To start my experiment, I researched the MLB teams and what type of stadium they played in. Once I did that, I selected a division (AL Central). After that, I found all the players on each team in the division. I also found their statistics for the 2016 season. Next, I found the baseball stadium dimensions of the ballparks in the division. I then formed criteria that I would use to find out which players to use. After I formed my criteria, I was able to see what players I should test. To start the experiment, I got the players I at-bats, hits, and averages in each divisional ballpark that were tested. Next, I calculated the average of each player using an Excel spreadsheet. I then found the average of all the players in each ballpark. I also found where players had their best and worst average in the division. I have concluded that the further the wall is in the ballpark, the hitter will have a better average because the player has a higher chance of getting a hit because there is more space for the ball to land. The ballparks are listed below in best to worst order: Target Field, Guaranteed Rate Field, Comerica Park, Kauffman Stadium, and Progressive Field.

***MCM108: Passwords: Piece of Cake or a Hard Nut to Crack?***

My objective is to evaluate the time and effort required to crack different types of passwords and then write a simple password-guessing program using Python, the language I learned at Tech Camp over the summer. My hypothesis is that if I make the password longer and more complex, the computer will take more time to guess the password, because it has to go through more characters and more digits to guess the password. I will write a Python program that is able to guess any password no matter how large or complex. I will also add a timer to this program to see how long it took to guess each password. I will test various types of passwords. I will then compile, analyze, present and reflect on this data along with my exhibit.

***MCM109: Password Security***

Can the strength of a password be determined and graded? The purpose of this project is to create a password strength meter that will grade the strength of a password against several different requirements or characteristics of a strong password such as length, number of upper and lowercase characters and symbols, etc. I was able to create a program to analyze a password based on these characteristics, but in the future, I would like to improve my program so that it would output a numerical ranking of the security of the password.

***MCM110: Tunnel of Doom***

The purpose of my science fair project was to develop a computer generated adventure game that could be enjoyed by individuals with visual disabilities.

***MCM111: Instant Contact***

This project addresses the efficiency of adding a new contact into a contact directory of a smartphone. A process will be developed for a smart phone app to read all necessary fields to establish a new contact. These fields will be stored as QR code. Two phones with the app will be able to instantly exchange and store contacts.

***MCM300: Optimizing Robot Rescue in Natural Disasters***

Our idea started with the First Lego League championship and a documentary based on robots facing natural disasters. We had trouble deciding what sensors to use and wondered what sensors could be the most accurate, fast, and precise. Throughout this project, we compared the accuracy, speed, and precision of a robot with an optical sensor, then a microphone sensor to a robot without sensors in an obstacle course. The robot was programmed with arduino and a CAD program to build the outer shell. The optical sensor performed the best, followed by the microphone sensor, and the robot without sensors.

## Consumer Science (MCS)

### ***MCS100: Skittle Is Up***

Which liquid dissolves the Skittles the fastest? I hypothesized that the vinegar will dissolve the fastest. I set the materials on the table. I took 118ml of water, vinegar, and orange juice and then put the Skittle in the liquid and recorded how many seconds it took to dissolve. Recorded my data and repeated for two more trials. My prediction was right because the vinegar dissolved the Skittle the fastest.

### ***MCS101: What is the Best Natural Substance That Can Be Used as a Substitute for Toothpaste/Fluoride?***

Brushing teeth is a daily thing. Regular toothpaste contains excessive fluoride and has been known to increase aluminum absorption in the brain, with high levels being found in Alzheimer's patients. I tested which natural substance would clean the best. I gathered vinegar, baking soda, etc. and subjects to be tested on (coffee, grape, soda, etc.). First, I measured 235 mL of the "staining" liquid. Place teeth in the liquid and allow them to sit for a total of 9 hours. Remove, record, and place in "cleaning agent". The experiment proved my hypothesis by showing how vinegar performed the most efficient.

### ***MCS102: Vitamin C Content: Dark Green versus Light Green***

You may think that eating iceberg lettuce everyday adds tons of vitamin C to your diet, but does it? This experiment tests light green vegetables against dark green vegetables to see which have the higher vitamin C content. After liquefying different vegetables, I then used an iodine indicator to test vitamin C content. The results support that the darker the green, the more vitamin C content.

### ***MCS103: Water Bottle Blues***

The purpose of this project was to find which water bottle keeps water the coldest in extreme heat. Five different types of water bottles were tested. The hypothesis was the Yeti water bottle would keep water the coldest because the Yeti has the best insulation. Water bottles were placed in a heated oven and the temperature measured every three minutes until it reached 23.9 degrees Celsius or timed out at one hour. The experiment showed that metal double walled vacuum insulated water bottles keep water colder than the other water bottles tested.

### ***MCS104: Natural Teeth Whitening***

The purpose is to find which natural teeth whitener will whiten the most. Eggs were hard-boiled, stained with Pepsi, then whitened with peroxide, baking soda, and banana peels. The Hexadecimal color code was taken by using an app called "ColorMeter Free". The peroxide whitened the most with an average of (-29, -27, -9), baking soda with an average of (-16, -1, 26), and banana peels with an average of (-3, 4, 17). The hypothesis was supported.

### ***MCS105: (Don't) Pour Some Sugar On Me***

Sugar is the basis of most food and drink us humans consume. Except for diet sodas, sugar is in soda. In my experiment, I tested to see if the label matched with the actual sugar content. To test this, I used a hydrometer. I used Coca-Cola, Pepsi, and Great Value Ginger Ale. What brands of sodas do you think will match with the labels? Coke? Pepsi? Maybe even the Walmart brand!

### ***MCS106: Which Beverage Contains the Most Electrolytes?***

Please visit student's exhibit.

### ***MCS107: What form of packaging is most durable?***

The purpose of this experiment is to see what form of packaging is most durable. The procedure used two types of bubble wrap, Duck Brand's large and small bubble wrap, were dropped in a package from the same height. The percentages of bubbles popped were calculated and compared to see which popped more. The first type (small) of bubble wrap on average had 20% of it's bubbles pop while the second type (large) had 44% of it's bubbles pop. The hypothesis was refuted because the less dense or larger version of the bubble wrap on average popped more by 24%.

***MCS108: All Washed Up***

The purpose of the experiment is to test the best way to clean dishes before putting them in the dishwasher. Three different cleaning procedures are tested: rinse, no rinse, and dishwasher pre-rinse. Six plates with six different substances will set on the plate for twelve hours and then one of the three ways will be used. The same steps will be used again three times, 1 for each cleaning procedure. The data found will help decide the most efficient way to clean dishes. Results will be available on the day of the Science Fair.

***MCS109: Is the Name-brand Worth the Money?***

Is it worth the extra money to buy the name brand? Many people go to the grocery store wanting to buy the best detergent to get rid of daily stains. For my Science Fair Project, I tested to see if the more expensive detergent would remove stains better than the less expensive detergent. To test the detergents, I used red wine, mustard, and spaghetti sauce as stains. For testing purposes, I wanted to make sure I had an equal amount of  $\frac{1}{4}$  for both detergents, the same water cycle time, and the same water temperature.

***MCS110: Fresh Eggs versus Store-bought Eggs***

I chose this experiment, because I wanted to know which egg will make my cakes taste the best. This experiment is important, because everybody wants their food to taste delicious. Plus, you always want to please the people you are making them for by making your customer the best cake you can bake. I came up with my hypothesis, because I assumed that the fresh eggs would produce a cake with an amazing appearance. Based on my research, I am able to conclude that a cake made with fresh eggs has a fluffy consistency and a dark yellow color.

***MCS111: Do More Expensive Sunscreens Inhibit Bacteria Better Than Less Expensive Ones?***

Hypothesis As the price of sunscreen increases its ability to inhibit bacteria will increase. Procedure 1) Prepare a 0%(-control), 25%, 50%, 75%, and 100%(+control) solution of sunscreen/sterile nutrient broth and inoculate them with 1 ml of *S.epidermidis*/nutrient broth solution 2) Determine the initial optical density of each solution from step 1 using a Spec20 and incubate them at 37°C 3) Repeat step 2 after incubating for 24, 48 and 72 hours. 4) After 72 hours prepare a 10<sup>-7</sup> serial dilution of each solution from step 3. 5) Place 1 ml of each on a different nutrient agar plate incubating them at 22°C for 72 hours and then record the number of colonies present 6) Repeat step 6 using 3 more petri dishes. Conclusion Final results available at fair.

***MCS112: Effectiveness of Flame Retardants on Children's Sleepwear***

The flame resistance of children's sleepwear will be evaluated for a variety of quality (cost) levels. In addition, one type of sleepwear will be evaluated for flame resistance after samples are washed in a variety of detergents.

***MCS113: Testing Sunscreens Effectiveness***

A sunscreen is a cream or lotion rubbed onto the skin to protect it from the sun. The SPF of a sunscreen determines how well the product can screen or block out the sun's burning rays. In this experiment, different sunscreens were tested, and their ability to protect against sun damage was evaluated based on the results of these tests. This was then compared to the SPF on the label, and the cost of each. The hypothesis was that Banana Boat Sunscreen with SPF 100 would afford the best protection because it is labeled with the highest SPF. In order to test this hypothesis, I went to a tanning bed with the 8 sunscreens that I was testing, dried on plastic wrap. The amount of sunscreen was carefully measured and applied in exactly the same way for each set of tests. An UV detector was used to determine the amount of UV radiation penetrated the sunscreen. The direction of the UV meter was oriented so that the UV sensor was pointed the same way for each test, and the distance of the UV detector from the wrap coated with sunscreen was the same for all trials. Three different trials for each product were conducted in this experiment, at the same distance from the tanning bed for each product test. I tested 2 different types of sunscreen; with 30 and 100 SPF. The Neutrogena Clear Face did the best for the SPF 30, and the Neutrogena Ultra – Sheer; Dry touch did the best for the SPF 100. After further research, the investigator determined that this was most likely because Neutrogena sunscreens have a larger amount of oxybenzone and avobenzone than the other sunscreens. According to the National Center for Biotechnology Information, avobenzone is a topical, broad range UV protector that block UVA I, UVA II, and UVB wavelengths, thereby limiting the impact of UV rays on skin. Oxybenzone absorbs UVB and UVA II rays, which results in photochemical excitation and energy being absorbed. But then when it returns to ground state, the absorbed energy results in longer wavelength radiation being emitted, and so less radiation is absorbed by the skin. This reduces the risk of DNA damage.

**MCS114: Mints**

Purpose: Does the mint flavor really lower temperature, or is it just a sensation? Hypothesis: I think that the mints will lower the temperature of water because there is a chemical reaction.

**MCS115: Freeze Frame**

Have you ever wanted a successful greenhouse? The purpose of my experiment was to prove which material is the cheapest, and creates the best environment for plants. I tested Polycarbonate, plastic, and glass to see which one had a higher temperature and humidity. I predicted that the Polycarbonate would have a higher temperature and humidity. Polycarbonate had the highest temperature, but the glass had a higher humidity. Polycarbonate was warmer, but it is expensive. Glass is cheaper, but is not as durable. The plastic is cost efficient, the most durable, and will create the best environment for your greenhouse plants.

**MCS116: What is More Important to Consumers-Price or Looks (packaging)?**

Every year companies spend extra money on marketing and packaging, but is it worth it? This project was seeing if it was worth it for companies to spend extra money if people do not care about the packaging. The way I did this project was I had six participants ages thirteen through sixty-nine answer questions while looking at nine different objects. After they had answered the questions, I collected the data and saw that five people chose packaging and one person chose price. This shows that it is worth companies to spend extra on packaging or marketing.

**MCS117: The Hottest Cup**

Do you know why your cup of coffee is cold? I found out the reason why in this investigation. The reason this experiment was conducted is I wanted to find out what type of insulated cup can keep the liquid hotter longer. I brought a pot of water to a boil, I poured that water equally into separate cups, then over the course of 30 minutes I measured the temperature of the water every 5 minutes. In the end the hypothesis didn't support the data because the steel cup did second best.

**MCS118: Cellular EMF**

The purpose of this experiment was to determine if different types of cell phones gave different amounts of electromagnetic radiation. During the experiment a text message is sent while being read by the EMR meter. The hypothesis was supported and refuted because only one of the two older phones which was the iPhone 4 gave off the most radiation at 0.36 milligauss while the iPhone 6 and LG-G3 gave off 0.16 milligauss. The two lowest were the iPhone 5c at 0.1 milligauss while the lowest was the other older phone at 0.08 milligauss.

**MCS119: How Much Vitamin C Is in Orange Juice?**

Please visit student's exhibit.

**MCS120: Glucose, Don't Sugarcoat It**

My project, Glucose, Don't Sugarcoat It, determines different glucose levels in drinks before and after the use of digestive enzymes. I used two drinks that had no sugar added and three drinks that did (refined sugar). Using urinary glucose strips, I tested each of these drinks with and without the digestive enzymes. I hope that the information gained from this project will help others make a more informed decision about how much and what kinds of sugar are safe to consume. Also, it may help others better understand how digestive enzymes assist our body in the breakdown of food molecules.

**MCS121: A Simple Way to Reduce Kitchen Waste**

Food waste is the 2nd largest component of one's trash that is sent to landfills in the U.S. This is about 30 million tons of food waste per year. Additionally, less than 3% of this food waste is being recycled into compost. I am planning to see if I can use vermicompost to recycle our food waste into compost.

**MCS122: Gatorade, The Drink For Athletes?**

The makers of Gatorade spend millions of dollars advertising their drink each year! When they advertise their drinks, they always say about how they have a high level of electrolytes, which your body loses as you sweat. In this science project, I compared the amounts of electrolytes in Gatorade compared to Orange juice. I am doing this to find out which one has more electrolytes to replenish the electrolytes you lose when you play sports, or work out. When I am done will you even need to buy sports drinks?

***MCS123: Squeaky Clean?***

The purpose of this project is to determine the purpose of this project is to determine whether homeopathic or store bought surface cleaners eliminate the most bacteria. I purchased 3 commercially produced surface cleaners and I made 3 homeopathic surface cleaners the commercially produced surface cleaners being; ECOS, Seventh Generation, and Honest. The homeopathic surface cleaners containing; Tap Water, Vinegar, and Essential oil the other containing Citrus peels, Tap Water, Salt, and White Vinegar and the last one containing Castile soap and Tap Water. I did 32 samples of each product using staphylococcus epidermidis as my bacteria.

***MCS124: Amount of Energy in Different Foods***

For my project I burned different foods to see which would give off more energy. After two unsuccessful attempts with turkey and Italian bread, I succeeded with cheese puffs, Slim Jims, and marshmallows. After the kit assembled, food was placed on needles of top of a cork that sat under a can of water. I recorded the temperature of the water before burning the food. Then I caught the piece of food on fire and waited until the flame went out and then took the temperature of the water. A formula was used with both temperatures to get the results.

***MCS125: Applicious***

My question was which type of apple spoils the fastest? I took 3 apples in 3 different varieties(Gala, Golden Delicious, and Fuji), and timed them after they were sliced to see which browned the fastest. I hypothesized that the Golden Delicious would start to spoil the fastest because of its light skin color. After doing research and the experiment I found, however; that my hypothesis was wrong. Red apples spoil at a faster rate than green apples. This is one reason why the Gala spoiled the fastest.

***MCS126: Wheelchair Test***

Purpose: Which wheelchair out of carbon fiber, aluminum, steel, and titanium is the most cost effective, and is easier for the user to propel? Hypothesis: I think that the aluminum wheelchair would be the best because of its lightweight body and is still cheaper than the carbon fiber or titanium bodies.

***MCS127: Finding Fast Filter Flaws***

Water is essential to survive. All living organisms rely on water. Humans need clean water to drink. There are many water bottle filters and cleaners to help us. So which water filter purifies water the best? I have tested five different filters and tested each with seven different waters, and measured pH, TDS (ppm) and described color changes. My hypothesis stated that the most expensive filter would work best, but it was proved incorrect. People looking for cheap filters that work well or as advertised should invest in a Zerowater tumbler.

***MCS128: Soak Up the Sun***

Have you ever wondered if expired sunscreen actually worked? I decided to find out if they really do. I tested different expiration dates of sunscreens at a tanning bed by smearing sunscreen on plastic wrap and using a UV checker to determine how many rays each sunscreen blocked. The strength of ultraviolet radiation, or UV Index, decreased as the expiration date increased. This means the older sunscreens did not protect from harmful rays as well as the newer ones. Even though that is the case, I found that expired sunscreens still provided some protection against harmful UV rays.

***MCS129: Representation of Race in Prime-Time Television Commercials***

The purpose of my experiment is to analyze the racial representation in the prime-time Television commercials in the ethnically diverse America. My hypothesis is that Prime-Time TV commercials lack diversity. I plan to collect data by watching the recorded prime-time TV commercials, analyze the frequency, context, and speaking vs secondary rolls of characters in a 3-day sample of prime-time TV ads. My analysis will help the Ad companies to address and rectify the social issue in their TV Ads and to position themselves for optimal success in the ethnically diverse tomorrow

***MCS130: The Effect of Washing on Fire Resistant Clothing***

All pajamas sold in small children's sizes are required to be fireproof. Despite the potential safety benefits, there is also the possibility that the pajamas could release harmful chemicals, or not work. I wanted to determine if washing fire-resistant fabric would dull its reaction to flame. I hypothesized that washing the fabric would diminish the fabrics fire resistance, however the washing had no effect.

***MCS131: Reducing paper waste using fading ink***

My project is about how much paper can we save if we use fading ink instead of permanent ink on paper. I will calculate if the fading inks are cost-effective, and the amount of paper we will save. For this project, I will base all of my calculations off of a fading ink that fades in three to four months. I will also check if this a feasible option for printing purposes. If we can reuse the paper over and over again because of fading ink, then we will save large amounts of money, paper, and, indirectly, trees.

***MCS132: How Do You Like Them Apples?***

Which wrap keeps food fresh? The investigation is testing to see which food wrap keeps apple slices the most preserved and fresh. The purpose of this experiment is because some kids like to pack apple slices in their lunchboxes for school, but whenever they open their lunchbox, the apples usually turn brown. The conduction of this experiment is by using five apple slices and wrapping four of them in different wraps - aluminum foil, wax paper, plastic wrap and a plastic bag and leaving one apple slice bare. Repeat this process for four trials and check the apple slices in each trial for six days. Record the data every day around the same time and observe how brown, dry, sticky, smelly, and overall how fresh each slice was in each trial. The results obtained indicated that the plastic bag was the best wrap to use to preserve food because the apple slice inside it was the most preserved.

***MCS133: Keeping Your Cool: The Best Fabric to Wear in the Heat***

The purpose of this experiment is to see which fabric will keep you the coolest in the heat. To perform the experiment, fill up a mason jar with water and place a sticky thermometer on the side. Place each t-shirt on top of the mason jar and secure it with a rubber band. Place a lamp above the jar and heat it for one hour. The cotton stayed the coolest at 22.6 degrees celsius, the polyester stayed in between the two at 24.4 degrees, and the rayon was the hottest at 29.5 degrees. The hypothesis was supported.

***MCS134: Durability of Paint***

Please visit student's exhibit.

***MCS135: Keeping Baby Bottoms Dry***

A variety of disposable baby diapers will be tested to evaluate which will hold the greatest volume of liquid.

***MCS136: Watch your mouth***

The purpose of this project is to find the outcome of which mouthwash eliminates the most bacteria and most cost effective for the consumer. I first purchased 6 mouthwashes, to be tested against E. Coli. Sterile paper disks were soaked in a mouthwash for 1 minute and dripped for 30 seconds. This was completed 4 times on 1 agar plate. I then placed the agar plate in an incubator for 48 hours. After the 48-hour period, I removed the plate to measure the zone of inhibition. Once I measured the zones, I was able to conclude my results.

***MCS137: Baking Soda versus Baking Powder***

This project was about baking soda versus baking powder and which works better in baking. Both of these are leavening agents which help make the baking product rise. Although both are leavening agents, baking powder is more active in bread and baking soda is added to help neutralize the acids in the batter. By experimenting I have been able to determine the differences in the end results of baked textures.

***MCS138: What is the Best Way to Remove Oil From Feathers?***

Marine wildlife impacted by oil spills has been a problem for many years. In this project, a number of different materials to remove oil from feathers will be evaluated for effectiveness.

***MCS300: Are All Golf Balls Made the Same?***

For our project we decided to test golf balls based on which brands was truly the best. We tested Titalist, Tayler Made, Callaway. They were judged on length and how straight they flew. We had one person hit the ball as far as he could near a target an measured length and accuracy Titalist ended up going the furthest with the hits of 82,107,and 94 feet long which averaged to 94.3 per hit. Although Titalist went the furthest Taylor Made ended up flying the straightest with hits of 19,2 ,and 1 wide which averaged to 7.3 off per hit. In conclusion, we decided that Titalist and Tayler Made are superior to Callaway.

## Engineering / Robotics (MER)

### ***MER100: Sensors Saving the Society***

Men and women who have color blindness may have trouble deciphering whether a banana is ripe or rotten. The project developed is a device that uses color sensors and complex programming to allow these people to have the same sense of independence that someone with 20/20 vision would have doing everyday tasks. If a device using a color detector is engineered, than people with blindness will be able to assess if a banana is ripe or not, because according to the American Blindness Association, tomatoes and bananas are two fruits, it is nearly impossible to assess ripeness by touch.

### ***MER101: Earthquake Resistance***

For my project I am investigating the designs for improving the earthquake resistance of buildings. I am building a shake table to test different building foundation designs to see which has the greatest impact on reducing building damage due to an earthquake. Testing is still ongoing and no final results are available yet.

### ***MER102: How strong are arches***

the propose of my experiment of this experiment is to find out what arch supports the most weight My hypothesis states that that the largest arch will support the most weight how i preformed this experiment is i bought bought a 1/8 inch plywood slab and cut it down into 1inch by 550 600 700 800mm slabs then i built a rig that held the wood into a arch by screwing in two pieces of 1/4 inch plywood board. the results where that the 800mm board stood up to 11.33kg and the 700mm stood up to 13.27kg and the 600 stood up to 9.98kg and the 550mm board stood up to 9.07kg so in the end my hypothesis was wrong

### ***MER103: An Integrated Modular Platform for Tracking and Logging Water Quality***

Recently, contamination levels in waterways have increased significantly, both due to man-made and natural causes. There is a need for a safe and convenient method for measuring and recording water quality. To address this issue, I developed a robotic device to simplify water quality testing. The remote-controlled robot is capable of collecting data on several surface water parameters (pH, conductivity, salinity, total dissolved solids, gravity, and oxidation reduction potential). Data on water quality parameters are sent to a computer wirelessly through Bluetooth. The robot also contains an LCD and LED interface to allow for quick assessment of water quality. Coordinates of the testing locations are recorded via a GPS module and logged on a computer. In addition to the robot, I will create a system which logs all data that is collected. The system will present water quality data in a graphical form, and will allow users to identify points of contamination. Field testing of the robot is currently ongoing.

### ***MER104: Eyes on the Road: Preventing Distracted Driving***

Currently, more than 1,600,000 Americans either get injured or killed by distracted driving. Almost all of these accidents are caused because the drivers are texting on their cell phones while driving. At the moment, there are no effective methods to prevent distracted driving. Such a method needs to be non-intrusive, easy to use, and user friendly. When drivers are distracted, their eyes tend to be on their device which are on their lap rather than on the road. An automated sensor system could detect the downward movement of the driver's head while the driver is texting and could alert the driver. This will help the drivers keep their eyes on the road, preventing distracted driving related accidents.

### ***MER105: Working Hard or Hardly Working***

The purpose of this experiment was to test the best method of electricity production. I believe that the faster the motor is turned, the more electricity it will produce.

### ***MER106: What shape can store the most duck sauce packet?***

Triangle, rectangle, and square were used for this project. The shapes have similar volumes and surface areas. The shapes are to determine which can store the most duck sauce packets. The containers were built from cardboard and the number of packets that fit were counted. The rectangle was able to store the most amount of packets; thus, the hypothesis was refuted. The rectangle stored 1380 packets, the square stored 1340 packets, while the triangle stored 780 packets.

***MER107: Sticky Shoes***

The purpose of this experiment is to test how mass affects shoe traction. The researcher will test 3 different shoes by allowing the shoes to slide down a board at various degrees. The researcher will add 200, 100 and 50 grams to the middle of the shoe. The researcher will then tilt the board every ten degrees and wait until the shoe is stationary for five seconds. The distance the shoes travel will be measured in centimeters. The researcher will repeat this five times with three different shoes. Results will be available on fair day.

***MER108: Homemade Hand Warmers***

The purpose of my project is to create a homemade version of hand warmers that can be reused multiple times. I decided to investigate this because i'm not a big fan of the cold and store bought hand warmers may be inexpensive but they don't last long. I think that making different versions of hand warmers will be beneficial to myself and others because it is an easy way to keep your hands warm. I will test this by mixing various kinds of acids and bases that can be found in everyday kitchen supplie. I think when mixing different acids and bases it will create a long lasting hand warmer to use when it's warm outside. I think that combining baking soda and vinegar will make the best homemade hand warmer because that is the original recipe that I found and baking soda has a really beneficial reaction when combined with vinegar.

***MER109: Watch Your Weight***

I did this project because I have always been interested in aviation. My hypothesis was that Plane 2 would not gain lift above the line as quickly as plane 1 in the wind tunnel. First, I measured the planes and made sure it fit in my wind tunnel. Secondly, I put two pennies on the right wing of Plane 2 serving as weights. Finally, I preformed twenty-five trials for each plane. My results supported my hypothesis. The average time for Plane 1 was 10.27sec. The average time for Plane 2 was 60+sec. My project demonstrates how fatal weight imbalance is.

***MER110: Is It Real or Robotic?***

Art is done by many people in many ways. However, in my experiment a robot will make a piece of art and a person will copy the piece and try to make it close enough so that someone else could not tell the difference. I will assemble a servo powered robot and it will use markers to produce an original art piece. Once I have both, I will take pictures of them and display them online and have people vote anonymously and use their best judgement to determine which was made by a robot. (Conclusion will be available at fair)

***MER111: The Effrect of Bridge Design on Weight Bearing Capacity***

The purpose of this experiment was to see which bridge design was the safest for holding weight. I first conducted three bridges: a camelback, an under arch, and a truss bridge. I filled a bucket of water hooked to the bridge and waited for the bridge to collapse. The results of the experiment are that the camelback bridge held the most weight of 51 kilograms. The under arch bridge crashed with the least weight. The first half of the hypothesis was supported; camelback bridge design held the most weight, but the second half was not supported.

***MER112: Blast Off!***

The original purpose of this experiment was to determine if the difference in the area and number of fins would change the altitude of the rocket. After conducting three trials on each size of fins, under the same weather conditions, and using the same type of launcher, the results of the experiment was the rocket with 4 medium fins had the highest average altitude and the rocket with 5 large fins had the lowest altitude.

The first trial for each rocket is labeled in blue, the second trial is labeled in red, the third trial is labeled in green, and the average is labeled in purple. The highest rocket traveled about 85 meters or 280 feet. The lowest rocket traveled about 37 meters or 122 feet.

***MER113: Solid Ground?***

The experiment was conducted to determine the different soil bearing capacity of top soil, sand, loam and clay. To conduct this experiment, a jig and dowel was built. The dowel rested the dowel on top of the soil then placed a 500mL beaker of water on top of it. The depth of the dowel sunk into the soil over an hour time period was recorded. The moisture capacity of each soil was conducted a sieve test. These procedures were used to conclude that clay has the highest soil bearing capacity

***MER114: Sparkgap Tesla Coil***

The purpose was to create large arcs from the Tesla Coil. The Tesla Coil was tuned by adjusting the primary coil, secondary coil, and spark gap. It produced half-inch arcs and dimly lit a CFL bulb when powered by 12V 2A. It produced arcs one inch long and brightly lit a CFL bulb when powered by 12V 10A. In conclusion, I could have wound a new secondary coil that was shorter and had less resistance in order to make the Tesla Coil more powerful.

***MER115: Hydrogen Power!***

A small scale fuel cell was engineered using steel and plastic foundations. The electrolytic fuel cell has the ability to split water into usable amounts of hydrogen and oxygen fuel. This project can apply in energy/fuel production for transportation to infrastructure.

***MER116: Power From The Air***

Radio waves can be useful for other things, not just listening to the radio. My experiment shows that you can produce power from the air. I am modifying the design I got from my research and I will see what gets the most power out of the air. I hypothesize that I will get the most power if I try the simplest design in series. If I test the same circuit several times and if I average them I should get a constant score. You can see my final results at my exhibit on Fair Day.

***MER117: Piezo-Electric Generator (PEG)***

Hypothesis: Energy generated by Piezo discs can be stored and used as a renewable energy source.  
Purpose/Summary: My research problem is, "Can you generate safe, efficient, and renewable energy using the piezoelectric effect?" The project I will be working on is called the Piezo-Electric Generator (PEG). In 1880 the piezoelectric effect was first discovered by the Jacques and the Pierre Curie brothers. The relation between mechanical stress and electrical voltage in solids is known as the piezoelectric effect. This effect is reversible. An applied mechanical stress will generate a voltage, and an applied voltage will change the shape of the solid by a small amount. This effect only occurs in non-conductive materials. Piezoelectric discs are generally made of quartz. The first uses of this concept was in piezoelectric ultrasonic transducers, and quartz clocks. Final results will be available at the student's exhibit on Fair Day

***MER118: Open Sesame***

This experiment tested the effectiveness of childproof containers in determining if safety mechanisms can be easily opened. The question: Are childproof containers really childproof? Subjects tried to open three different, empty and sanitized containers, with different lock designs, in 30 seconds. The data showed that 22%, four out of eighteen, opened the containers. Childproof containers are pretty effective in keeping kids from getting into hazardous materials. However, safety precautions still need to be taken, because although they have childproof locks, there is still 22%, four out of eighteen, of kids out there who may be able to get one open.

***MER119: Verruckt...What Went Wrong?***

Why did Verruckt, the worlds' tallest and fastest water slide, not open on time? My goal was to build models to figure this out. I recreated the slide by building two models. The first model, scaled from the original design, created too much kinetic energy causing the rafts (or in my case, marbles) to fly off the structure. On the second model, I elongated the second incline and made it less steep. The 'rafts' stayed on course. This project supports why you have to have a balance and management of each energy or your plan could fail, like Verruckt did.

***MER120: What coil topology works best in wireless power transfer?***

Many geometries can be used for wireless power transfer. I wanted to find out which geometry excelled in transferring the most power per inch squared. To do that, I built a radio frequency transmitter based on IC 555 circuit. Then, I assembled circular, square and Koch snowflake coils using enamel-coated wire. I then connected nine-volt batteries to the circuit, used a bridge rectifier to help measure the voltage across the receiver coil and a multimeter to quantify the voltage being generated. After experimentation, I found that the second iteration Koch-snowflake demonstrated the highest energy density, agreeing with my hypothesis.

**MER121: Robo-Rescue**

This purpose of this experiment was to test automatically-programmed and manually-operated bomb disposal robots to see which would go through a maze faster. It was predicted that the manually-operated robot would go through the maze faster. The robot that was used to perform this experiment was the BOBB3E from a Lego Mindstorms set. In this experiment the result was that the manually-operated robot went through the maze faster than the automatically-programmed robot. The average time for the manually-operated robot was 75 seconds and the automatically-programmed robot's average time was 82 seconds. Therefore, the manually-operated robot the faster option for bomb disposal.

**MER122: Solar/Super-Capacitor Car**

I tested the performance of a solar powered toy car equipped with a super-capacitor. I decided to test a super-capacitor because I am interested in exploring alternative ways to power cars. I did this by exposing the solar panel on the car to varying amounts of sunlight and compared the distances traveled. I learned that the longer I charged the car, the farther the distance it would travel. My hypothesis was supported. In the future I would like to test how using a super- capacitor compares to using a rechargeable battery.

**MER123: Does Temperature Affect the Energy Produced by a Piezoelectric Transducer?**

Purpose: Does temperature affect the energy produced by a piezoelectric transducer? Hypothesis: As the temperature increases, the energy produced will increase. Procedure: 1. Construct the testing apparatus. 2. Place the testing apparatus in a heating/cooling device until the desired temperature is reached. 3. Determine the amount of electrical energy produced by the piezoelectric transducer at the temperature being tested using one of the masses. 4. Repeat Step 2-3 for 29 more tests. 5. Repeat steps 2-4 using the remaining masses. 6. Repeat steps 2-5 at each of the remaining testing temperatures. Conclusion Final results available at fair.

**MER124: Light-up Cane**

I did this experiment because my gram was having trouble getting up the stairs or anywhere at night. I built two canes out of dowel rods, and I attached the light, battery, and case. I then tested them by having my gram walk up and down step and timed them to see if the cane with the light is better. In conclusion, my data said that the cane with the light was better and easier to use.

**MER125: Plastic Pollution Tracking**

For my Science Fair project, I engineered a device to collect floating plastic waste in storm water outflows to reduce the amount of plastic in the ocean. I researched other solutions people were trying and chose to create a simple, inexpensive, durable device that can be easily implemented into streams and rivers. Since plastic waste in the ocean is a growing problem, I thought this would be the best way to solve it. I also released a floating buoy to track the path plastic waste in the ocean takes. This data and final conclusions will be available on Fair Day.

**MER126: Ballon car**

Could you build a car that moves with just air? A car powered by balloon filled with air would propel the car forward. this is fun to do, easy to build, and the supplies could be laying around in your house. Imagine what your car could look like when it's finished! so get your supplies and start building.

**MER127: Robot**

Purpose: The purpose of my project is to build, program and test a robot that will learn to find its way through multiple variations of a maze based on checkpoints. Hypothesis: I think that if I place a series of colored spots throughout the maze, I can get the robot to identify these and determine the correct and eventually the fastest way through the maze. I also believe this will enable the robot to find its way even when the course is changed.

**MER128: Bridge Breaker**

The purpose of this experiment was to see which bridge design: beam, arch, cantilever, cable stayed, and suspension can hold the most weight and is the most cost effective. The procedures are to construct each bridge type three times and attach weights to them until they break. The data did not support my hypothesis that the suspension bridge would be most cost effective for how much weight it held. The arch bridge was the most cost effective holding 558g and costing \$2,400 per square meter. The least cost effective bridge was the beam bridge.

***MER129: The Journey Through Wire***

This project involved a comparison of the gauge of wire against sound frequency. A small circuit was created that could input different gauged wire in order to measure the sound abilities. This project could be applied to almost any sector of the technology engineering field.

***MER130: Ideal Wheels***

There is no perfect pair of wheels but in my experiment, I want to find out which size wheel causes the least drag and is the most time efficient. I will test small, medium, and large wheels. My hypothesis is that the medium sized wheels will cause less drift and drag and will be the most efficient in time. I will complete an accuracy test, turn test and traction test and my results will be available at the fair.

***MER131: I Got Hops!***

The purpose of this experiment is to test whether or not shoe design affects jump height. The researcher is going to conduct five tests of five different types of shoes by measuring a vertical jump with each pair of shoes. After each jump, the researcher will place a sticky note on the wall. Results will be available on fair day.

***MER132: The Lego-Vac***

The purpose of my project is to design an attachment for a Shop-Vac that when added to a Shop-Vac, makes the clean up of Lego bricks quicker and more efficient than picking Lego bricks up with your hands alone. Procedure: 1. Design an initial prototype model 2. Gather materials 3. Build initial prototype 4. Analyze, record, and redesign attachment where necessary 5. Make adjustments to design and model 6. Test attachment for effectiveness 7. Record final analysis on designs and final data

***MER133: Electricity from Recyclables***

Develop an electric generator that will be able to produce electricity using flowing fluids.

***MER134: How Does Weight Distribution Impact Speed of a Go-Cart?***

The speeds of a student-built go-cart will be evaluated with additional weights placed at different locations on the go-cart.

***MER135: Improving Battery Car Speed***

For my project I am investigating the factors that effect the speed of a toy car. The car is made from recycled materials and uses a battery operated fan for propulsion. The variables I am investigating are the mass of the car and its size. Testing is still ongoing with no final results yet.

***MER136: Battery Brand Endurance Comparison***

I was curious about which of three popular battery brands would last longest in identical flashlights. I installed AA alkaline batteries, turned the flashlights on, left them on and measured the voltage hourly. The Ray-O-Vac outlasted the other two brands. I thought the Energizer was going to last the longest, and also that the Duracell would last longer than the Ray-O-Vac. This was surprising to me because the Ray-O-Vac is the least expensive brand. I also learned that when I took the batteries out to measure their voltage, it would start to increase rapidly.

***MER137: Robotics***

Please visit student's exhibit.

***MER138: A Helping Hand***

For my experiment I built a prosthetic hand and performed a series of tasks with the hand, then I cut off the tips of the fingers where the first joint, or bending point of the finger would be. The purpose of this experiment is to see if people with an amputated finger tip/tips can still do everyday tasks to the same ability as a person with their finger tip/tips. The results of this experiment showed that with the finger tips, the hand was able to function with more dexterity than without fingertips.

**MER139: Bridge Power**

My question is what type of bridge will have the greatest strength-to-weight ratio. I hypothesized that the Warren bridge will be the strongest. In this project I built a Warren, Camelback, and Howe bridge. To measure the bridge's strength, I tied a rope to the bridge and kept adding weight until it collapsed. I used water as a weight and converted it to a strength-to-weight ratio. In my data I found that the Camel Back had the best strength-to-weight ration, and the Warren had th least. The Howe bridge was in between both the Warren and the Camel Back

**MER140: How To Build A Cardboard Boat**

Cardboard boats are low cost and easy to make flotation devices. The main materials for a boat were double walled cardboard paper with lightweight liner, sealant, and duct tape. The boat shape was modeled using finite element technique (ANSYS Student software). The main properties, such as density and water resistance were measured with and without sealant. Buoyancy and stability of the boat have been calculated and tested on practice. A load of the two riders was taken into consideration. The bottom of the boat was fortified by additional layers of cardboard. To help the boat float, a Styrofoam insert was used as well. The boat dimensions were based on a model that satisfied the convenient center of buoyancy and the depth of boat displacement with a load. Due to a high cost of duct tape, the outside walls were covered only up to a level of possible water contact with the corrugated cardboard surface. The cardboard boat has been built and is ready for testing this summer.

**MER141: Physics of Flight**

Airline companies want a wing to produce more lift. The purpose of the experiment is to discover which wing shape creates the most lift. First, I simulated three different airfoils in a software called X foil. Next, I 3D printed the airfoils. Finally, I tested the airfoils in the Carnegie Mellon University wind tunnel. The results showed that a thin, slightly curved airfoil will create the most lift. My original hypothesis was incorrect that a thick, heavily curved airfoil would create the most lift. I concluded that that a thin, slightly curved wing therefore makes the right pressure zones.

**MER142: Magnetic Eddy Current Lifting Platform**

Factories use air cushion transport carts to move heavy materials. Once they are hovering, they can be moved with little effort along multi-directional pathways. Air carts require large air compressors and cumbersome supply hoses. Since there are many factories around the world, simplifying this process could have large economic and environmental benefits. The goal of the is project is to create a levitating platform to transport materials using magnetic eddy currents. A polycarbonate (Makrolon) magnetic disk was constructed and tested. Using those results, a prototype lifting platform has been designed to demonstrate the feasibility of the concept. Experimentation is ongoing.

**MER143: Energy Efficient Lighting**

The purpose of this engineering project was to create an automated light controller with a bi-directional visitor counter. A circuit board was engineered using an Arduino Uno, IR sensors, and LED lights. This project could help save energy costs for all living and working quarters.

**MER144: Carbon Monoxide Detector**

The purpose of my experiment is to create an early warning system which helps users measure and predict Carbon Monoxide levels in the air. This makes people aware in advance when CO levels are the highest. For my procedure, I connected my MQ-7 CO sensor with a Bluetooth chip in an Arduino Uno microcontroller. Then, I programmed the device to send CO levels to a person's phone. Lastly, I created an app which prints levels. Experimentation will occur 2/3/17 through 2/12/17 with results on Fair Day.

**MER145: From Straw to Robot**

The purpose is to find whether or not the diameter of a drinking straw will affect its strength. 3 hands were made with 3 different diameter straws, 5 straws per hand. The straw hands were tested for their strength in a controlled environment. The coffee drinking straw lifted the least amount of mass, the bendy drinking straw lifted the second least amount of mass, and the standard drinking straw lifted the most amount of mass. Therefore the hypothesis was supported.

***MER146: Dehumidifier Filtration System***

Clean water is a fundamental right that all people should have access to, no matter where they are. Unfortunately, close to 783 million people live without clean water which is an amenity we take for granted. While producing clean water may be an easy fix, there needs to be some way to collect the water with ease. I have designed a process that captures the water molecules in the air and filters them into clean drinking water. A dehumidifier will collect the water molecules out of the air and will transfer them through an active carbon filter. The water will be further treated and will be passed on as clean drinking water. The dehumidifier can be set up outside where it will collect the water molecules and the filtration process will take place directly after, cleaning out any bacteria in the water. Then it will be able to be tested and will produce liquid with a balanced PH of 7.

***MER147: Manufacturing Graphene-Based Supercapacitors and Their Advantages Over Traditional Capacitors***

For my project, I wanted to focus on making graphene supercapacitors easier to mass produce. One main barrier is that graphene itself is hard to produce. I am using a laser cutter/etcher to carbonize a copolymer of poly butyl acrylate and polyacrylonitrile. This will create graphene for the capacitor. Previously, an extremely expensive oven had to be used with a pure nitrogen environment. The machinery needed to do this is expensive to maintain and to buy. Using a laser to do this allows supercapacitors to be made such more simply.

***MER148: Earthquake Shake***

This experiment was conducted to discover which sediment is best for building a bridge on in earthquake-prone areas. Using a mold, two piles of sand were made and put into a container. A bridge was put across them, and the bottom of the container was filled with water. An earthquake was simulated, and the amount of time the bridge took to collapse was timed. This was repeated with soil and gravel. In conclusion, sand performed the best when small volumes of water were added, and gravel performed the best when larger volumes were added.

***MER149: Improving Efficiency of Pneumatic Projectile Systems***

The goal of this project is to improve the distance and accuracy of a projectile launched from a pneumatic projectile system by minimizing loss of energy. Illuminated particles will be traced using ImageJ video analysis software. Maximum distance will be reported and compared with results of other investigators

***MER150: Plastic Prosthesis Design***

We all know how tragic it is to have a disabled pet, and how miserable they seem when they try to move around. What if there was a way for you to print a prosthetic leg from your own 3D printer? I am trying to determine which plastics would be the strongest and best suited for a 3D design of a generic model prosthetic leg. I will test which type of plastic is the strongest and create a prototype prosthesis to test in various terrains and weather conditions. My guess is that the TPU plastic will be the strongest. Results will be available at the science fair.

***MER151: Catapult***

Have you ever wondered which catapult worked the best during ancient times? Well, by observing this project you will get an excellent understanding on two types of catapults used back then. Catapults had payloads that would demolish castle walls, topple over enemies, destroy enemy camps, and many more. I tested to see which catapult had better accuracy and which one had more power. In my results, found out that the trebuchet had extremely superior accuracy and it launched the foosball the farthest. The mangonel was used to obliterate walls while the trebuchet was used for launching projectiles over the walls.

***MER300: Boat Hull Efficiency***

The idea for this project came from both of our love for the water. That's why we were testing boat hull efficiency. Our problem was trying to find what boat hull traveled through the water with the least After many different trials just trying to find a suitable way to test our project we finally found a working option. After running through over one hundred trials we found that the pontoon boat hull traveled through the water with the least resistance. And that our control did the worst on all of the test.

## Earth / Space / Environment (MES)

### ***MES100: Let's Replant the Planet***

The purpose of my science fair experiment is to demonstrate how the world's resources can negatively affect plant growth. I will take four common house plants and label them. Plant A is the control group, B coffee grinds, C pesticide, and D motor oil. Every Sunday and Wednesday, starting 1/29/17, I will water each plant with ¼ cup of tap water and it's harmful substance. I predict the motor oil will actually harm Plant D the most because it might prevent the water from correctly reaching Plant D. The final results and conclusions will be available at the Science Fair.

### ***MES101: Landslides***

the purpose of this experiment is to determine how landslides caused. To conduct my experiment i will use dry and wet soil and determine the angle which will determine the angle which the soil starts to slide

### ***MES102: The Effect of Water Conductivity on Macroorganism Population***

Have you ever wondered why there usually aren't many fish in a stream that's near a coal pile? It could be just because the conductivity, coming from the acids, kill off the microorganisms. Without microorganisms fish would barely have anything to eat. So I go to streams that were once effected by acid mine drainage and measure the pH and conductivity. I then take samples of the microorganisms, count them and place them back into their habitat.

### ***MES103: Air Pollution***

Purpose Statement: How does air pollution differ in different environments?

### ***MES104: What Solar Panel has a Greater Effect on Water Temperature?***

The purpose was to see what solar panel was more effective at heating water. A box was made and PVC pipe was arranged so that water would come in through the bottom and leave through the top. Each of the boxes either had aluminum cans, water bottles, or black PVC covering the pipes. The black PVC pipe solar panel had a temperature of 4.2oC, the aluminum can solar panel had 5.3oC, and the water bottle solar panel had 6.4oC. The hypothesis was refuted because the water bottle solar panel heated water more by 1.1oC.

### ***MES105: Does the angle of a solar cooker's sides affect how fast water heats up in an hour?***

A solar cooker is a tool that uses the sun's rays to produce heat to cook. From the research the experimenter learned that if the angle of a solar cooker is changed from 180 degrees or 10 degrees to 90 degrees then the water in the solar cooker will heat up faster in an hour. Solar cookers of 3 different angles were left in the sun for an hour and the data was recorded. The hypothesis was supported with 90 degrees producing the greatest results even though there was little differences because the experiment was done in fall.

**MES106: The Toxic Element**

The purpose of my project is to test and compare lead concentration in tap water from geographically diverse structures of various ages. This topic is useful to see how to prevent lead poisoning and sickness. My hypothesis is as the age of a structure increases the concentration of lead in its tap water will also increase, more-so than the closeness of a structure to an industrial site increasing the concentration of lead in tap water. The project experiment involved thirty water samples from geologically diverse areas. I collected the water samples, and then with the supervision of Mark Stoner, Water Quality Superintendent for the Municipal Authority of Westmoreland County, I tested the water samples for lead contamination. My materials included Water sample buckets, the Hach DR 6000 spectrophotometer for lead contamination, the LeadTrak Reagent Set, two beakers with 150 mL of polypropylene, a beaker with 250 mL of polypropylene, a clamp with 2-prong extension, with clamp holder, pPb-5 Indicator Powder Pillow, a cylinder with 25 mL of graduated polypropylene, a cylinder with 100 mL of graduated polypropylene, a dropper with 0.5 and 1.0 mL marks, a support for the ring stand, pPb-6 Decolorizer Solution, cotton plugs, a plunger, 1.0 mL of pPb-1 Acid preservative Solution, gloves, a laptop, and a sharpie marker. My results showed that although none of my tap water had high lead concentration levels above 15ppb, four of the samples did test positive for lead in their tap water. All four of these buildings were built before 1986 and were within a ten mile radius of an industrial site, and the industrial sites closest to these samples were all different. In addition, there were 18 other samples that too, were within a ten mile radius of an industrial site but did not test positive for lead. Therefore, I can conclude that the age of the structure has more of an influence on lead in tap water than the proximity of an industrial site. In conclusion, this science experiment met my goals of understanding lead in tap water. These results are important in stopping lead contamination and educating people on it by communicating my results. This experiment could help save lives in the long run.

**MES107: The Effect of Mangrove Gradient on Coastal Tsunami Erosion**

My purpose for this experiment was to study the effect of mangrove gradient on tsunami erosion, which basically means how much sand will erode when a wave is pushed at a “coast” on a specific angle. I will do 5-10 trials on each angle, dry the sand that eroded, then mass it . I believe this project will assist others around the world on how to prevent tsunamis. The data for this experiment can be seen on my tri-fold at PRSEF.

**MES108: Is Acid Rain Really a Pain?**

Marble chips were randomly selected and massed, placed in labeled cups and placed into water of varying pH levels of 1-7. The levels were achieved by adding sulfuric acid to distilled water for 7 days then it air dried for 17 hours before being massed. The procedure was repeated for 6 weeks for each of the 30 samples for all 7 varying levels of pH. Results were averaged, and percent reduction was calculated. I expected the lower the pH the higher the percent reduction. This held true for pH 1-5, but not for 6-7. This is because the carbon dioxide in the air can mix with the distilled water making carbonic acid.

**MES109: The Effectiveness of Organic and Inorganic Fertilizer on Marigold Growth**

For my science fair project I examined what type of soil combination will help a marigold grow the fastest, chemically infused fertilizer, planting soil, or the soil and cow manure combination. I predicted that the soil and cow manure combination will create the most plant growth. My results disproved my hypothesis, the soil and fertilizer grew the tallest by the end of the 35th day which was the end of my experiment. I think the soil and fertilizer combination worked the best because the fertilizer gives the plant nourishment.

**MES110: Homemade VAcuum Chamber**

Procedure 1. Cut a circle in the top of the mason jar that will just fit the rubber stopper. 2. Insert the rubber stopper into the top of the jar. 3. Place a candy, such as a peep into the jar. 4. Screw the top on tight. 5. Place the nozzle of the pump into the jar through the stopper. 6. Evacuate the air from the jar. 7. Turn off the pump promptly. Continuing to suck in air after there is none can damage the pump. 8. Take observations about the candy. 9. Repeat the experiment using the other materials eggs, and cup of water The purpose of this experiment was to see how little to no air pressure would affect the materials. Little Balloon: As I pumped the air out, the Balloon became inflated. When the air was returned the balloon shrunk back down. Egg: The air pressure had no effect on the egg. Egg with a hole: As I pumped the air out, the contents of the egg dripped out. When the air was returned the egg's content was sucked back into the shell. 1 cup of water: The air pressure had no effect on the cup of water. Conclusion: Air pressure does affects the contents. With the vacuum I saw some of the basic effects on the air pressure. With a stronger vacuum the egg and water would probably be affected, how I do not know.

**MES111: Does CO<sub>2</sub> Really Make it Warmer?**

My Science Fair project is the study of global warming. Specifically, whether introducing carbon dioxide into the environment will cause temperature to rise. In conducting this experiment, I determined that there is a relationship between carbon dioxide and temperature, increasing carbon dioxide levels will increase temperature over time. I performed this experiment because it is important to understand the relationship between our environment and things that cause temperature to rise. Experimenting with enclosed environments and dry ice as a source of carbon dioxide was a safe way to learn about the relationship between our environment, carbon dioxide, and temperature.

**MES112: Wat-er You Fishing In?**

After purchasing capped tubes water will be collected from the 5 tributaries flowing into Crooked Creek Lake. Each of the 10 samples for all of the 5 tributaries will be tested for temperature, pH, hardness, and nitrate and phosphate levels. This will be repeated for 6 weeks for a total of 6 trials containing 50 samples each. From my results, I have concluded that Spring Run (One of the 5 tributaries) has the overall best water quality.

**MES113: Friend or Foe**

Many do not think that plants can grow like humans with vitamins. As a start, I put 3 Pothos Neon into 3 different containers containing orange juice or milk (good sources of vitamins) and one container of water. Then every day, I measured the heights of the 3 plants after “watering” them with 1 ½ cups of liquids. As a result, the increase was 1.5 inches in 4 days for the orange juice plant more than the others. As a result, this project was the opposite of what I expected, so now people know what can help their plants grow.

**MES114: Weed Killers vs. Ladybugs**

Purpose To determine if common weed killers also kill ladybugs, and if so what is the safest brand. Procedure 1) Create five containers: four with different weed killers, and one with no poison (control) 2) Place ladybug food and ladybugs into same containers 3) Count how many ladybugs are found dead in the containers each day 4) Repeat step three until complete Data Spectracide caused 26 deaths, Garden Safe caused 19, Weed B’ Gon 18, Round Up 14, and the one with no poison six. Conclusions All of the weedkillers resulted in deaths. Round Up caused the fewest deaths. The most lethal is Spectracide.

**MES115: Sunspots and the Solar Wind**

In my project I investigated sunspots and the solar wind. The purpose of my project was to find out if the sunspot number affected solar wind speed, solar wind density, or the strength of the interplanetary magnetic field. The experiment was conducted by recording each variable on the first of every month from 2001 to 2016 using online databases. In general, my analysis of the data appears to show a slight increase in each of the tested variables when the sunspot number was larger.

**MES116: Effects of RPS on Renewables**

I examined the effects of renewable portfolio standards (RPS) on renewable electricity generation. Renewable portfolio standards are state laws that require electricity utility companies to generate a certain percentage renewable energy by a certain time. Data was gathered from multiple sources. Stata (a statistical package) was used to create graphs and run regressions. The regressions made it clear that the states with more difficult RPS had a greater effect on renewable electricity production. I also found that later RPS seemed to be more effective than earlier ones. Just having a RPS didn’t seem to make a difference in renewable production.

**MES117: The First Step to Cleaner Water**

Water that is available from natural resources is not always clean. Treated or filtered water is not readily available in the wilderness or in the under developed countries. I want to test a simpler way to purify water with Alum. I believe that if Alum is added to dirty water, then the water will become cleaner.

**MES118: Polling Pollinators**

In response to President Obama's June 20, 2014 memorandum urging private citizens to provide better environments for pollinators, I wondered what plants in Southwestern Pennsylvania would encourage the most insect activity and support the most pollinators. Identifying the most insect-friendly plants would be especially helpful to people with limited planting space, so they could stimulate maximum beneficial insect activity in their small gardens. Thoughtful planting in small spaces could promote pollinator health as efficiently as in larger spaces. I decided to study three types of plants: native plants, cultivars, and natives. What we plant in our yards in the next fifty years will impact the world food industry, the US economy, and the biodiversity of Pennsylvania.

**MES119: A Biodegradable Silt Fence**

Plastic silt fences are used to prevent disturbed soil from washing into nearby bodies of water. Often times the plastic silt fences are left in place too long, causing them to fray and release plastic shards into the environment. In previous bench studies, a biodegradable silt fence made from wool felt and cattail fluff was found to be a superior alternative. In this study, a full scale field test compared the plastic silt fence to the biodegradable silt fence. The biodegradable silt fence performed significantly better than the plastic silt fence when tested for total suspended solids removal.

**MES120: To UV or Not UV**

Blue and black pond with and without UV blocker was purchased. A mathematical calculation was used to determine the proper ratio to algae rate for my small sample size. 30 CC of purchased algae was measured into beakers. To determine the number of algae colonies in the beakers a sterile pipette was used to take a small sample of algae from each individual beaker. This sample was placed under a microscope and 3 random readings were counted. This was then multiplied by the amount of algae in the beaker to determine the number of colonies prior to experimentation. After the algae was counted and calculated 10 cc of the various pond dyes were added to the beaker. The 11 samples were placed under a UV light in a locked room for 4 days before being removed and the same procedure was repeated for counting the algae colonies. The entire procedure was then repeated again for 2 trials containing 11 samples for both blue and black pond dye with and without UV blocker.

**MES121: Does the type of seed affect how many birds come to a feeder?**

The purpose of the experiment is to test different types of seeds; sunflower, thistle and peanut, to see if it would affect the number of birds that come to a feeder. One feeder at a time was set out with one type of seed and observed for 30 minutes for 5 days. After conducting the experiment the hypothesis was refuted, for the most birds visited the thistle seed. The results were an average of 137 birds visited the sunflower seed, 56 visited the peanut, and 222 visited the thistle.

**MES122: The Effect of Snowfall on Air Quality**

This experiment explores whether the air is cleaner after it snows. A Speck Air Quality Measurement Device was used in the same spot of a residential neighborhood over three trials. Trials were performed during a period of time with no precipitation for twenty-four hours and one hour after it stopped snowing. Among all three trials, there was a consistent decrease in particulate matter (PM2.5). The data yielded a high reading of 954 PM2.5 to a low of 626 PM2.5 and an average drop of 194 PM2.5 calculated at 21%. Indeed, the air is somewhat "cleaner" after snowfall.

**MES123: Alternative Plant Growing Methods: Hydroponics vs Aquaponics**

My purpose in conducting this experiment was to find the most successful plant growing method in place of soil comparing hydroponics to aquaponics. For my procedure, I constructed a hydroponic and aquaponic system. I planted three varieties of seeds using those to compare the growth success of the systems. I learned that the aquaponic system was much more successful at plant growing. The hydroponic system did not perform as well and its plants were not as healthy. My results show that when trying to decide between hydroponics and aquaponics for successful plant growth, aquaponics will deliver healthier, faster growing plants.

**MES124: Time Dilation and its Problems for Interstellar Travelers**

The purpose of my research is to determine the cause of time dilation and its possible problems for human interstellar travel. After learning the formulas for calculating time dilation based on speed and time, I shall make a data chart showing its effects for traveling between Earth and other celestial bodies at differing speeds. Research will also be done on viable ways of interstellar travel and how time dilation will affect them. My conclusion will be a statement regarding the problems time dilation poses for different modes of travel, and a recommendation of using these modes of travel or not.

**MES125: Which Species of Insect Larva Is Most Effective at Biodegrading Polystyrene**

Question Which species of insect larva is most effective at biodegrading styrofoam? Hypothesis The ability of larva to biodegrade Styrofoam will occur in the following order • Super worm-best • Mealworm • Waxworm-worst Procedure 1. Place 30 larva of each species into 3 different containers. 2. Place 25 grams of Styrofoam into each container. 3. After two weeks determine the amount of styrofoam consumed by the larva in the container. 4. Repeat steps 2 – 3 for each species of insect larva Conclusion Final results will be available at the fair

**MES126: Keeping Our Heads Above Water: Early Detection of Stresses in Buried Water Pipes**

The purpose of this project is to develop an early detection system for weakening pipes. My research hypothesis is to find a relationship between the acoustics detected in new and weakened pipes.

**MES127: Bumpy Ride or Smooth Sailing**

In this study, I varied the depths of water to find if that would affect the height of waves caused by wind. By placing a fan on different depths of water I discovered that the wave height does not change. I can use my findings in the future when I am planning to go boating. From this procedure, the depth of water did not affect the wave height. However, the question remains: Will even greater depths affect the wave height?

**MES128: A Proposal of Plastic**

Plastic, as has been previously proven, does not have to be produced inorganically. Nevertheless, this purely scientific analysis holds no message to the economy and society. The consumer response may prove fatal to the multibillion dollar industry, therefore causing economic mayhem. Additionally, it is important to question whether industrial giants will be willing to invest in change and whether the driving government action will be fruitful. In conclusion, a system which is socially and economically sound must be envisioned prior to action.

**MES129: Is Tesla Really Good for the Environment as Compared to a Gas Car?**

Tesla cars have claimed that they are better for the environment as they are total electric cars. I believe that if the true cost of the car for making and using the Tesla car is compared to gas based cars, then the total positive impact on the environment may not be as good as claimed.

**MES130: De-Icing Mat. & Plant Growth**

The purpose of my experiment was to show the effects of de-icers on plants. I used de-icers like calcium chloride, sodium chloride, and a product called Enviroblend 6300. The procedure required to complete my experiment was to first plant grass seeds in pots, water them everyday, and leave them in the sunlight. Then, after the majority of the plants have sprouted, organize them into groups and water them with a designated salt solution. All of the tested substances negatively impacted plant growth, with calcium chloride being the worst, followed by sodium chloride and then the Enviroblend 6300.

**MES131: Finding a more effective way to grow in nutrient poor soil.**

I conducted my experiment because I am curious about the world and the well being of people and I think that it is important to help people with nutrient poor soil find an affordable and easy way to grow the plants. My hypothesis for this experiment ended up being incorrect and I was shocked to find out that compost had the most growth and not manure. My original hypothesis was that manure was going to have the most growth followed by compost then fertilizer. In reality the order was compost followed by fertilizer than manure.

**MES132: Fertilizer, More Like Fert-Kills Water**

The objective is to investigate how chemical fertilizers harm the water system and ecological habitats. The hypothesis, created by me, goes in the direction of the plant with the fertilizer will have a shorter lifespan than the other plant because of the chemicals involved with the fertilizer. I have designed an experiment that simulates two identical gardens of grass, in a bowl. I'll then water the plants for a week, so they have enough time to actually have a length over 2 mm. After that, I'd apply fertilizer to one plan and compost to the other. I'd water the same amount for the next 3 days, and I'd apply the compost and fertilizer every day for 3 days. Before I'd apply the fertilizer again, I'd squeeze out the excess water, from the soil and pour it back into the soil for every time I apply fertilizer and compost. Then I wouldn't even touch the plants after the week and 3 days. I'd observe that plants' changes, and what day the occurred on, and after one died, I'd end the analyzation. After, all the data is collected, I'd then make table for both of the plants showing all the information I collected.

**MES133: Sunscreen... Friend or Foe?**

The purpose of this project is to determine the effects of sunscreen on the growth rate of Danio Rerio embryos. I purchased Vanicream, Alba Botanica, Aveeno, and Hawaiian Tropic Sunscreens. I then purchased Danio Rerio eggs. A microscope was used to observe the stage of development for each of the 30 samples for 4 sunscreens, as well as the control methylene blue. A numeric value was assigned to each fish embryo and placed into separate beakers. The growth rate of each egg was measured at 15 hours and at 30 hours in the sunscreen solution. A total of 150 samples were taken.

**MES300: Plant Filtration Systems**

This experiment tested the effectiveness of a plant-based filter vs. a dirt and rock-based filter to remove common wastewater pollutants. Two of the above mentioned filters were made and used to cleanse water contaminated with laundry soap. The polluted water was tested before and after the filters. The test strips measured nitrates, nitrites, hardness, chlorine, alkalinity, pH, ammonia and phosphates. The experiment findings conclude that plant-based filters can be a viable source of water purification. These types of natural filters are economically and environmentally friendly and can provide water uses other than consumption. While this experiment was primitive in design and limited by time, the plant-based filter concluded that it can remove common pollutants from wastewater. The plants in the plant-based filter continued to grow. Further research could be done on a larger scale and longer duration.

**MES301: Can Sand turn into Glass?**

My partner Ben and I tried to see if we could turn sand into glass. We tried by using two types of sand, beach and Home Depot sand. My partner and I wanted to see which sand would heat faster. We heated the sand using a bunsen burner for 12 minutes. Our results were unsuccessful. Instead of turning into glass, both sand types changed colors from tan to an orange color. Also, the beach sand had become more rocky then the Home Depot. This proves the beach sand had more progress then the Home Depot sand. In the end, our test turn out differently. We couldn't heat both sands into glass. The bunsen burner was not hot enough for us to be able to heat it.

**MES302: Solar Powered Air Heater**

For our experiment, we wanted to make a solar heater that was affordable, easy to make, and environment-friendly. We built our solar heater in two days and tested it in three days with different weather conditions. We measured a window in my house, and using those measurements, made the heater. After making it, we placed it on the same window. We then measured the input and output temperature at three times. Then we took the average temperature for each time. Overall, we could create a solar power heater that was affordable, easy to make, and environment-friendly.

**MES303: Crystal Fudge**

Discover the process of crystallization by experimenting with the cooling of fudge.

## Medicine / Health / Microbiology (MMH)

### ***MMH100: The Effect of Temperature on Antibiotics***

My project was about how the temperature can effect an antibiotics ability to fight bacteria. Therefore, I decided to run a test to figure out. To run this test I diluted antibiotics in sterile saline and tested them against E. Coli K-12. I ran this test for three different antibiotics. The antibiotics sat for 6 days in either a cold temperature or a room temperature. The antibiotics were then tested with the E. coli. The results were recorded 2 days later. The plates were then soaked in bleach for 24 hours and disposed of by my sponsor.

### ***MMH101: Does EM Exposure Affect Cells?***

The topic of EM radiation related health concerns is severely underdeveloped, with little conclusive research. Considering how prevalent EM radiation is in our society, it is very important to know exactly how it affects us. Within the scientific and general community, there is lots of debate over the EM radiation produced by cell towers, computers, microwaves, and especially phones. I have decided to single out the effect of the Em radiation from cell phones and it's effect on cell growth. As human cells aren't available, I will use a nearly identical cell, yeast. I will expose the yeast to cell phones connected to wifi, data, and on standby. After the cells have been exposed for 48 hours, I will take pictures to count cells. Once I have performed multiple trials to , ensure accuracy, I will compare the cell counts from data, wifi and standby to the control.

### ***MMH102: Which Type of Bread Molds the Fastest?***

Purpose Determine which type of bread molds fastest. Hypothesis Cinnamon Raisin=Fastest White=slowest  
Experimental Procedure • Obtain needed materials. • Place a 5.08 cm square piece of wheat bread in a petri dish, moisten it. • Repeat 29 more times. • Incubate samples in a testing chamber for 24 hours. • Select sample and photograph it. • Place 1cm square grid over samples and determine amount of mold present. • Record any changes a day later. • Keep samples moist. • Repeat steps 6-9 for a week. • Repeat steps 1-10 with other types of bread. • Take photos on day 7, properly dispose of bread. Conclusion Final results available at fair.

### ***MMH103: Crusin the U.S.A.***

Where would you store medicine in a 1997 Dodge Avenger if you did not have a cooler? I tested three places, the passenger seat, back seat, and the trunk. We tested these areas because they are common places in a car. When we tested we got results that were not expected. I thought that the trunk would be the best place to keep medicine but in fact it was the back seat.

### ***MMH104: Food Preservative***

Purpose Statement: What are the effects of different concentrations of food preservative on bacteria growth?  
Hypothesis: I think that if I test what are the effects of different concentration of food preservative on bacteria growth that salt will be the least effective. I think salt will be the least effective because salt an ancient method of preserving food there are newer method that were formed by scientist for the purpose of preserving food.

### ***MMH105: Doppler Technology to Measure Heart Rate***

People say that a person's heart rate should be the same whether measured manually or with a Doppler Device. This project looks at this statement. The heart rate was tested the two different ways on three people. My hypothesis stated that both ways are basically the same. The results supported my hypothesis.

### ***MMH106: Honey, I'm Home!***

After I purchased my honeys, I put on googles, gloves, and an apron, and started to test. I created paper discs, sterilized them, and put them into a sterile petri dish. I then flamed forceps and used them to pick up one disc and put it into one type of honey for one minute. After one minute, I held the disc over the dish for thirty seconds. The disc was then put into an agar plate swabbed with Bacillus cereus. The plates were put into an incubator for 48 hours. After 48 hours, the zone of inhibition was measured.

**MMH107: A Cell Protein Kills Bacteria**

Question: Can human cell protein kill bacteria? Background Research: Bacteria are everywhere. They're on your hands, in your food, and drinks. There are both good bacteria and bad bacteria. Good bacteria help digest your food and fight invading microbes. They are also used in your medicines and are in your dairy products. The bad bacteria cause infectious diseases. Millions of human beings and animals are dead because of bacterial infections every year. Currently, the only approach to fight against bacterial infection is antibiotics. This is becoming a huge problem because widely application of antibiotics has been resulting in antibiotic resistant bacteria. The antibiotic resistant bacteria obtain new plasmids or adapted gene mutations to protect themselves by adapting to the antibiotics or prevent antibiotics enter the bacteria. Therefore, scientists are continuously designing new antibiotics to fight against the bacteria threat to our human beings and animals. In my research project, I am interested to find a new approach to kill bacteria. I test if the protein named gasdermin d that can kill human and animal cells under inflammation can kill bacteria when it is introduced into bacteria. Hypothesis: If gasdermin d gene is introduced into bacteria, the gene product of gasdermin d may kill the bacteria. Conclusion: gasdermin d protein (276-GFP) expressed in E.coli bacteria can efficiently inhibit or kill the bacteria. A few of bacteria colonies grew on culture plate. In comparison, the gasdermin d protein (211-GFP) in E. coli bacteria did not inhibit or kill the bacteria, demonstrating the specific killing effect of gasdermin d protein 276-GFP. My study provides evidence of proof that human cell protein that can induce cell death under inflammation may be used for fighting against bacterial infection.

**MMH108: Does the amount of pulp affect the amount of Vitamin C?**

Does the amount of pulp in orange juice affect the amount of vitamin C? Titration was used to determine the amount of Vitamin C in pulp and no pulp Minute Maid orange juice. The hypothesis was if the amount of pulp is changed, then the amount of Vitamin C will be greater in pulp vs the no pulp juice. The hypothesis was refuted. The explanation is that pulp is only fiber and doesn't contain as much vitamin C as the juice itself. Pulp is fiber and takes up volume in the container, thus, less pulp, more juice fills the container.

**MMH109: Do Fresh Fruits or Frozen Fruits Have a Higher Glucose Level?**

Glucose is a carbohydrate, and is considered a "simple sugar" because it is one of the smallest carbohydrate units. Glucose can also cause diabetes, either Type One or Type Two. Type One diabetes is caused by the body being too low on insulin, and Type Two diabetes is caused by poor eating habits or not getting any exercise. The purpose of this experiment was to determine if fresh fruits or frozen fruits had a higher glucose level. The data I collected showed that frozen fruit had a much higher glucose level than fresh fruit.

**MMH110: Determining an Effective Way to Purify Water**

I wanted to know the best way to purify water. I collected a sample of river water. Then I tested three ways of purifying it: filtration, chemical treatment, and boiling. I hypothesized that boiling would work the best.

I took these treated samples and put them on petri dishes, which incubated for 3 days. Then I counted the number of bacterial colonies growing on each plate. The most colonies were found on the control. The filtered sample grew many colonies but not as many as the control. The iodine sample had just one colony. Finally, the boiled sample had no growth after 3 days, which was my hypothesis.

**MMH111: Does the Color of Nail Polish Affect the Accuracy of a Pulse Oximeter?**

Purpose Determine if the color of nail polish affects the accuracy of a pulse oximeter. Hypothesis The color of nail polish will affect the accuracy of a pulse oximeter. Procedure 1. Calibrate pulse oximeter 2. Select a 7th or 8th grade test subject 3. Determine which color of nail polish will be placed on the 2nd, 3rd, or 4th digit of the test subject's left or right hand. 4. Select which color of nail polish will be tested first 5. Using the pulse oximeter, record the amount of oxygen in the subject's blood and heart rate. 6. Repeat steps 3-5 for the control (no nail polish) 7. Repeat steps 3-7 for 29 more test subjects. Conclusion Final results available at fair

**MMH112: Fresh vs Processed Fruits : Which one has less glucose?**

Many foods contain carbohydrates which provide us with energy when they break down into glucose. Both healthy and junk foods contain carbohydrates. After consuming foods with carbohydrates, our blood sugar increases. Too much sugar in the blood causes diabetes, which is a serious health problem in the United States. People with diabetes are unable to regulate blood sugar levels. Too little glucose or too much glucose affects their health adversely. It is important for people with diabetes to control their sugar intake through their diet. Although fruits are healthy, they provide different types of sugars, too. Therefore, diabetic patients should be concerned about their fruit intake. Processed fruits are inexpensive and more convenient than fresh fruits. The objective of this project is to find out whether processed fruits provide more glucose than fresh fruits. The glucose will be tested by a urinalysis test. Data and results will be available on the science fair day.

**MMH113: Fighting the Flu: How Your Immune System Uses Its Memory**

Looking for some ways to rev up your immune system so you don't get the flu this year? That's a great idea. Thankfully, common illnesses usually last for just a few days, and then you start to feel better. Why is this? It is thanks to the immune system, which is a group of special organs and cells in your body that constantly work to keep you healthy. In this science project, you will make a simple model to investigate how the immune system defends the human body from common illnesses, and the role of the immune system's memory in this process. When it's working well, it can help you avoid illness. But if you let it get run down, you're more likely to get sick.

**MMH114: Which Soda Pop is Worse for Your Teeth?**

What soda pop is worse for your teeth is a question that I often wondered. I hypothesized that cola will stain your teeth the most because it is the darkest. To discover the answer to this question eggs were soaked in soda because eggs are made from a calcium composite just like teeth are. I concluded that cola does not stain teeth the most. Fanta does because it has the most sugar. If I could do this project again I would use sports drinks.

**MMH115: Is Your Pet Good For Your Health?**

I performed this experiment to find if spending time with a pet will be good for a subject's health. I predict that spending 5 minutes with a pet will be good for a subject's health. 1. subjects drew a label from a bag. 2. subjects sat quietly for 5 minutes. 3. recorded baseline vital signs then administered the Sing-a-Song Stress Test. 5. recorded vital signs immediately following the stress test. 6. #1 subjects spent 5 minutes with my dog. #2 subjects spent 5 minutes sitting quietly. 7. following those 5 minutes, I recorded vital signs.

**MMH116: Can UV light disinfect contaminated water?**

The purpose of this experiment is to test to see if U.V light can disinfect, two different creeks, contaminated water. To conduct this experiment, I will compare the creek water before and after the SODIS process. The experimental results were measured to see the amount of bacteria and parasites in the contaminated water after being placed under the light (to act as the sun) for more than 12 hours. My hypothesis didn't agree with my results. This is due to my project not working since my agar melted in the incubator.

**MMH117: Kinesio Tape: Help or Hype?**

The purpose of this experiment is to determine if Kinesio Tape increases strength. I will test the grip strength of all ten subjects without the tape on and retest their grip strength with Kinesio Tape applied. The results of this experiment were inconclusive. When the tape was applied with no stretch, it on average decreased the strength of the test subject by 2%. When the tape was applied with 75% stretch, it only increased performance by 3% on average. I predicted that the subjects with no stretch applied would observe and increase in performance and they experienced a decrease in performance.

**MMH118: Antibacterial Soap vs Regular Soap on Staphylococcus aureus**

Please visit student's exhibit.

**MMH119: Does Memory Loss Affect Reflexes?**

The purpose of my project was to see if memory loss affects a person's reflexes. To conduct my experiment I tested nine people in three different categories using a meter stick to test their reflexes. My experiment resulted in the category with moderate memory loss doing the best, and that each category had about a ten centimeter difference in the groups' total average scores. Meanwhile, the group with no memory loss did the second best, and the group with a high-level memory loss did the worst. In conclusion, the second group did the best, so my hypothesis was denied.

**MMH120: Antibacterial Effects of Copper Surfaces**

Background: Hospital-related infections are a major problem in hospitals around the world, and they result from poor hand hygiene and touching common objects. Certain metal surfaces, such as copper, may be better than others in preventing the transmission of bacteria to humans. Hypothesis: Copper surfaces will be associated with less microbial growth compared with non-copper surfaces, such as stainless steel. Methods: The 2 BSL-1 bacteria used will be Escherichia coli and Staphylococcus epidermidis. A constant quantity of non-pathogenic bacteria will be applied on each of 3 surfaces (copper, brass, and stainless steel). After 15 minutes, 30 minutes, and 60 minutes, the bacteria will be collected using a sterile swab and placed onto an agar plate. The plates will be incubated at 37 degrees for 48 hours after which the number of colony-forming units (CFUs) will be counted and size of colonies will be measured. A total of 3 trial were completed. Results: There were significantly fewer bacterial colonies from the bacteria collected from copper surfaces as compared to the non-copper surfaces. This was true for both E. coli and S. epidermidis. Conclusions: Copper surfaces appear to kill bacteria better than non-copper ones making it a good option in hospitals to prevent the transmission of infections.

**MMH121: The Effects of Temperature Influenced Vinegar on E.Coli**

The purpose pf this project is to find if changes in temperature will affect vinegar ability to effect E. Coli survivorship. Pulse and Vortex procedures will be used to create cultures. Knowledge from this study will enhance methods to prevent bacterial food poisoning.

**MMH122: Which Gendered Bathroom Grows The Most Bacteria?**

The purpose of my project is to find out which gender bathroom has more bacteria. This project could impact people in their everyday lives by making them think different on how they use bathrooms and what they touch in them. To conduct this experiment, petri dishes with agar and an incubator to grow the bacteria were used. The female bathroom overall grew the most bacteria and my hypothesis was supported. At the end of this experience, I met all of my goals.

**MMH123: Which Public Place has the Most Bacteria?**

My goal was to find out what public place had the most bacteria. To do this, I had to find out how to grow bacteria. The results of my experiment could help myself or others keep from spreading germs and getting sick. First I gathered bacteria samples from chosen places. Then I grew the bacteria in a controlled environment to get my results. I thought that the areas with the most human use would have the most bacteria, but I found out there were other variables. The results are important because they could keep people from getting sick.

**MMH124: The Impact of Support Systems on Blood Cancer Treatment**

The purpose of my experiment was to see if patients with stronger support systems would have a better response to treatment. I identified ten adult patients with recently diagnosed blood cancer undergoing treatment, then after obtaining informed consent I presented each patient with a survey regarding support systems and how they are perceived. I then presented each patient with a follow-up survey regarding response to treatment after they met with their physician. Lastly I analyzed data to evaluate a correlation between support systems and treatment response. Without going very much in detail I can state the data was mostly inconclusive because of the large amount of variables. In conclusion my hypothesis is neither rejected nor accepted because I believe my results may reflect a sampling error, with all patients having high support scores in at least one category.

**MMH125: Which Mouthwash Best Inhibits Oral Bacterial Growth?**

Please visit student's exhibit.

**MMH126: 5 Seconds of Safety?**

The researcher wants to determine if the amount of bacteria on food is affected by the amount of time spent on the floor. Many people believe that if food is dropped on the floor, if it is picked up within five seconds, it is still safe to eat. What people do not realize is that there is a chance that they are eating common bacteria that would be on their floor. To investigate, lunch meat and crackers were placed onto the floor for lengths of time and swabbed onto petri dishes with agar. Results will be available on fair day.

**MMH127: Do Pittsburgher get enough sunlight?**

Please visit student's exhibit.

**MMH128: Increasing Visual Dexterity**

The purpose of this experiment was to find out if visual dexterity could be increased over 2 weeks of training.

**MMH129: What way of disinfecting water works best: SODIS or water purification tablets**

My project is to see if UVA light or water purification tablets will disinfect the water. The purpose of my project is to help people who don't have clean water. To do this project I will compare plain river water, UVA light water, water with purification tablets.

**MMH130: You Are What You Eat**

Please visit student's exhibit.

**MMH131: Cleaning Water with the Sun**

• In this project I investigated the effectiveness of using solar energy to clean water, also called Solar Disinfection (SoDis). • SoDis is used in third-world countries as a cheap way to clean water. • To measure the effectiveness, I compared it to a sterilization method for water - boiling. I used SoDis and boiling of river water separately and compared the growth of bacteria to untreated river water. • I used tryptic soy agar plates as nutrition for the bacteria to grow • After 3 days I concluded that SoDis cleaned over 90% of the bacteria in the river water, which was almost on par with the boiled water, being at 100%.

**MMH132: To Eat Is To Cure**

Recently it has been shown that the intestinal microbiota has an impact on the function of our immune system, cells that work together to protect us against extraneous things entering our bodies and making us ill. The microbiota are possibly influenced by what we eat and maybe there is a connection between the development of good bacteria in our intestines and battling cancer. Further studies have shown that inhibitors such as PD-1 produce remission in patients lasting many years. In this study I am evaluating whether the dietary composition of patients is associated with good outcomes to PD-1 therapy.

**MMH133: What over-the-counter acne medication is the most effective?**

Teenagers constantly go to the dermatologist to get prescribed over-priced acne prescriptions, while others switch between over-the-counter acne creams until they find the one that works best. In both situations, people are spending beyond what is necessary to care for the acne bacterium on their face, when they could simply just test which product and/or ingredient works best for their own face. So, in this project, I decided to test three acne medications with different ingredients including, benzoyl peroxide, salicylic acid, and sulfur to see which worked best across the board for a small group of young teenagers.

**MMH134: Budding Bacteria**

In this experiment I will be observing the bacteria growth on meat at room temperature. The meats that will be tested are pork, chicken, and steak. I will be placing 3 petri dishes with 10 grams of each meat in an incubator at 25 degrees Celsius. The meat will be left in the incubator for 24 hours. Once the 24 hours is up I took agar, swabbed the meat, and made a zigzag motion across the agar. After the first day of bacteria growth I took my data. To see my results stop by on March 31st.

**MMH300: Which Water Filter Can You Trust?**

Water is a necessity in life, which means that it is absolutely imperative that it is clear of chemicals, so we decided that we want to see what type of filter we really can trust. To keep all data as accurate as possible, we are using the same amount of water, same type of water, same cup, and same test strips. We ran the pool water through the filters; the Brita, LifeStraw, and the homemade; and tested, using the chlorine strips. The final results have not yet been compared and are still in progress.

## Physics (MPH)

### ***MPH100: Using Motion Parallax to find Distance***

The purpose of this experiment was to see if motion parallax gives an accurate measure of distance between two objects.

### ***MPH101: There's Power in the Mud!***

I did this project to see how much electricity could be pulled from the mud. I hypothesized that mud with high acidity will charge a cellphone more than mud with less acidity. To complete this project, I had to measure how much acidity was in the mud. I also had to use a mock microbial fuel cell converting chemical energy to electricity. After 3 trials, adding food to the mud and letting time for bacterial growth. I tested acidity and voltage. After three trials, I found adding more pickle juice produced more acid but less voltage.

### ***MPH102: Measuring the Cost Effectiveness of Light Bulbs using the Photometer***

In this experiment, we will find out which type of light bulb is the most cost-effective using a photometer. We bought six light bulbs: CFL 25 W, CFL 60 W, LED 2 W, LED 4 W, Incandescent 40 W, and Incandescent 60 W. We compared each bulb with each other. I will research the amount of time that each bulb lasts on average, and I will look at the prices of each bulb and how much electrical power they each consume. I am going to come up with my conclusions which will be displayed at the science fair.

### ***MPH103: Bouncing Basketballs how much energy does dribbling take?***

the purpose of this experiment is to see what surface a basketball will bounce the highest. the hypothesis is that a basketball will bounce higher on a concrete surface than wood or carpet. the procedure was: set up a camera using a small tripod and card table at 82cm drop the ball from 101cm and record data the results were that the wood surface and the concrete surface were only .5cm apart after taking averages they were only 86.8cm and 87.3cm. the concrete surface and gym floor did not absorb as much energy as the carpeted surface

### ***MPH104: Testing Da-sign***

In the experiment Testing Da-sign, a slant (forward, backward, or level), will be the fastest performance on a Pinewood Derby car. I hypothesize that the car with the forward slant will be fastest do to its ideal aerodynamic design. The cars will be assembled placing equal weights to control the center of mass and thus controlling the potential energy stored with each car. They will be raced and times will be recorded. The least amount of time taken to complete the race will have the best design. To find out more stop at my project on presentation day.

### ***MPH105: Where's My Signal***

I wanted to test what blocks the most dBm in a Wi-Fi signal. I put multiple materials in front of my Wi-Fi router and tested the dBm strength. I found that steel pans block -5.0 dBm, the most of all the materials. Cardboard blocks -0.6 dBm, the least of all materials. Through my experiment, I concluded that my hypothesis was right.

### ***MPH106: Does propeller size matter?***

In this experiment, different size chord widths of propellers were measured to test what size would have the greatest speed. My hypothesis was that the largest width propeller chord would have the greatest surface area so it would turn the fastest. First, two wooden apparatuses were built in order to control wind velocity. Then five different size chord widths were cut and molded into propellers. At that point, the propellers were attached to a hobby motor as well as a digital multi-meter and tested four times. The results did not support my hypothesis; the middle-sized chord had the greatest speed.

### ***MPH107: The Effect of Primer on Paint Durability***

Paint primer is used to increase the durability of paint, but it can be very expensive. My experiment is designed to test the durability of paint. I will obtain two equal pieces of drywall. On one primer and paint will be applied, the other will only have paint. I will use a force sensor to measure the amount of force it takes to chip the paint. I will record the number of applications of the force that was necessary to chip the paint.

***MPH108: Does the mass of a marble affect the time it takes to complete a track?***

Marbles with different masses were tested to complete a track. The hypothesis was if marbles with different masses are tested to complete a track, then the marble with the greatest mass will complete the track in the fastest time because the more kinetic energy an object has the faster it is and heavier objects have more kinetic energy. The track was made out of pipe insulation tubes for the marbles to travel through. The hypothesis was refuted because the marble with the second greatest mass completed the track in the fastest time.

***MPH109: Water Bottle Thermodynamics***

I conducted an experiment to determine what water bottle material would keep water cold the longest. I measured the ability of 7 different materials to keep water cold. I started with water that was about 5 degrees Celsius (slightly warmer than fridge temperature) and let it warm up to 15.5 degrees Celsius (slightly cooler than air temperature in my house). I used a digital thermometer connected to a programmable microcontroller to measure water temperature every minute inside each water bottle. I repeated the experiment three times for each water bottle. The vacuum water bottle kept the water cold for about 42 hours, which was much longer than any other materials I tested. On the other hand the aluminum water bottle kept the water cold for only about three hours, which wasn't any longer than the control, a plastic bag. However, when I put the aluminum water bottle in an insulated lunch box it kept the water cold for about 7 hours, which was the second longest time. The plastic water bottle, the stainless steel water bottle, and the double-walled plastic water bottle kept the water cold from about 3.5 hours to 5.5 hours.

***MPH110: Dance Surfaces and Pointe Shoes***

The purpose of the experiment is to see which type of flooring, wood, tile, or marley, will wear down pointe shoes the fastest. Being a dancer, and having a sister on pointe, I have realized that they go through pointe shoes very fast. The experiment was conducted by attaching a pointe shoe to a drill press. Then put satin on the shoe and turned the drill press on to let the shoe spin on the floor. Inspected the shoe for rip and tears. This was repeated for five trials. It is thought that wood flooring will wear the shoe down the fastest due to the amount of friction, however the results showed that tile wore down the shoe the fastest. This is caused by the high amount of friction and the glossy coat on the wood flooring causing a small amount of friction.

***MPH111: What Material has the Best Insulation?***

My project was done to find out what household material is the best insulator. My hypothesis was that the felt would be the best insulator. However, when I did this project, the paper used was the best insulation, so my hypothesis was incorrect.

***MPH112: The Speed of Light***

For my science fair project, I used a microwave oven to calculate the speed of light. My purpose behind doing this project was I found it very interesting and seemed like an enjoyable project. The problem of the experiment was to find the speed of light. My hypothesis was that the microwave would calculate something close to the actual speed of light, which it did. My results for the experiment were very close to the speed of light. My calculation was 26,950,000,000 cm per second and the actual speed of light is 29,400,000,000. In conclusion, my project succeeded amazingly.

***MPH113: Watch the Angle***

Like shooting targets? My investigation found the best angle to shoot a projectile the longest distance. This investigation can help people to more accurately hit a target stationed at a far distance. I used a Nerf gun and Nerf darts(made from the same materials and the same amount of mass. to conduct this investigation. I built an apparatus to shoot at each angle, and tested multiple darts and ran multiple trials at each angle. After measuring the distance for each, I reached the conclusion that 45 degrees is the optimal angle,, which was my prediction.

***MPH114: Loop Diameter VS Mechanical Energy and Speed***

The purpose of my project was to determine how the diameter of a roller coaster loop effects the speed and mechanical energy of a roller coaster cart. I predicted that the greater the diameter of the loop becomes, the more the speed and mechanical energy of the ball will decrease. Using a rubber roller coaster track, I determined the speed and mechanical energy of a plastic ball at the start of the track, the entrance of the loop, the peak of the loop, and the exit of the loop using photogate sensors. The photogates each collected 30 samples of data for each of the the loop diameters being tested. The height at the start of the track, the mass of the ball representing a roller coaster cart, and the distance the ball travels from the start to the entrance of the loop will remained constant. The data collected was transferred into a data book. The experiment was repeated three times for a total of three trials and 1,350 points of data. All data was recorded in my data book.

***MPH115: Pencil Resistors***

The purpose of this experiment was to determine if length pencil length, acting as a resistor, affects the brightness of a light bulb in a circuit. Pencils of varying lengths were added to a circuit then the brightness of the bulb was measured. The length of 2.5cm, gave off 36 lumens, the length of 5.3cm gave off 14.7 lumens, 7.8cm gave off 12.3 lumens, 10.3cm gave off 13.4 lumens and at 12.7cm gave off 11.4 lumens. The shortest pencil, with the most lumens, showed the least resistance. The hypothesis was supported.

***MPH116: Water Effects on Sunscreen***

The purpose of this project is to find out which sunscreen is the most effective in water. To conduct this experiment, cover a petri dish with duct tape except for a one centimeter by one centimeter square. Then, fill the dish with water and put the sunscreen covered bead into the water directly under the square on the top. Record the color the bead turns after five and ten minutes. The sunscreen that performed the most effectively was Neurogena with an overall average of 2.06 on the color scale. The results did not support my hypothesis.

***MPH117: 2 Stroke Vs 4 Stroke***

The purpose is to see which type of engine is faster and which bike is quicker. I tested each bike on a straight away. I went through gears 1 through 5. Then I saw which gear top speed was faster. The 2 stroke over all is faster. The 2 stroke overall is faster but isn't quick right off the start like the 4 stroke. My conclusion is that the 2 stroke is faster than the 4 stroke even though the 4 stroke has low end power and is quicker off the start.

***MPH118: Do Soccer Balls Inflated With Air Bounce Higher Than Soccer Balls Inflated With Nitrogen At Different Temperatures?***

Purpose: Determine if soccer balls inflated with nitrogen bounce higher than soccer balls inflated with air at different temperatures. Hypothesis: A soccer ball inflated with nitrogen will bounce higher than a soccer ball inflated with air at different temperatures. Procedure: 1. Inflate 5 soccer balls with 62051.4 Pascal's (9 PSI) of air and 5 with nitrogen. 2. Place the soccer balls a tray for 30 min at 18°C. 3. Select 1 of the soccer balls from step 4 and drop it from the testing apparatus. 4. Determine the height it bounced. 5. Repeat steps 2-4 using the same soccer ball for 29 more drops. 6. Repeat step 2-5 using the remaining soccer balls. 7. Repeat steps 2-6 for the other temperatures (-7°C, 4°C, &52°) being tested. Conclusion: Final results available at fair.

***MPH119: Light Bulbs & Room Temperature***

The purpose of this experiment is to see how different light bulb types (incandescent, Fluorescent, LED) affect the temperature of a room. Each bulb type was tested in a wooden box that mimics a room and the temperature of the box was recorded twice each minute for five hours with the light bulb on. The average of three trials showed that the incandescent bulb reached a temperature of 42.4 degrees Celsius in 4.8 hours, the fluorescent bulb reached 24.3 degrees Celsius in 4.6 hours, and the LED bulb reached 24.7 degrees Celsius in 4 hours.

### ***MPH120: Light It Up***

The purpose of the experiment was to discover whether or not sodium chloride solution could be an effective conductor to generate electricity to power a light bulb. In this experiment different concentration of sodium chloride was used to produce the ions to create a circuit and deliver power to the light bulb using aluminum foil as the electrodes. The results indicated that a higher concentration of sodium chloride solution generated more charged ions and free flowing electrons to form the electrical current. The availability and flow of electron in a circuit generates electricity that would power the light bulb. Three different concentrations of sodium chloride was used. A popsicle covered in aluminum foil acted as an electrode. The electrodes were immersed in the individual sodium chloride concentrated solutions three different times. Insulated copper wires were attached to the electrodes and the light bulb to create a circuit. The outcome of this investigation indicated that a salt solution can be used as a source for electricity, but the amount and the concentration would have to be enormous. Therefore this method of generating electricity commercially would be ineffective. The hypothesis was proven to be correct as shown by the lighting of the light bulb. If this experiment were to be repeated it would be interesting to see the results with potassium chloride solution.

### ***MPH121: Does The Amount of Calcium Chloride In Flexible Concrete Affect Its Tensile Strength?***

Purpose: Does the Amount of Calcium Chloride in Flexible Concrete Affect Its Tensile Strength? Hypothesis: As the amount of calcium chloride in flexible concrete increases the tensile strength of the concrete will decrease. Procedure: 1. Obtain all needed materials 2. Construct experimental apparatus 3. Prepare flexible concrete (control) mixture according to directions given. 4. Pour the flexible concrete mixture prepared in step 3 into 30 PVC forms measuring 30.48 cm in length (Control) 5. Mix calcium chloride with flexible concrete and pour into mold. (Experimental) 6. Repeat step 5 with experimental concrete with experimental samples A,B,C,D The following is the amount of calcium chloride mixed with each experimental samples A= 5ml, B=10ml, C=15ml, D=20ml 7. Measure samples tensile strength using weights and record data. 8. Repeat steps 3-7 if necessary Conclusion: Final results available at fair.

### ***MPH122: Investigating Impact Forces***

The purpose of my experiment was to see how the mass and drop height of a tennis ball affects the impact force. This was investigated by dropping a tennis ball on a force plate and recording the greatest force value. For my experiment I tested twenty different masses and twenty different heights which were each tested ten times each. I concluded that as the mass and drop height increased so too did the impact force at a constant rate. This was because the force necessary to change the ball's momentum had to increase.

### ***MPH123: Oh Cracked***

Oh Cracked, How Much Pressure Can You Take? is the title of my project. With this experiment, I will be able to find out how much weight can fragile eggshells hold. My hypothesis is they will be able to hold only 64 ounces of weight before cracking under pressure. I placed the eggshells on a solid surface, began to add weight. I used books/magazines that I had lying around my house. The shells working together distributed the weight and held 411.5 ounces before cracking. My hypothesis was off by 347.5 ounces.

### ***MPH124: Color Vs. Heat***

The purpose of this experiment is to find out which color of construction paper will absorb the most light energy. To conduct this experiment i will use different colors of construction paper to see which color will absorb the most light energy. The experimental results were measured in Celsius by which color absorbed the most light energy. The results of the experiment were that purple absorbed the most light energy and white absorbed the least light energy. The results indicate that the hypothesis should be incorrect because black didn't absorb the most light energy purple did.

### ***MPH125: Tha- Whack***

The purpose of my project is to see if broad heads or bullet tips arrow heads penetrate more. I will shoot each type 10 times from 20 and 30 yards. I recorded my data and bullet tips penetrated more than broad heads even though they don't have sharp fins.

***MPH126: Does the Magnus Effect Influence the Trajectory of Soccer Balls With Different Panel Designs?***

Purpose: Determine if the trajectory of soccer balls with different numbers and shapes of panels will be influenced differently by the Magnus Effect. Hypothesis: The influence of the Magnus Effect on the trajectory of soccer balls will occur in the following order: Panel Number - Panel Design, 6-Most Brazuca-Most, 8-Jabulani, 32-Least Buckminster-Least, Procedure: 1:Drop a smooth ball from the testing apparatus. 2:Record the distance the ball travels forward from testing apparatus. 3:Repeat steps1-2 twenty-nine more times. 4:Repeat steps1-3 for each of the different soccer balls being tested. 5:Change rotational speed and repeat steps1-4. Conclusion: Results available at fair.

***MPH127: Increasing a Linear Accelerator's Kinetic Energy***

My Science Fair project is the study of a linear accelerator and whether changes in the number of magnets in a linear accelerator will increase the kinetic energy of the linear accelerator. In conducting this examination, I determined that there is a relationship between the number of magnets and the kinetic energy and velocity of a linear accelerator. Increasing the number of magnets will increase both the kinetic energy and velocity of a projectile launched from an accelerator. Through varying the number of magnets of the linear accelerator, I was able to show that the experiment supported my hypothesis.

***MPH128: Sound proofing a room***

My purpose of my experiment is so my parents didn't want to hear my loud music in the middle of the night. To conduct this experiment I had to get 3 materials and a shoe box and speaker. The experiment results were measured my a disable meter on my phone. My results indicate that the carpet was the best material of them all.

***MPH129: Float An Egg***

I wanted to determine what salt could do to objects in water. I made a stock solution out of water and salt. Then placed different amounts of the stock into four cups, Cup 5 was plain tap water. Once this was completed, I placed the eggs in each cup. The eggs floated in all stock and 50% stock, I also mixed cup 2 and 3 to make cup 6 which was 37.5% stock. The egg didn't float in cup 6. In conclusion, an egg can float somewhere between 37.5% stock and 50% stock.

***MPH130: Which Gauge of Wire Conducts Electricity the Best at Different Temperatures?***

Question: Determine which gauge of wire conducts an electric current best at different temperatures? Hypothesis: Ability of different gauges of wire to conduct an electric current at different temperatures will decrease as the gauge increases. Procedure: 1.Attach one of the gauges of wire being tested to the thermatron until the desired testing temperature is reached. 2.Calibrate the millimeter. 3.Using the millimeter determine the amount of electrical resistance in the wire at the temperature being tested at. 4.Repeat steps 2-3 twenty-nine more times. 5.Repeat steps 1-4for the remaining gauges of wire being tested. Conclusion: Final results will be available at fair.

***MPH131: Ship Shape***

My project tested how much weight a boat could hold when the shape changed. I used three different shapes, rectangular, circular, and pointed, to test this. I did three trials for each boat shape, dropping pennies into the boats until they sank. I chose to do this project because I like physics. The most successful boat was circular because it had the most support from the sides. If I did this again I would use new shapes and improve the construction of the boats. I learned that density, mass, volume, gravity, and shape impact a boat's ability to carry weight.

***MPH132: Slowing Down Light***

Please visit student's exhibit.

***MPH133: Thermoelectricity- converting heat to electricity***

Purpose: Convert heat directly into electricity with no moving parts or use of machines such as generators.

Hypothesis: If a unit measurement of heat is applied to a thermocouple whose dissimilar metals are held at different temperatures the result will be a direct electric current that can be utilized to produce any kind of work. Procedures: 1. Turn on the multimeter. Set the multimeter to measure in millivolts, record meter reading after each test. 2. For each test check and record the temperature of the variables. 3. Perform tests with each of the 4 variables. 4. The first one will be with the heat produced by the experimenters hand. 5. The second will be the heat produced by a 7 volt/120 watt incandescent light bulb. 6. The third will be the pan of boiling water. 7. The fourth will be the flame from a standard tea-light candle. 8. For each test, record the voltages reached once the multimeter stabilizes. 9. Repeat 3 trials for each heat source.

***MPH134: The Effect of Water Depth on Tsunami Wave Velocity***

Tsunamis are huge waves of water that take multiple people lives each year. My project is meant to find how the depth of the water affects the velocity of each wave. I am going to drop a heavy weight into a small container full of water and take data on the wave depth and velocity. You will see my results at the science fair.

***MPH135: Gauss Rifle: The Transfer of Power***

What can you do with magnets and ball bearings? Why, build a magnetic rifle, called a Gauss rifle, of course! Now, this rifle is not a weapon, but a way for you to learn a lot more about physics concepts, like momentum. In this physics science project, you will investigate how far a ball bearing launched by a Gauss rifle will fly, depending on how many magnetic acceleration stages are in the rifle and the ball bearing's initial velocity.

***MPH136: Working with Wheels***

The purpose of this project is to see if the wheel size affects the speed it lifts mass. 18 centimeters, 14 centimeters, 10 centimeters were the diameters of the wheel that were used to lift the same mass with the same distance. The results were that the smallest wheel was able to lift 5 grams the fastest with an average time of 1.34 seconds. The hypothesis was refuted and the smallest wheel lifted the mass the fastest.

***MPH137: Testing Tensile Strength***

My PRSEF project is to determine the tensile strength of certain things so you know what to make stuff out off. I became interested because I wanted to see which of the objects I am testing could be used to build buildings or bridges. I also wanted to see how a big building can be affected by tensile strength. I will determine tensile strength by stretching things out until their breaking point. I can then determine their tensile strength. I will tie the top of the object to a bar and put a tray with weights on the bottom and add the weights until it breaks. I predict that none of my will take over 20 pounds to break, I think that fishing line will be the strongest because it can pull a big fish. I think that yarn and thread can break pretty easy.

***MPH138: from the foul line***

Basketball is a big sport. My project purpose is to test if it is easier for a boy to shoot a girls ball or a girl to shoot a boys ball.

***MPH139: Does the material affect the distance a paper airplane flies?***

The purpose of the project was to find the material that made the paper airplane fly the farthest. Four materials were tested, scrapbook, construction, magazine, and computer paper, using same airplane architecture. Paper airplanes were launched in a controlled manner and area. The Scrapbook paper flew the farthest, 209.57 cm., the magazine paper with 190.9 cm, construction with 179.124, and computer paper at 181.184 cm. The hypothesis was refuted.

***MPH140: Speed of Light Through Different Mediums***

Please visit student's exhibit.

***MPH141: How the type of fabric affects the speed which an object sinks?***

This project was done to see what fabric allows an object to sink faster. It was done because I am on the swim team and I wanted to see what fabric is the best one to make a swimsuit out of. So it is seeing which one allows faster movement in the water. What was done in this experiment was I coated an object in 5 different fabrics and then dropped them in a graduated cylinder and timed it to see which one allowed it to sink faster. The five fabrics I used were neoprene, polyester, cotton, rubber, and nylon. The neoprene was thought to sink the fastest. When the experiment was done the neoprene was the fastest

***MPH142: Which Glue Is The Strongest?***

In my project I was testing how strong 3 types of glue could be with 3 different types of wood. Using a come-a-long I pulled apart the wood and measured in kilograms the amount of force it took to pull apart the wood. In conclusion my hypothesis was incorrect on types of glue but was correct on the type of wood. The Titebond and Oak held the best not the Gorilla and Oak wood

***MPH143: How to bike faster for dummies?***

Introduction: In my experiment, I determine the best way to increase speed on a bike with various upgrades. I tested this with five different upgrades, a lighter bike frame, aerodynamic positioning on the bike, clip-in bike shoes, racing wheels and tires, and drafting. So for those who race in cycling and multisport, you can find out the best upgrade to spend your money on. Problem Statement: My question is "Of the various bike variables and factors, aerodynamic positioning, racing tires, drafting, clip-in bike shoes, and bike weight, which one gives the best performance increase, so you know how to spend your money." Procedures: In order to prove or disprove my hypothesis and answer my question, I needed to complete the test. During every test except one, I strapped a 5 pound weight to the frame to simulate a heavy bike. The first test was the baseline test with no upgrades. The second test was the lighter frame test in which I took the weight off, but used no other upgrades. The third was the aerodynamic positioning test where I had to get in a more wind resistant position on the bike. After, came the clip-in test in which I used special cycling shoes that clipped in to the pedals for more pull. The fifth run was the aerodynamic clothes test where I wore more wind resistant clothes. Lastly, I did the drafting test where I biked behind someone else, deflecting most of the wind. I then collected data and analyzed results. Results: In my experiment, some upgrades were more efficient than others. In order from most improved to least improves follows as: clip-ins, drafting, aerodynamic positioning, aerodynamic wheels and tires, aerodynamic clothes, and drafting. Conclusions: Results of my experiment tell me that my hypothesis was correct. The best upgrade in speed is clip-in bike shoes.

***MPH144: Sound Reduction: Absorbing Acoustic Waves***

The purpose of my experiment is to determine what type of insulating material has the best acoustic insulating properties in building walls. To conduct my experiment I will build a small test wall using 2"x4" lumber and drywall, place a speaker on one side and a decibel meter on the other, and place different types of insulation in the wall. I will play sounds to record the amount of sound that passes through the wall. To reduce outside noise, the entire lab will be covered. Testing has not begun, but results and conclusions will be drawn when testing is complete.

***MPH145: Mix It Up***

Concrete is made from natural earth material. It is durable in liquid form, it can be formed into any shape and thickness. Concrete dries rapidly in higher temperature with dry air. The constant use of these materials will in time result in lose in these natural resources over time. It can also lead to old used concretes occupying space on our planet. It is non biodegradable. If concrete can be recycled less natural resources would be used. This investigation looked at the possibility of recycling concrete. Recycled concrete was pre broken down at the concrete plant and brought back to my house to make a 100% regular concrete, 100% blend of recycled concrete, and a 50/50 blend of recycled and regular concrete. During and after the investigation I discovered that the 100% blend of concrete was the strongest and the 100% blend of recycled concrete was the weakest. The results of this investigation disapproved the hypothesis. This would indicate that concrete is similar to plastics and other non biodegradable. Since concrete can be broken perhaps we can find other ways to reuse this materials.

***MPH146: Recharged***

The purpose of my experiment was to find out which brand of rechargeable NiMH AA battery lasted the longest. The batteries tested were Rayovac, Energizer, Duracell and Amazon Basics. To do this, each battery was used to light a bulb, and voltage of each battery (four each) was measured over time, out of the box and after two recharges. My data showed that Energizer lasted the longest (7.7 hours) and improved after each recharge, compared to Rayovac (6.8), Duracell (6.6) and Amazon Basics (6.5). The data also showed that Rayovac was the most cost effective battery.

***MPH147: How To Win The Checkered Flag:How Do Gases Help?***

Please visit student's exhibit.

***MPH148: Under Pressure***

This experiment is to see if different 3-dimensional figures hold different amounts of weight. To test this I built a triangular prism, rectangular prism, cube, and a semi cube, and placed a plastic container holding sand on top of them. If they couldn't hold the weight I recorded that they held 20 grams. If they did I poured sand into the container until it collapsed and recorded that weight. The results of this experiment were the semi cube held the most with 73 grams, triangular prism with 61 grams, rectangular prism with 39 grams, and cube with 20 grams.

***MPH149: Buoyancy***

I plan to show the different buoyant forces(Positive, Neutral, and Negative) with three different examples.

***MPH150: Chaotic Order: A Study of Entropy***

Entropy is defined as a level of disorder in a situation. In my project, I experimented with entropy and it's attributes. One of the particularly interesting parts of these is that the world is always gaining entropy, meaning it is getting more and more disordered. This isn't true, however, if there is a constant positive force pouring towards low entropy. I recorded my results from a randomized situation of dropping identical blocks. The results I got were interesting, and went against some of my predictions. These situations also related to chaos theory, because even after dropping the blocks identically, they still changed every time.

***MPH151: Storm the Castle***

The purpose of my experiement was to test if anrm legth woul have an effect on the distance the trebuchet threw. I proved it by making a base with the capability to switch the arms outm then I used a rag to make a cloth bag. Next I used string to tie it to the arm and added a bent nail for a release trigger, Kast I launched a tennis ball multiple times with each arm, It proves my hypothesis. Th 40 inch arm did have the longest average distance.

***MPH152: Stretch It!***

Do rubber bands really react unexpectedly when exposed to cooler temperatures? The purpose of my experiment is to find out. The procedures for this experiment are: a rubber band is set to stretch for five minutes in room temperature, in a refrigerator, and while being heated with a hair dryer. After each step, the rubber band's length will be measured. The averages of my results are: room temperature (control), 20.6cm, chilled, 22.8cm, and heated, 21.3cm. In conclusion, my hypothesis was correct. The rubber bands expanded when cooled.

***MPH153: Does Ball Inflation Affect Distance?***

My project was about how much air is to put inside a soccer ball. I found out that you should use a 7.9 PSI. I also found out that weather does play an effect on the ball. If it rains or it snows the ball can get harder to kick the ball and the ball won't go as far as if it wasn't raining or snowing outside. My project doesn't really change how you do anything in your regular day but it suggests how much air to put inside of a size five soccer ball.

***MPH154: Jello Light***

Can you imagine a world where traveling the speed of light is possible? The purpose of my science fair project was to find if the speed of light could be slowed. Scientists can invent high powered lasers or night vision goggles that can greatly improve the way we see our world from results of the experiment. I solved that light can be slowed down and it is possible to do this with common equipment. My approach was to be effective and precise in completing the experiment. I found that the speed of light in gelatin is 19% slower than air.

***MPH155: Natural Materials V.S. Kevlar***

The purpose of this project is to help the common person make a cheap, disposable bulletproof vest. In today's violent society it is imperative that the common man protects himself against any random bullets being shot. The vest made out of aluminum is going to be shot. The vest out of nylon-rope will be shot. Then, both of the vests will put together to see if any of them would work as a bulletproof vest. The vests were shot with the .22 caliber handgun from -6.1 meters. If the bullet went through the material it would not work as a bulletproof vest. If it dents or totally stops it, a bulletproof vest has been made. The results prove that neither the aluminum or the nylon-rope would work as a bulletproof vest, however if you put them together it would stop the bullet. If this investigation were to be repeated, using a more powerful gun would be investigated because guns tend to be more automatic.

***MPH156: Is the target material affected by the penetration of a bullet?***

The purpose of the project is to gain a better understanding of the ballistics of bullets which will help educate emergency personnel. The information can be applied for better training and equipment.

***MPH157: Which Helmet Protects eh Best***

Purpose: The reason this experiment is important because it shows how effective the helmets we are using to protect our head are. Procedure: Put accelerometer in mannequin head. Put football helmet on head. Drop wait on helmet six times. Do same thing with three other helmets and head with no helmet. Data: Football: 9.8 meters per second, Baseball: 28.43 m/s squared, Bike: 32.3 m/s squared, Ski: 30 m/s squared, No Helmet: 52.85 m/s squared. Conclusion: My hypothesis was right the football helmet did the best.

***MPH158: Pipe Up the Volume***

Did you ever want to have a speaker but not have to pay a hefty price? Well, I attempted to make an iPhone speaker using PVC pipe for under five dollars. Then, I wondered which size PVC pipe would make the loudest speaker. If you want to find out what size PVC pipe is the loudest come to see my project at the science fair.

***MPH159: Mason Jar Madness***

The purpose of my experiment was to look at the differences in energy absorption of light energy between light colors and dark colors.

***MPH160: Ice Breakers***

The purpose for this experiment is to see in which liquid ice melts the fastest. These liquids include Sprite, Coke, water, Motts apple juice, and milk. For my experiment I poured 100 mL of each liquid into a glass and dropped ice cubes of the same size into each of the liquids. I timed how long it took to melt each ice cube and recorded this data. The hypothesis was that the Coke would melt the ice the fastest because it is carbonated, has a lot of calories and contains many ingredients such as caramel color that will affect the time. In conclusion, the water was the quickest liquid to melt the ice. This is because the water's process of heat transfer was smoother and quicker. The hypothesis of coke was not supported.

***MPH161: Can these special objects Block WiFi?***

WiFi transmits data over short distances at a high speeds using radio waves. This experiment was conducted because, I wanted to know what objects can block WiFi. An object blocking WiFi depends on what the object is made out of. If an object is dense the more that object will block a WiFi signal. The objects that will be being used are are a wooden box, a plastic box, cardboard box, a t-shirt, a blanket, and a bath towel. These objects will be placed in front of the WiFi router. Then take the signal strength of each object for five trials.

***MPH162: Wind Turbines Blade Length and Its Effect on Voltage Output***

The purpose of this project is to inform people on what length of wind turbine blades give out the most power.

***MPH163: How will banana bread bake in different pans?***

The purpose of this experiment was to find out if banana bread bakes differently when in different materials. The materials I chose were different types of pans. I chose silicon, glass, ceramic and metal (aluminum). The bread was baked for one hour and fifteen minutes. At fifteen minute increments, I stuck an instant read thermometer in the middle of the pan while it was baking and recorded the temperature for my graph. I measured the temperatures in Celsius. Whatever pan reached the temperature of (98.6 degrees Celsius) would be the best conductor. At the end of the experiment, the metal pan was the best conductor.

***MPH164: Investigating Light Intensity***

My project was investigating light intensity. The purpose of my experiment was to see how the light intensity of five different colored light bulbs was affected by distance. My procedure involved me to be in a darkened room, with a vernier light sensor, recording the intensity of the colored bulbs from many set distances. My data showed that as the distance increased, the light intensity decreases, with the darkest bulbs being the least intense.

***MPH165: Solar Panel Power***

The purpose of my experiment was to show how environmental factors could affect the power output of a solar panel. If the solar panel isn't producing its rated power, it could have a negative effect on the electrical grid. The experiment was performed by changing the angle of the light source as well as adding increasing amounts of water and dust to the surface of the panel. The angle of the light source and the amount of dust had the greatest impact on the power produced by the panel, while the addition of water had very little impact.

***MPH166: Masses Affect on Velocity***

The experiment is to determine if the mass of a bowling ball will affect the speed the ball travels down a bowling lane. Place a weighed bowling ball atop a ramp, when the ball hits the lane start timing, than when the ball hits the head pin stop the timer. Repeat the steps for 4 other bowling balls 5 times. This experiment proved that the experimenter hypothesis was supported because the lightest mass was the slowest. The 3.5 kilogram ball traveled 2.4 meters per second. The 6.4 and 7.3 traveled 2.7 meters per second

***MPH167: Who's in Charge***

Purpose of the experiment was to determine an Amazon Fire tablet's charge and the most effective charger. Information was gathered when measuring electricity and the USB cords of each charger. Each Amazon Fire tablet started at 0%, charged for 30 minutes, and power levels recorded before and after 15 minutes of use. Results: Samsung charger was the most effective. On average, the Samsung was 23.4% faster at reaching a full battery associated with the LG, at 13.8%, HTC at 13.2%, and Amazon Fire at 14.7%. In conclusion, this experiment showed the differences in percentages in chargers with the same voltage.

***MPH168: Just Shoot It***

Have you ever wondered if a damaged or missing fletchings will affect the way an arrow flies? The purpose of my experiment was to find out if damaged and missing fletchings would affect the precision of an arrow. I predicted that if I damage and take fletchings off it will have a very little effect on the arrow. I proved that damaged and missing fletchings has very little effect on an arrow's precision. However, it did change the flight of the arrow and the way it hit on the target and the entry holes.

***MPH169: The Perfect Shot***

The purpose was to see which angle of an 180 degree, 90 degree, and 45 degree angle is the best to score the perfect basketball shot. I took 10 practice shots from 180 degrees, and then I had my five participants each shoot the ball ten times from all three angles. The 180 degree angle had the most baskets made. I thought that the 90 degree angle would have more because it was straight in front of the basketball hoop.

***MPH300: Batter Up***

Our experiment proved which type of bat would hit a ball the furthest. We think our experiment will be helpful to baseball players looking to buy a new bat. We decided to see if an aluminum, composite, wood, or corked bat would hit the ball the furthest. We also decided the most fair way to test this question was to hit the balls off a tee. We found the aluminum bat hit the ball the furthest, followed by the wood, corked, and composite bats. Our experiment will help baseball players decide which bat is best for them.

***MPH301: Dancing Water***

The purpose of this project is to figure out if sound waves can move the polar molecule of water. To figure out if our hypothesis that water would move when sound waves were played, we added different amounts of water, ranging from 2 to 12 cups to a large container and played the sound at 111 Decibels. We found that the sound waves moved the water 3mm with 2 cups, 8mm for 4 cups, 5mm for 8 cups, and 7 mm for 12 cups. To conclude, our hypothesis, that the water would move, is correct.

***MPH302: Better Punt: Rugby Style versus Drop Kick***

Most NFL kickers now kick rugby style for distance; however, is it better than the traditional drop kick style? This experiment will test out the two kids and decide which style actually causes the football to go further.

***MPH303: Fall Like Dominoes***

The testable question, how does the spacing between dominoes affect the speed? The hypothesis, if the time of the dominoes falling relies on the spacing then the dominoes will go through the course faster when there is no space because there's not that much air resistance acting on the domino that was pushed compared to if the dominoes were spaced further apart. The experimental design is to set up 10 dominoes in the amount of spacing using a yardstick, and use a stopwatch (or anything that has a timer on it) to time from the start of the push (tap 1 of the dominoes to start the chain reaction) to when all 10 dominoes falls. The results were as expected, the shortest spacing will have the faster.

***MPH304: Charging an iPod with Pineapple and Water***

In this experiment, we were trying to see if we were to get a charger and put it into a pineapple in cold water, would it work, and the answer is no. Can fruit produce electricity? We wanted to see if there are other ways to charge my phone. To find out, we plugged my iPod connected to a charger into a pineapple in cold water, but it did not charge. In our research, we learned about conductors such as metals. Using metal with my fruit would probably have helped create an electrical current which could have charged the iPod.