79th Pittsburgh Regional Science & Engineering Fair

Senior Division

Student Project Abstracts

March 23, 2018

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: S – Senior Division (9th through 12th grade)
- YY: Category Name
  - BS – Behavioral and Social Science
  - BI – Biology
  - CH – Chemistry
  - CM – Computer Science and Math
  - 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)

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Behavioral and Social Science (SBS)

SBS100: Is Green Really That Lucky?

Studies have shown that color is the most important factor in advancing leaning capabilities. Through my research, I have decided to test this theory by providing second year high school students with a piece of material, each line highlighted in either red, green or blue. I will allow them to study this material for twenty minutes and then give fifteen minutes to answer a battery of general knowledge questions surrounding the material. If my study goes as others have, the material in red should be lowest, the green should be highest, and blue should be neutral in score.

SBS101: Teens and Decision Making: The Choice Is Yours, Or Is It?

For my project, I will study human behavior, specifically decision making amongst teens. Social scientists have observed that teenagers' personal preferences are influenced when they are placed in a group with friends. I hypothesize that if people are asked-- while in group setting-- questions of personal preference, then their answers will be more homogeneous than if the same teens were to be asked about preferences while in an individual setting. To test my hypothesis, I will make a survey where people are asked personal preference questions based on pop culture such as: What is your favorite singer? What is your favorite sport…? They will then answer by choosing one of four pictures with a brief caption underneath. Half of my participants will take the survey individually. The other half of my participants will also take their own survey, but they will be permitted to discuss the questions in groups of five. I will repeat my experiment with many different classes in many different grades at my school. I will perform the experiment with at least 100 subjects. I will then compare the diversity of the answers between the surveys taken in groups and the surveys taken individually. If my hypothesis is correct, there will be a larger variety in the surveys in the individual setting, and more homogeneous answers in the group setting.

SBS102: Fake News

Today the mainstream media is being accused by President Trump of using fake topics and changing data. My experiment test how test subjects answer questions about changed graphs and data. When each subject was tested as the data and graphs were changed more and more each group did worse and worse. Some ways the data was changed was by using colors that are similar and using not needed data on a key. I would like to further my experiment by using more test subjects and using different ways to change and distort data.

SBS103: How Inattentional Blindness Varies by Gender

Cell phone distraction is a growing problem in today's society, and this can be attributed to inattentional blindness. I wanted to see which gender was less likely to be distracted while on a cell phone. To do this, I had students walk one lap with and one lap without a phone to determine speed differential while vs while not on a phone. Once 24 people had completed the experiment, the results were averaged by gender. In the end, females were faster than males while on and off a phone, rejecting my hypothesis.

SBS104: How Stress Effects the Body

I will study how stress effects the body. I will check the body temperature and the pulse rate of the participants. I will then administer a test,and after the test i will check the temperature and pulse rate again to see how stress effected the participants.

SBS105: The Effect of Foods on Hissing Cockroach Maze Completion Time

Organisms are driven by the need for food. This project aimed to observe the food preference of hissing cockroaches when exposed to aromatic (apples) vs. nonaromatic (carrots) foods. Eight cockroaches were split into two groups of four, two females and two males. They were fed plain oatmeal prior to the experiment. A maze was designed for them to run through, testing how much time each took compared to the other. Trial was terminated if not completed within ten minutes. Out of eight, five cockroaches were excluded. The conclusion was that the carrots attracted more attention based on time of completion.

SBS106: Genre of Music Affecting Sleeping Patterns

The purpose of this experiment is to see if music has an effect on people's sleeping quality and length of sleep. If my experiment works, this will let people with sleep insomnia or stressful sleepers to sleep better. My hypothesis is if listening to rock, pop, country, rap, and classical while sleeping, then classical music while help keep someone in a deep sleep longer throughout the night. I will collect data by using a sleeping monitor and mark the time in deep, awake, and restless sleep. I am expecting the classical music will work the best. Results will be available on fair day.

SBS107: Generations and Social Justice

The purpose of this investigation is to see if there is a difference in how generations judge individuals who committed a crime, based on the individual's race, sexuality, etc. The hypothesis of this experiment is, if a millennial were to take a social justice survey, then they would be more just than an older generation. The first step is to make a survey consisting of the same crimes, but with different individuals (race, sexuality, etc.) committing the crime and a list containing different punishments. Then, have participants from four different generations (Silent, Boomer, Gen X, and Millennials) take the survey. Finally, the results would be recorded and analyzed. Results will be available at the Student's exhibit on Fair Day.

SBS108: The Color of your Feelings

The purpose of this experiment is to identify correlations between emotion and color. There is a common psycho-sociological association between color and emotions, such as yellow and happiness and blue with sadness. Hue, saturation, and brightness are the three variables that make up color and I will arrange 42 different color options for participants to choose that vary in hue, saturation, and brightness. I will be asking participants to watch a series of videos and record their emotional response, as well as the color they associate with the clip from a list of 42 available colors. I anticipate that I will receive results indicating no correlation between color and emotion exhibited by media watched.

SBS109: Introverts Vs. Extroverts

How does an individual's place on the social spectrum correlate with their academic ability? The purpose of this experiment is to determine if introverts or extroverts perform better in the classroom, and to observe the reasons why this is so. The methods that will be used will be as follows: In-class observations, ethograms, recordings of interactions, collecting outside information, surveys and personal interactions. The predicted results of this experiment are that the extroverts will be more successful with assignments that require group work and open discussion, while the introverts will excel with an assignment that is calmer and requires less interaction. This study will also hopefully help debunk some stereotypes about either groups (introverts are not antisocial, extroverts are not chatter boxes). The hypothesis for this experiment will be supported and used through the processes and will be applied to each experiment.

SBS110: Music and the Mind

This project tests the effects of different music genres on a student's test-taking abilities.

SBS111: Effects of the Uncanny Valley Theory on Learning with the Implict Association Test

In the face of ever-developing technology, the field of human-robot interaction has become paramount. As robots become integrated into daily society it is important for consumers and producers to create products that are appealing and functional. The Uncanny Valley Theory, a concept identified by the robotics professor Masahiro Mori, states that as the appearance of a robot is made more human, some observers' emotional response to the robot become increasingly positive and empathetic, until it reaches a point where the image is humanoid; the response quickly becomes strong revulsion. However, as the robot's appearance continues to become less distinguishable from a human being, the emotional response becomes positive once again and approaches human-to-human empathy levels. This experiment aims to answer the question: Is information learned better from a robot with a robotic, intermediate, or humanoid appearance? Hypothesis: Because of the revulsion associated with the humanoid appearance, participants will remember fewer words as compared to those faced with a robotic, of human appearance. Participants will be posed with an Implicit Association Test (IAT) with images ranging from robotic to humanoid. Then, participants will be given five minutes and will be asked to recall as many of the sixteen words as they can. Statistical analysis will be used to evaluate the data.

SBS112: Are there quantifiable characteristics of popular songs?

Popular songs can be linked to memories of time and place. Popular songs may share some commonality in regards to their lyrics, chords, and rhythm. The proposed project will investigate potential similarities within top popular songs. This will be done through the use of different applications which will help to analyze the chords in each of the songs.

SBS113: Am I Beautiful Mommy?

They say that beauty is on the inside but does the outside really not matter? I surveyed 50 males and 50 females individually on what is physically attractive and if any of their friends fit their definition of beauty. My hypothesis was that most people's friendships will be with people who match their definitions of physical beauty in some way. The data summary is available on competition day. My experiment had shed some light on how beauty actually affects human relationships.

SBS114: Memory Mnemonics

The title of this experiment is “Memory Mnemonics and Its Effects on Memory”. The category of the experiment is behavioral and social science. The purpose of the experiment is to test whether memory mnemonics will help a person to better memorize a list of words. Two word lists were made for the control and experimental groups. There were 6 experimental and 7 controls. The control group had a better outcome and the hypothesis was not supported

SBS115: The Prisoner’s Dilemma: Testing Human Ability to Cooperate

I examined the cooperation of children in prisoner’s dilemma scenarios across 4 factors: school level, gender, math level, and time of communication. Elementary and high school students were given scenarios in pairs which they could gain prizes by indicating cooperation or refusal by writing their action on a slip of paper. Students personally gained more prizes by refusing to cooperate, but were overall better off if they both cooperated. Using a chi square test, the factors of school level and gender were shown to be statistically significantly associated with cooperation, with elementary and female students more likely to cooperate.

SBS116: Are You Lying?

In most movies, police interrogations are done under a bright focused light.The focus of my project is to determine if light intensity affects a person's propensity to lie. I will be asking people a series of questions while holding a heart rate monitor under different lighting conditions. I will examine their respective heart rates to determine which environment produces the most lies.

SBS117: Are Smart Phones Making us Dumber?

The purpose of this experiment is to see if there is a link between IQ and how often a person uses their cell phone and also to discover if there is a link between IQ and what people use their cell phones for. Hypothesis: There is no connection between IQ and cellphone use. People who use their phones frequently for social media apps and mobile gaming will have lower IQs than those who spend their phone time for other purposes. Procedure: Participants will download an app called “Moment” to track their phone usage each day for two weeks. They will then fill about a short survey about their phone use over the two week period. The participants will then take an IQ test. Results of this study will be available on the day of PRSEF.

SBS118: Did Anyone Call For An Accident? Distracted Driving

The researcher will test some of the different distractions that can be associated with driving. They will have participants play the video game “Mario Kart Wii” while exposed to the distractions of holding and talking on the phone, talking to others in a car, texting, eating and drinking (simulated), listening to the radio, and, as a control group, will not be exposed to any distractions. The researcher will be collecting their body language before/after each test, completion times of each test lap, and the amount of wrecks the participant endured during each distraction while playing the game. The researcher will have the data they have collected at the science fair.

SBS119: Distracted Driving

The purpose of my investigation is to determine how easily it can be to get distracted while driving. The researcher will bring in a group of volunteered participants, and ask them to play mario kart. The participants will individually have to play three trails of Mario Kart. One with no distractions, the second with texting and driving and the last with drinking in driving. Every time the participant crashes will be recorded. The researcher will record the results in a data journal. Results will be available on competition day.

SBS120: Perception Versus Reality of Teenage Cell Phone Use

The amount of time teens spend on their phones in a day becomes an increasing issue over the years. This study looks to see if teenagers understand how much of their day goes towards their phones. A sample of high schoolers were asked before the experiment began, how long they believe they spend on their phone during a typical school day. The participants downloaded an application called “Moment” to track their screen time for a week. While many students underestimated the amount of time they spend on their phone, an equal amount overestimated their time.

SBS121: The Center Stage Effect on Decision Making

The center stage effect is a belief that people tend to choose a center display among three options. This experiment explored this hypothesis among different genders in the following age groups: 5-16 years, 17-28 years, 29-40 years. Chi square data analysis revealed that in most groups a center stage effect did occur. Males and Females of every group did not appear to vary in this bias, nor did age appear to play a role.

SBS122: Did You See the Chicken?

The project that the researcher plans to do this year is to test children (ages 5-6), teenagers, and adults and see who has better selective attention.The researcher will show both groups a video of people jump roping and the participants are to focus on how many times a person jumps, then a chicken will walk in the background to see if they notice it, or if they are focusing on the jumper’s feet. I will use some faculty members for my adults, the middle school students and high school students for my teenagers, and the kindergarten class for my children. I will test 25 people in each age group. Data will be available at the competition.

SBS123: The Politics Behind Violence

For many, the idea of a peaceful society seems unachievable. The National Partnership to End Interpersonal Violence (NPEIV) is a non-partisan effort to prioritize the prevention of violence within communities and on a national scale.While working with Dr. Pearl Berman of IUP’s Psychology Department, my objective will be to test the correlation between the NPEIV and America’s current division through surveying those in my community about their political affiliation and response to the partnership. The data I collect will provide a better understanding of how the everyday person perceives attempts at violence prevention.

SBS124: Comparing Online Tests and Written Tests

As education becomes more digital, the question comes up as to whether or not there is a change when going from traditional education to online education. My project looked specifically at the testing aspect of education by comparing online and written tests and also looking at whether age has any effect on this. After testing 80 participants, the results suggested that the adults did better than the students on both versions of the test. However the students did better on the written test than they did on the online, but the adults did better on the online.

SBS125: How Fast Can You React?

The researcher will perform an experiment to see if using a cell phone will affect reaction time. The researcher believes that if a person is using a phone, then their reaction time will increase by a significant amount. The researcher will collect data by finding the average, in milliseconds, of the participants reaction time both with and without the cell phone. To use another data set, the researcher will also count how many letters/characters that are typed while taking the online test. Data will be available competition day.

SBS126: Investigating Predisposition in Crimes

The purpose of this investigation was to determine whether predisposition affects a crime in which the defendant was convicted to a sentence. The researchers hypothesis was that the African American males will be sentenced more harshly than the Hispanic and Caucasian males. To investigate, the researcher arranged forty five students to watch three videos of an African American, Hispanic, and Caucasian man committing the same crime (stealing phones from stores). The participants were asked to identify the crime the defendant has committed, and to select an appropriate sentence range. By doing this, the researcher was able to identify if predisposition affects crimes. The researcher will have the results made available on competition day.

SBS127: Pandora's Box

In my project “Pandora’s Box” I believed that if I put a box with “Do Not Open” on it in a populated hallway then the male gender will open the box more. First, I would gather all materials such as the box,camera and, table Secondly, set up the box in hallway 1 and camera. Third, let camera record for 2 days in hallway Fourth, repeat steps 2 and 3 in hallway 2. Fifthly, I would review the cameras. Finally, record the data. My data summary will be available on competition day.

SBS128: Watch Your Step

The fitness movement in America began in the 1920s. Dieting and exercising were thought to be key parts of a healthy workout regime. It was not until the 2000s that walking was seriously considered as a beneficial workout. Walking 10,000 steps everyday can burn up to 2000-3500 calories, approximately one pound. People use fitness trackers, like the Apple Watch, to track their daily progress and monitor heart rate. In “Watch Your Step” I tested the accuracy of the Apple Watch step counter, and determined that the Apple Watch has a 6.50% error, making the Apple Watch a reliable tool.

SBS129: The bystander effect as a function of age

This experiment dealt with the psychological phenomena of the bystander effect and tested freshmen, sophomores, and juniors in high school. I tested the bystander effect as a function of age. To test this I went into classrooms where these different grade levels were being taught, dropped books, and recorded the number of students that assisted me during the staged situation. My hypothesis was that freshmen would help me the most, but to my surprise this group helped me the least. It was actually the sophomore class that helped me the most, with 20% of the tested students helping me. The junior class was the second highest with 10% of the tested students helping me. The senior class was not tested because I am a senior and that may have created bias since everyone knows me.

SBS130: The Mandela Effect

In my experiment I will be showing my classmates a slideshow of two pictures, and they have to pick what one is right. They will be picture examples of the Mandela effect. The Mandela effect is the observed phenomenon of people having clear memories of events that did not occur or misremembering significant events and facts. I will be testing to see if kids that take art class are more observant than kids that don’t take art class.

SBS132: In the Room...

Battle of the sexes is a debate that gets spread across many different topics. While some try to argue there is no different above the shoulders, others do not agree. One's memory is used everyday in order to do simple functions, such as brushing one's teeth, getting dresses, or writing anything. The purpose of this experiment is to determine whether high school boys or girls notice more items in a room, and who will have more detail in the responses. The prediction is that high school females will be able to recall more items from the room in detail than the males because females tend to be more perceptive in their way of thinking, making them more likely to notice things. TO do this experiment, an unused room is needed. Have a participant sit in the room for two minute. Participants must be unaware of the research question in order to keep results unbiased. After two minutes, ask the participant to step out of the room and ask them to recall everything they can remember from the room in the greatest amount of detail they can provide. Repeat this for every participant. To draw conclusions from the data, first compare the total number of responses, putting the data into mean, median, and mode form for each gender. To compare the amount of detail used, divide the number of adjectives the participant used by their total number or answers, and convert this number into a percentage. Use this for each participant, and then find the mean, median, and mode for each gender. The final results will be available at the exhibit on Fair Day.

SBS133: Artistic Expression and Refugees

Why is artistic expression important to society, and why do some governments reject it? Should America play a role in artistic expression in the world and help refugees? My project will seek to illustrate the importance of artistic expression in a society and describe the modern history of refugees. Due to the fact that this is not a project involving an experiment, most of my information will be obtained through research. Books and journals will detail the majority of my data, but a large part of my paper will also be from interviews. Real life examples of people who have been exiled from their home countries will be a great addition to my project because they will provide a more human element to my paper.

SBS134: Stress and Free Time in Teachers

Studies about the stress of teenagers are very common, but what about the people who teach them? This experiment focuses on the stress-levels of high school teachers, and how their stress levels are affected by the amount of free-time they have, and more specifically how they use it. A survey was administered to approximately 37 educators, and their responses were recorded and studied for patterns. From the responses, the majority of teachers are on the higher stress-level spectrum, and 64.9% admitted that they spend most of their free time on technology (watching television).

SBS135: Analysis of the Influence of Gender In Corporate Campaign Finance

The purpose of this study is to investigate whether women hold significant influence in the upper echelons of corporations in federal election campaign finance — one of the most influential forces in American politics. Therefore, this study will analyze the impact of gender in both the corporate and political spheres of America. Data will be set up by investigating all members of the United States Congress elected in the biennial elections (2010, 2012, 2014, 2016 for the 112th, 113th, 114th, and 115th Congresses, respectively) after the Supreme Court case Citizens United vs. Federal Election Commission significantly loosened federal campaign finance laws. Political data will include election year, candidate, political affiliation, state, district (if U.S. Representative), and whether the then-candidate was elected to the U.S. House of Representatives or U.S. Senate. The top five donating corporations to each candidate will be recorded using the Center for Responsive Politics and Federal Election Commission databases. The top five executives from each corporation at the time of campaign donation will be recorded using databases such as Execucomp, Lexis Nexis, and the Wall Street Journal (current), along with the executives' genders and specific positions. Data is currently being collected.

SBS136: Rock On or Rock Bottom?

Why do people listen to music during important activities? The purpose for performing this experiment is to find out if listening to music can affect a person's ability to concentrate. The researcher tested the hypothesis that if a middle school student listens to music while taking a test, then they will answer with more wrong answers than if they take the test without music. Using a test made by the researcher, middle school students were given two different versions of the test. The first one was taken in silence and the second one was taken with music playing. The researcher recorded how many questions the students missed on each test. Results will be available on fair day.

SBS137:. Are you uncomfortable yet? Habits and how they form

Social habits are cues for others in a group of peers. If you laugh and look at someone it means that you feel that they are the leader so you are watching for their example. Testing to see if social cues and group habits can be introduced and absorbed by others in the group in a short period of time is the basis of the experiment. Test groups will be random or groups that have common interests. Inserting small basic habits into the group this will be observed over several test groups including age, gender, and social groups.

SBS138: Gender Stereotypes: Past or Still Present?

My purpose for this experiment is to figure out if gender stereotypes improved or not. In the past, (more like in the 1920's) a lot of people were very stereotypic over the topic of gender. Women stayed at home, cooked and cleaned, while men were the bread winners and worked. Now women are working and doing just more than just cooking and cleaning. Although there are jobs for that purpose like being a chef and house-keeping. Men wear makeup and are stay at home parents as well. Needless to say there was a huge change. I'm trying to figure out if we are still stereotypic or not. I believe we did change. I believe that we are not as stereotypical as we were before in the 1920's. Procedure: Gather participants. I chose 36 participants. The participants should be from middle school to adult hood.12 for each category of age. 6 will be girls and the other 6 will be boys. Figure out your questions for 4 parts. Scenarios, jobs, yes or no questions, and statements. The last part is asking them what their job is or what they want to be in, tell them if it is either a girl or boy job and write down their opinion. Take your participant to a quiet room and start asking the questions you figured out. First ask them your scenario questions (ex. Jamie was in the police academy but when the given oppurtunity to dance with the ballet company, the police academy was put on hold). Write down whether they think you're talking about a girl or a boy. Next do your jobs. Pick out 9 jobs. Give them the name of the job (ex. Police officer) and ask them which gender do they think of when you say that job.Write down what they say. Then do the yes or no questions. Ask them a simple yes or no question (ex. Is it ok if girls play football?) adn write down their answer, being yes or no. Next, do your statements. (ex. I like the colors red and blue) Write down whether they think you are talking about a girl or a boy. Finally, ask them what their job is or what they want to be. Write down their job or what they want to be and then tell them if that job is considered a girls job or a boys job. Write down what their opinion is or if they are offended. Then analyze your results and figure out if people are still stereotypic of gender. The final results will be available at exhibit.

SBS139: How did non-voters impact the 2016 election?

The purpose of my research is to determine and analyze how non-voters impacted the 2016 election. In order to perform my research, I will be analyzing different demographics of both voters and non-voters. Some of these demographics include races, genders, age group, income, etc. I will use these numbers too measure how non-voters changed/impacted the election. I will also analyze this data more specifically in key battle ground states. By performing these methods, I will be able to come to a conclusion for my project.

SBS140: Does Screen Time Affect Sleep?

The purpose of the experiment is to determine how the blue light given off from electronics will affect the sleep cycles of teenagers. If teenagers use their electronics before going to bed without protection such as blue blocking glasses or night shift mode, then their sleep cycle will be more restless. On the first night, one participant will wear blue blocking glasses, one will use night shift mode, one will not use their device, and one will use their device as normal before bed. The participants will rotate through the steps until each participant used each method a total of three times. The participants will wear fit bits to track their sleep and the data will be collected and available on competition day.

SBS141: Who Likes What?

Learning Style Tests are often used to determine how someone learns. Some learn best by listening to the information being told to them while others need to read it for themselves, and some need to touch and do it for themselves to be able to truly understand what is being taught to them. These descriptions represent the auditory, visual, and tactile styles of learning, respectively. These tests can be taken by anyone online with accurate results. Many of the tests are around 20-30 questions, but some may be longer or shorter depending. The test used for this experiment was 20 questions long. The problem question for this experiment was, “Is it possible to predict what someone likes to do based on how they learn?” Once the experiment is conducted, the following hypothesis will be assessed: “Based on how a person learns, it is possible to predict what they like to do.” The null hypothesis for this experiment is: “How a person learns does not affect what they like to do.” To conduct this experiment, first find a learning test to use to find out the test subjects’ style of learning. Then, create a survey where subjects check boxes the boxes with the activities they like to do. Activities should correspond to a certain style of learning and each style of learning should have 12 activities that correspond. Next, have all subjects first take the learning style test. Record their style of learning. Afterword, have all subjects take the created survey. Record results. Write down predictions of what each subject likes to do based on the activities that correspond to the subjects’ learning style. Compare predictions to the results of the created survey. Analyze results. The final results of this experiment will be available at the 2018 Pittsburgh Regional Science and Engineering Fair on Fair Day.

SBS142: Library Product Placement

This project tests whether an algorithm can successfully compute a new shelving position for library items that boosts or suppress their circulation as compared to other items. The algorithm used the item’s popularity, target audience, and checkout history to assign a rank. I implemented my system at a local library, and found that my algorithm successfully boosted items with low checkouts and suppressed items with high checkouts. Moreover, moving an item from a low shelf to a higher one increases circulation. Yet, a longer data collection period is needed to confirm these conclusions.

SBS143: Drive React Stay Alive

Do you ever stop and wonder if you could be a better driver if you weren’t so slow? Do you ever wonder if you could save money or save other people by not hitting as many things (animals, signs, trees, etc.) while driving? There many of vehicle accidents everyday and way too many people injured, paying tons of money, or even dying. What most people don’t know is that most of these accidents are caused by not being able to react quick enough in serious situations. The purpose of my science fair experiment is to increase reaction to save lives on the road. I hypothesized if reaction time is tested before and after playing quick games the it’s able to improve. My procedure is as followed, first create a Scratch account then borrow my Scratch driving simulator and space games: -https://scratch.mit.edu/projects/180305222/ (driving simulator) -https://scratch.mit.edu/projects/184003043/ (space games). Third get a Makey Makey connected with car pedals by connecting ground wires with space on the Makey Makey for the gas also connecting another grounding wire to down arrow on the Makey Makey for brake. The next step to take is to make sure Makey Makey is connected with computer by USB. Fith get Scratch up and ready on computer screen. Also be sure to test everything 1st and make sure everything is working. Go to Scratch driving simulator and click green flag to restart & start the testing. Have test subject drive the simulator then record all of their data. Next go to Space Scratch game and have the subject play this 3 times. After record all 3 scores. Go back to driving simulator and have them test one last time and record the driving simulators data. In the final steps you shall; Analyze and compare all data, Make graphing charts that show your results, and Put all of your data on a project board for display. In conclusion with my results of 11/15=73% improved, 3/15=20% not improving and 1/15=7% staying the same, my hypothesis was proven correct.

SBS144: Distracted Driving

Engineers are always looking for ways to make cars safer for the passengers when the car crashes, but for most crashes there's another way to stop the crash before it even happens: get rid of the distractions! An experiment was formed on distracted driving, using the distractions of texting, finding a wallet in a bag, and talking to someone. Each participant took the turn at the wheel of a video game car. The average of all the distractions showed a 7.42 second difference from no distractions. The results shows that distractions affect driving, which supported the hypothesis.

Biology (SBI)

SBI100: The Role of Platelets in Pulmonary Hypertension

Pulmonary hypertension (PH) is a pathophysiological disorder that involves increased pulmonary vascular resistance in which lungs are unable to receive an adequate amount of blood. This leads to a hypoxic (low-oxygen) environment. Platelets have recently been shown to contribute to PH. Their main role in the body is to regulate hemostasis, by forming clots that prevent excessive blood flow. The platelet in PH worsen the disease by causing inflammation and forming clots, known as thrombus, in the pulmonary vasculature. We hypothesize that this thrombus formation is caused by autophagy, which is a process of self-degradation for cell survival. Autophagy may occur in platelets to aid in their proliferation and aggregation. Several protein markers exist in the cells indicative of autophagy. One such protein is light-chain 3 (LC3), which detects the stages of autophagy in the cell. A pharmacological agent, Chloroquine, has shown to affect the autophagy cycle. Chloroquine prevents autophagosomes from binding onto the lysosome, hence, blocking the process of autophagy. In this study, we observed the activity of possible autophagy in platelets, and the effect of the drug Chloroquine on the autophagy cycle. We hypothesized that in a hypoxic environment, platelets are able to undergo autophagy and form thrombi, and we planned to measure this by the presence of LC3. We further hypothesized that in the presence of chloroquine, the concentration of LC3-2 will increase, being unable to degrade since the autophagosome cannot bind to the lysosome. The two main methods that were used were isolating platelets from blood (conducted by my mentor) and running gel electrophoresis samples of platelets to detect the expression of LC3-1, LC3-2, and chloroquine effects. Platelets were isolated and first ran through a gel to determine the number of platelets needed from each mouse and whether or not they were expressing autophagy in hypoxia (by viewing LC3 expression). After concluding that 7 million platelets were required (per well) for each experiment and that autophagy does indeed occur, the effects of chloroquine were tested. For the chloroquine experiment, a control of normoxic mice were used, and mice were placed in hypoxia with and without chloroquine for 24 and 48 hours. A gel was run with the chloroquine hypoxic mice and probed in LC3-1 and LC3-2 antibody to measure any changes. From this two-part study, we concluded that autophagy does play a role in activity of platelets, and therefore in pathogenesis of PH. We concluded this because we viewed the expression of LC3 in hypoxic mice. Additionally, chloroquine could be a potential treatment for pulmonary hypertension because LC3-2 expression did increase as hypothesized.

SBI101: Healing Light Waves

Going back to the basics is the underlying theme here. Today with the advances in almost every field of science my main focus is that of medicine, I hope to gain more knowledge and aid the topic through my research. Humans in general get hurt accidentally bumping into things or falling etc. It is almost impossible to prevent someone from getting hurt. We can try to prevent it. Or find a way to speed up the recovery. One such way is through light. There have been multiple studies showing that regrowth in certain organisms is affected by light's properties such as various colors/wavelength/type/duration etc.may sped up recovery time. With this background information, I hope to build off of it, verify for myself if this is true in my experiment I want to see whether Planaria, also known as flatworms, can grow back their heads faster under certain light conditions than others. Also, to see if planaria have a favorable response to a particular light. If I split a group of planaria into smaller subsections then I will be able to find out which light will encourage the fastest growth. Each will have its head cut off at the same time and will live under the same conditions but exposed to light at varying intervals. They will be fed and have their water changed as needed. I will also have one control subsection to make sure that the results and growth of the planarian was because of the actual lighting variables, not some fluke. There will also be multiple planaria specimen in each tank to confirm findings. The Planaria will be given a certain time period that all subsections will be subjected to (within the project timeline). Then the percentages of their regrowth will be recorded through 3D computer models to see the recovery time of the Planaria in each light variable. Such variables include light colors, and others such as wavelengths, duration etc. I believe that this information will prove helpful because it will aid the medical field in the information collected on this topic.

SBI102: Jaguar Protein's Role in Apical Constriction in Drosophila Melanogaster

Apical constriction, the process by which cells bend to form tissues, regularly occurs in developmental stages. Shroom protein is an essential part of apical constriction. Not much is known about which proteins genetically interact with Shroom in this process. I tested three alleles of one candidate protein, Jaguar, in Drosophila melanogaster. Male mutated Jaguar flies were crossed with female flies with Shroom overexpressed. The progeny were observed to see if the crumpled phenotype was enhanced (Jaguar genetically blocks Shroom) or suppressed (Jaguar genetically aids Shroom). A Jaguar mutant showed suppression (p=0.0001) but I will test two other alleles to confirm.

SBI103: DNA Extraction in Fruit

The purpose of this experiment was to determine if storage of fruits at room temperature over a period of time would affect the amount of visible DNA extracted from the fruits. The goal of the experiment was to test how the progression of time affects the amount of DNA extractable from certain types of fruits(purely botanically speaking). 3 of each fruit were bought from a local supermarket, and kept exposed to air (at room temperature) inside my house(at the same location). On the day of purchasing these fruits, one specimen of each fruit was blended in a blender for 30 seconds. After straining the pulps through a coffee filter to remove any remaining solids, the specimens were mixed with a solution made of dish detergent, salt, and tap water to extract the DNA. Pulp was mixed with the DNA extraction solution. Isopropyl alcohol (pre-chilled in the freezer for 8 hours) was then added (pouring along the side to attempt to keep layers distinctly separated) to precipitate the DNA and make it become visible. The DNA was then physically removed from the container and measured in mL. This process was repeated 6 days after purchase on one specimen of each fruit; and again 12 days after purchase. The data (amount of DNA extracted in mL) was then compiled and examined. I hypothesized that the amount of DNA extracted will decrease over time in all 3 tested species because cells may die due to lack of nutrients and exposure to air. The results indicated that there was indeed a reduction in visible DNA. These results were consistent with my hypothesis that the amount of visible DNA would reduce. This maybe due to breakdown and decay of the nucleic acids themselves, or death by exposure to possible airborne pathogens.

SBI104: Family Fingerprints

We can tell two people are related by their physical traits. How about a mother and daughter—have you ever spotted a girl who looks so much like the mother when she was younger. The child receives half DNA from each parent. The purpose of this project was to determine whether or not parents and children share similar fingerprint patterns. The hypothesis of this project was that if a child’s fingerprint is compared to their parents, then they will have matching patterns. Each family member was asked to clean their right index finger. Once the finger was cleaned removing excess dirt and oils, they rolled their finger from one side to another across the ink pad. Using the same side to side motion, the fingerprint was recorded in the designated area on the piece of white paper. Fingerprints were labeled with father, mother, son, and daughter. All of the fingerprints in the family were compared to each other and were classified under the selected patterns which are as followed: plain arch, tented arch, plain loop, whorl, central pocket loop, double loop and accidental. After testing ten families, the average similarities in fingerprints was 1.7 where the average in differences was 2.1. Therefore my hypothesis was proven incorrect.

SBI105: Using Brain Imaging Analysis to Address Alzheimer's vs. Physical Exercise

Currently, Alzheimer's disease (AD) is the sixth leading cause of death in the United States, claiming a victim every 66 seconds. The characteristic molecular feature of AD pathology is the accumulation of abnormal clusters of protein fragments, also known as amyloid – beta (Aβ), that build up between neurons. Aβ is proposed to be what puts the disease in progress, ultimately leading to neuronal loss and the symptoms of AD. Recently, Aβ has taken center stage as the leading cause of AD and is the focus of many explorations in model systems for mechanistic studies and for identification of genetic modifiers. To address Aβ in AD patients, mild cognitive impairment patients and even healthy controls, researchers are now looking at Positron Emission Tomography (PET) scans. These scans can specifically image Aβ in the brain, using biomarkers to look at Aβ in all regions of it. The specific compound used in this study, was Pittsburgh Compound B (PiB), which binds to Aβ. It has recently been found with patients with the AD genetic determent, ApoE, that exercise helps lower Aβ in the brain. This similar result has also been found in mice. As the foundations of AD have been discovered, the usage of PET scans has improved, and the evidence that exercise has been beneficial, lead to the current study, on how exercise in the last 14 days of one’s life has affected their Aβ pathology. By looking at patients, none of whom actually have AD and who are generally 60 years or older, it was found that exercise actually contributes to higher retention rates of PiB. This result is a benefit however, as it appears exercise is delaying the symptoms of AD.

SBI106: Human vs. Plants

I plan to test the effects of various pollutants commonly found on roadsides in PA. by administering them to common roadside plants.

SBI107: Nitrogen Fixation of Rhizobium-Legume Symbiosis

Currently, food is mostly produced around the world using nitrogen fertilizers. However, nitrogen fertilizers can cause pollution like water contamination which negatively affects the environment and can lead to other harmful effects. Thus, the purpose of the experiment will be to see whether or not Rhizobium is a viable replacement for nitrogen fertilizers. Rhizobium is a type of bacteria that infects the root nodules of legumes and fixes nitrogen to better help the plant grow. The hypothesis is that the Rhizobium will successfully be able to promote plant growth. The experiment will consist of growing clovers, alfalfas, and lima beans with both nitrogen fertilizer and rhizobium to compare their effectiveness. The result will probably be that both Rhizobium and nitrogen fertilizer will promote plant growth.

SBI108: The Effects of Road Salt on Plants

Road salt is used to keep roads from becoming icy during the winter. It works due to freezing point depression as the salt dissolves and dissociates into ions. Since the plants are exposed to a solution with low water potential, I wanted to see how it affects plant growth. I had 20 plastic cups and planted 50 grass seeds each. After they sprouted, I cut them to equal length and watered with different molarities of CaCl2. I watered them every 2 days for 2 weeks. The growth lessened as the molarities got higher, supporting my hypothesis that road salt has a negative effect on plant growth.

SBI109: The Effect Of Caffeine On Cockroaches

My experiment was to discover the effect that caffeine would have on the circadian rhythms of cockroaches. Caffeine pollution is becoming a much more prevalent issue and it is important to observe the effects it may have on the environment. I used circular wheels to house the cockroaches and a infrared scanner to track and measure their movement. The expected outcome is that the caffeine will affect the circadian rhythm and cause the cockroaches to become more active regardless of the light and dark cycle.

SBI110: Eggshell Tickness

The name of this experiment was eggshell thickness. The category would be biology because it contained animals to do this project. The purpose of this experiment was to prove that feeding chickens calcium supplement would make their eggshells stronger instead of feeding them only regular grain. The procedures that were used were feeding six chickens calcium and 6 chickens grain then measuring their eggs thickness two different ways for two weeks. The data was not very consistent but it did show a difference between the two. My conclusion was that the calcium fed chickens definitely laid eggs with thicker eggshells.

SBI111: Testing Whether a Coflin Pathway Genetically Interacts with Shroom to cause Apical Construction in Drosophila melanogaster

Apical constriction causes tissues to fold. Shroom is a key protein involved in this process. When Shroom, or proteins involved in Shroom’s pathway do not function correctly, diseases such as spina bifida can occur. In this experiment, there were male flies that had a mutated version of a protein that was thought to interact with Shroom, and the other proteins in Shroom’s pathway. There were also females that had shroom overexpressed in their wings. The males and females were crossed and the wings of their progeny were scored to see what effect the mutated proteins had interacting with Shroom.

SBI112: A New Thrombin Signaling Pathway

These experiments investigated the role of the structural protein Particularly Interesting New Cystine-Histidine 1 (PINCH1), in the protease coagulant, Thrombin's activation of downstream effects in fibroblasts. Fibroblasts are important to study because they support tissue growth and regeneration, and Thrombin signaling could be a part of their function. Wildtype and PINCH1-/- Mouse Embryonic Fibroblasts (MEFs) were treated with Thrombin at different time periods, and their downstream effects were measured with immunoblotting and growth assays. Although the growth assays were inconclusive, we showed that PINCH1 played a critical role in Thrombin's activation of Protein Kinase B (AKT). These experiments also showed that PINCH1 was not needed for other effects of thrombin (e.g. activating the Extracellular Signal-Regulated Kinase - Erk1). Lastly it was shown that Thrombin's activation of fibroblasts led to secretion of the matrix protein Collagen, independent of PINCH1, Erk, and AKT signaling pathways. In conclusion, PINCH1 plays a critical role in some of the transduction of Thrombin's signals in fibroblasts, however further investigation is required to uncover the specific mechanisms by which this happens. Further investigation could also uncover if Thrombin signaling in Fibroblasts provides support for cancer development.

SBI113: Crayfish and Dissolved Oxygen Levels

The purpose of my experiment is to observe the effects of low dissolved oxygen levels on crayfish. The researcher placed crayfish into a fish tank with a dissolved oxygen level of 3 mg/L using an oxygen pump and observed their survival rates and behaviors for a week. The researcher also placed crayfish into a fish tank with a dissolved oxygen level of 8 mg/L and observed their survival rates and behaviors. The hypothesis is that the crayfish in the low dissolved oxygen rates will have less survivors and be inactive. Final results will be available at the exhibit on fair day.

SBI114: Alkalinity and Acidity Assessment of Anthocyanin

Landfills and fracking have been polluting water for decades, putting chemicals into the water. These chemicals harm wildlife and inhibit the growth of a healthy ecosystem. One of the effects of these chemicals that inhibits growth is a change in pH, which can make living conditions intolerable for many species. To test pH, chemicals are often used, or resources such at litmus paper, that is then disposed of as waste. Wisconsin fast plants, with a life cycle around 40 days, have a purple pigment called anthocyanin present in the stems, most vibrant in the first week of growth. Depending on how acidic or basic a solution is, this pigment ranges from blue to pink. In this experiment, standard Wisconsin fast plants will be placed in acidic and basic environments to see if they are able to tolerate and react to them as a natural pH indicator.

SBI115: Identifying new protein cargo for α-arrestins using Evolutionary Rate Covariation (ERC)

α-arrestin are recently identified trafficking adaptors, that bind the Rsp5 ubiquitin ligase via PY motifs and recruit the ligase to transmembrane proteins. The Ub ligase then ubiquitinates the membrane proteins, which marks them for endocytosis in response to signaling cues. This is crucial, because it helps cells grow and survive in response to environmental changes. However, identifying cargo proteins and α-arrestin pairs is challenging due to large number of possible cargo pairs and the flexible associations between α-arrestins and their membrane cargo. To overcome these problems, we used Evolutionary Rate Covariation (ERC), a computational biology approach, to identify new α-arrestin-regulated cargos. ERC is a technique that uses DNA sequence-based signatures to identify genes with similar evolutionary histories. Since functionally related genes experience similar selective pressures they tend to have co-varying evolutionary rates. We compared ERC rates for α-arrestins with membrane proteins across 18 yeast species. Among the top co-evolving genes were multiple previously confirmed α-arrestin cargos. Strong plasma membrane localization was also observed in the top gene hits, which is consistent with known α-arrestin functions in endocytosis. We validated a subset of these new α-arrestin cargos by assessing the localization and abundance of GFP-tagged cargo proteins in cells lacking specific α-arrestins. To date we have examined over 20 predicted α-arrestin-cargos in yeast and have identified at least 6 new cargo for α-arrestins. Current work is being done to apply this techniques to membrane proteins in mammalian cells. A recent study showed that one mammalian α-arrestin also mediates ubiquitination and lysosomal trafficking of an activated plasma membrane receptor.

SBI116: Replacement for FBS in Cell Culture Median

Fetal Bovine Serum (FBS) is great at providing growth factors to cells in culture. However there are ethical concerns regarding how it is obtained. Is there a viable substance that can replace FBS in cell culture media? If so, will it work with many cell types? Experimentation revealed many technical factors that had to be finessed, but overall, the research concept was supported.

SBI117: The Effects of Household Chemicals on Plant Life

I am going to test the effects that household chemicals have on plant life. I am going to take five spray bottles and fill them each with 600 mL of water. I will add 50 mL of the assigned chemicals (kitchen cleaner, drain cleaner, bleach, dish soap, and water as my control) to each bottle. I will plant grass seed in five different pots. Three times per day I will water each plant with the assigned solution. Each plant will be sprayed five times. After a few weeks I plan to examine height, biomass, and coloration of each plant. I assume that the harsh household chemicals like bleach and drain cleaner will have a negative effect on overall health of the plants.

SBI118: Genetic Analysis of Neurodegeneration

Neurodegenerative diseases kill neurons resulting in loss of brain functions. Inspired by last year's finding that developmental genes affecting memory decrease in Alzheimer's, I formulate the research question—will all neurodegenerative diseases similarly have developmental genes that are deregulated?

Using the cerebellum (region least involved in neurodegenerative disease) as control, I hypothesize that genes that change significantly during development of affected brain regions in neurodegenerative diseases (Frontotemporal Dementia and Huntington's are used as model systems), and not in the cerebellum, will decrease in the disease. I also create a new Allen Brain Atlas API to track gene changes during brain development.

SBI119: Drug Effects on Danio rerio

Water contamination could be caused by many things but I mainly focused on the effects of drugs. I wanted to test Excedrin Migraine on danio rerio embryos. I used the danio rerio fish embryos because they are a common freshwater fish. The reason for the use of Excedrin Migraine because pain relievers are one of the main contributors to contamination in water sources. I took ten petri dishes and had five under the control (spring water) and five under the variable (spring water and excedrin) with three danio rerio embryos in each. Over a corse of five days, I observed the danio rerio embryos.

SBI120: Not So Sterile Salt

My experiment researches the optimum condition for fungal spores on salt. Methods include the growing of fungus from salt on Potato Dextrose Agar Petri Plates, and separating them into three groups: control, an optimum temperature for fungus, refrigeration group, a condition to imitate conditions in storage facilities, and outside group, exposed to varying conditions similar to those that salt mounds are exposed. There was a significant difference in average fungal growth between the refrigeration and control groups leading me to conclude that colder conditions hinder the spores dormant until they reach a favorable condition, which could lead to food spoilage.

SBI121: Effect of Diaphanous Mutation on Shroom Expression

The purpose of this experiment was to determine whether or not a mutation in the gene Diaphanous either suppresses or enhances a crumpled wing phenotype that is the result of overexpression of a protein known as Shroom in Drosophila melanogaster. Females with overexpression of Shroom were crossed with males that carried both a balancer and the Diaphanous mutation. The progeny's wings were closely observed in order to determine how the mutation affected shroom activity. The control group expressed only the balancer inherited from the male, while the experimental group expressed only the mutation inherited from the male. Seeing as the diaphanous mutation tends to hinder protein expression, the hypothesis is that the mutation will suppress shroom function.

SBI122: An analysis of Citrus Fruit DNA

The discovery of DNA's structure stands as one of the most important turning points in scientific history. This experiment will look closely at the DNA of cirtus fruit. This could be used to determine if some people with an allergy to certain fruit can have similar effects if exposed to fruits with similar DNA bands. This was done by completing a gel electrophoresis on different fruits. The results will be available at the science fair.

SBI123: Forensic Fingerprinting

Fingerprinting is a technique used by forensic investigators every day in order to solve crimes. It is helpful to understand how this is used in crimes so they can be improved. I will see what fingerprint pattern is most common in men and in women in order to see if there is a more prominent pattern in a certain gender. I will also attempt to see if there is a correlation between fingerprint size and height. This could help investigators solve crimes, find suspects, or identify victims faster and more efficiently.

SBI124: The effects of RNA interference knockout on planarian regeneration

I'm conducting this experiment to test if planarian need the enzyme that makes RA (Retinoic Acid). The planarian is capable of regenerating itself to amazing extents when wounded or cut. We hypothesized that if we knockout the RA in planarians with RNA interference, then the planarian will be unable to regenerate because RA is required for growth. I'm going to feed the planarians double RNA strands which will inhibit the enzyme. Then I will be cutting them into 3 pieces to see if the planarian will regenerate or not. If it does not regenerate then RA is needed for regeneration.

SBI125: Antifungal Agents Alter Drug Levels Through Inhibition of Metabolism

The azole antifungal drug class is widely used in organ transplant recipients to compensate for reduced immune function. Azoles are potent inhibitors of the Cytochrome p450 liver enzymes. The novel drug Isavuconazole (ISA) is known to be a less potent CYP inhibitor than traditional azoles, but the extent to which has not been quantified. Human liver microsomes were fed testosterone as a substrate in a favorable environment in the presence of Isavucanoazole and other azole drugs, and the 6beta-OH testosterone concentrations were measured using UPLC-MS analysis. The median inhibitory concentration was found to be ~2 μM for ISA. Further confirmation with another substrate is necessary before determining an effective range of serum concentration for patients.

SBI126: FDo Humans Indirectly Affect the Growth of Algae?

Algal growth could really affect the ecosystem and the food chain. So, I decided to test 'do humans indirectly affect the growth of algae.' To complete this project, I had 20, 946mL glass jars and I measured 600mL of pond water and placed it into the 20 jars. Then, I measured 11.5g of algae and put it into the 20 jars and set up a plant light to try and get an equal amount of light on every jar. Leaving the algae for 7 days, I weighed it again. My results varied, based on the positioning of the light.

SBI127: The Effects of Chemical Lightening on Human Hair

This project tests the effects of chemical lightening on human hair and why it is harmful to the structure of the hair. I goal was to solve the myth of if hair lightener is truly bad for you. I used three samples which I dyed in a different manner every time. I then built hydrometers which I tested the structure of the hair with. The hydrometers were placed in a humid area in order to test the strength of the hair in humid conditions. My results are not yet complete.

SBI128: Flowers Vs. Environment

The purpose of this project was to determine if flowers that close their petals at night could be trained to keep them open in the proper conditions. Flowers that normally close their petals at night do so for a variety of reasons such as temperature, weather, and energy conservation. For this project, I used Portulaca umbraticola. My main hypothesis for the experiment was that the flowers would learn how to keep their petals open all night when they are placed in the proper conditions. I had four sub-hypotheses to help support the main hypothesis. These were: the petals will have a greater width in the morning, or AM; the petals will have a greater width when the temperature is 71 degrees Fahrenheit or above; the petals will have a greater width on the plants that are inside; the flowers on Plants 1 and 2 (outside plants) will be able to adapt when their environment is switched. To test these hypotheses, I used four flowers. I labeled each of the plants (1-4) and ten of the flowers on each plant using paper and pipe cleaners (1-10). Once they were labeled, I placed two plants inside and two plants outside. Everyday, the flowers were measured at 7:30 AM, 12:00 PM, 6:30 PM, and 9:30 PM using a ruler. The width of the flowers were recorded in a spreadsheet made on excel. Also, the temperature at each time was recorded as well as any other observations. The flowers were measured for fourteen days in their original positions, and after the fourteen days the flowers that were outside were placed inside and the flowers that were inside were placed outside. They were measured the same as before for seven more days. The final results of this experiment will be available at the exhibit on Fair Day.

SBI129: Maximizing E.coli Competence by Changing Cation Concentration

Bacteria can absorb and express DNA in the form of plasmids through a process called transformation. However, a major limiting factor is the competency of the bacterial cells, or their ability to take up DNA. In this experiment, Escherichia coli cells were treated with varying concentrations of calcium chloride to reduce DNA-membrane repulsions and maximize cell competence. Results indicated that competence peaks at an optimal concentration range and decreases at extreme values. Understanding factors that affect transformation allow future researchers to prepare bacteria cultures that take up DNA more efficiently in applications such as bioengineering, genetics, and medicine.

SBI130: Which Foods Provide the Maximum Sucrose to Glucose Conversion in a Given Time Using the Invertase Enzyme?

PURPOSE: Which foods provide the maximum sucrose to glucose conversion in a given time using the invertase enzyme? HYPOTHESIS: As sugar content increases, the amount of sucrose converted into glucose will increase. PROCEDURE: 1. Obtain needed materials. 2. Establish a linear time point with the invertase enzyme. 3. Test the beverage, with the glucose strip, at the linear time point. 4. Repeat step 3 for the remaining 29 more samples. 5. Repeat steps 3-4 for the remaining beverages 6. Analyze the results. CONCLUSION: Final results available at fair.

SBI131: Investigating the Ras/Raf/MapK pathway in Drosophila

Please visit student's exhibit for abstract.

SBI132: The Effect Of Mouthwash on Bacteria

The problem is Which ingredient in mouthwash kills bacteria most effectively? The hypothesis is if mouthwash contains thymol and alcohol, the most oral bacteria will be killed. If mouthwash contains sodium fluoride some bacteria will be killed. If mouthwash contains cetylpyridinium, the least amount of bacteria will be killed. Take Petri dishes, cover bottom with bacteria, next put mouthwash on half of the petri dishes. Document changes. Record results. The hypothesis was not supported because Crest Pro Health works the best, Listerine cool mint was the next best and then Listerine Total Care was the worst at killing bacteria.

SBI133: Daphnia Magna and Oil

The purpose of my experiment is to determine how different motor oils affect the survival rates of Daphnia Magna. My hypothesis is if I expose Daphnia Magna various types of oil then the control group will have the highest survival rate. Since Daphnia are very sensitive to changes in their environment. I will put ten Daphnia into different containers with various types of oil. Each day I will record the amount of living Daphnia and the activity level during the testing period. This experiment could be used help encourage people to use less harmful oils in their vehicles and push safer alternatives. Results will be available on fair day.

SBI134: UHT Pasteurization

To find out whether Ultra High Temperature milk pasteurization used in other countries could replace American pasteurization methods without significantly lowering nutritional value of the milk, I tested unpasteurized milk, High Temperature Short Time (US method) pasteurized milk, and UHT pasteurized milk for protein denaturation, fat content, and ability to make yogurt. UHT milk has the lowest pH, signifying the most protein denaturation had occurred; is most dense, signifying highest water composition and fewer fats; and makes yogurt with the lowest viscosity. In conclusion, UHT pasteurization would require further development to be a nutrition-preserving option for American milk.

SBI135: Rad55 Phosphorylation and its Interaction with Csm2 to create Error Free DNA Repair

Double-stranded DNA breaks are deadly for cells because they can lead to mutations that may eventually develop into cancer. Homologous recombination (HR) is an error-free pathway that can be used to repair double strand breaks. HR uses many proteins. We hypothesize that Rad55 phosphorylation is the driving force to allow Csm2 to interact with Rad55. To test this hypothesis, we generated mutants of Rad55. Evaluation of the effect of these mutations on Rad55 and Csm2 were seen using protein-to-protein interaction by yeast two-hybrid systems.

SBI136: Controlled Growth of Nutrients in Cells

The purpose of this research is to study and measure cell growth and to see if we can predict the cells future. Each experiments is done the same. We take the PDMS and pour it on a microfluidic base. We bake the base until it hardens and then we put the cell in it. We Then examine the cell with an automatic microscope, regulated with a temperature of 32 degrees celsius. The experiment usually takes 3-5 days. The experiments usually shows a change in the cell, because this study is the study of non genetic inheritance, where the cell was able to change, because of all the machinery around the cell. This change also applies to humans, when there is a change from generation to another generation not involving genetic alleles. So the cell grows in a certain way, just involving the machinery around it. Seeing the cell change is what we want to see, so it can further our knowledge about cells, because cells make up everything.

SBI137: Macrophages are required for Adult Mouring Gecko (Lepidodactylus Lugubris) Tail Regeneration

The inability to regenerate damaged body parts in adult mammals is in part the result of a poor growth response and excessive fibrotic scarring post-injury. Infiltrating immune cells have been shown to play a major role in mammalian wound repair and are critical to limb regeneration in the axolotl salamander (Ambystoma mexicanum). This study investigates the immune response during lizard tail regeneration and revealed a temporally defined requirement of macrophage infiltration in the regenerative process. Mourning gecko (Lepidodactylus Lugubris)tails were amputated and allowed to regrow past temporal regenerative landmarks then collected, cryosectioned, and immunolabeled with antibodies against F4/80, CD11B, 22/18, and Neutrophil Elastase. Systemic macrophage depletion was achieved through intraperitoneal clodronate liposomes injections and showed a direct correlation to regenerative ability by inhibiting tail elongation and significantly reducing macrophage marker expression. Taken together, these results confirm the recruitment of immune cells at various stages of lizard tail regeneration, and indicate a dependency on macrophage infiltration for progression of normal tail regrowth. Future work will determine the roles of other immune cells, such as T-lymphocytes, in lizard tail regeneration, as well as draw comparisons to mammalian immune responses in the hopes of enhancing tissue regeneration in humans.

SBI138: Stocking Up For Winter

Food for “exotic” species of stick insects is a well sought after commodity by insect hobbyists. Many of these plants are found during the warm months, but quickly die off in colder conditions. This experiment will test if these plants can be frozen and stored for use during cold months without negative effects on the insects. Four easily accessible plants will be tested: Multiflora rose, Red and White Oak, and Bramble. Growth rates of insects fed each food will be analyzed and health issues compared to see which is best winter option. Preliminary data is inconclusive, results posted at fair.

SBI139: Scaffold Material Influence on Stem Cell Behavior

The study investigated the potential for myoblastic development in various types of structural scaffolds. Collagen Type 1, Fibrin, Poly Lactic Acid, and Coverslip were selected scaffold variants in which preparation involved a spin coat of extracellular matrix scaffold with aspirations to cultivate a scaffold capable of both myoblastic development and structural integrity. A culture procedure was followed in which 24 wells were filled with a C2C12 cell line (including 8 control wells without a scaffold). Results were gathered using a Nikon Computer Interface to use imaging techniques to confirm cell behaviors including, growth, proliferation, and differentiation.

SBI140: Development of an Invitro Liver Model for NAFLD

There is a great need for a more effective drug-screening model for Nonalcoholic Fatty Liver Disease. I hypothesized that oleic acid and lipopolysaccharides would successfully induce steatosis and hepatocyte damage in an optimized in-vitro liver model ultimately used to test potential drugs. High-content imaging was done to quantify the damage, and the most effective disease model was found to be oleic acid as the initial condition and LPS with oleic acid as the stressors, thus supporting the hypothesis. 3D NAFLD models were created using the optimized conditions and used to test drugs. Rosuvastatin was most effective at stopping disease progression.

SBI141: The Effects of Acid Rain on Sunflower Plants

This project will determine the effects of acid rain on plant life by administering differing levels of sulphuric acid solution to the plants and measuring their growth.

SBI142: Effects of Peanut Allergen on the Barrier Function of the Skin

Peanut allergy is one of the major medical challenges of the 21st century. Reactions to peanut can be severe, and occur at low doses. Recent studies have proposed new avenues of exposure through the skin which are potentially linked to an increase of peanut allergy in children. Parallel experiments were conducted using murine skin and human keratinocyte cells in order to see whether peanut allergen affects the function of keratinocytes, and what cytokines are locally upregulated following the application of the allergen. Preliminary PCR data using RNA extracted from excised murine skin showed great variability in the baseline gene, indicating potential impurities in the isolated RNA. Later, peanut allergen was shown to induce a pro-inflammatory immune response, as indicated by the upregulation of IL-6, in the supernatants of HaCAT cells after 24 hours. PCR analysis of HaCAT cell RNA showed no detection of pro-inflammatory cytokines. Whereas, immunofluorescent microscopy indicated that peanut allergen disrupts tight junctions in HaCAT cells, as evidenced by the internal migration of the zonula occludens-1 (Zo-1) tight junction protein. Overall, peanut allergen may induce the release of IL-6, while tight junctions were shown to be disrupted, preliminarily. Future directions include inhibiting CD44, a cell surface protein that is known to bind peanut lectin and alter tight junction formation. If resulting data are positive, neutralizing anti-CD44 antibody will be administered in concert with low doses of peanut allergen to vaccinate mice.

SBI143: Will Iron(III) Oxide Kill Japanese Knotweed?

My project is testing if iron (III) oxide will kill japanese knotweed. By coating the leaf with iron (III) oxide, i measured the plants over a course of three days, and treated them as normal house plants.

SBI144: pH of Plethodon hoffmani Habitats

This experiment was performed to determine the pH that Plethodon hoffmani, a salamander common to southwestern Pennsylvania. This species is understudied, allowing this experiment to provide a potential basis of information for further research to build on. Soil samples were collected from areas where the salamanders live and from where the salamanders do not live. The samples are being tested and results will be compared to draw a conclusion. Experimentation is still in progress.

SBI145: The Effect of Water Fluoridation on Bone

Over half of the population in the U.S. drinks fluoridated water. It is praised for its ability to reduce cavities; however, multiple studies have also found that fluoride has detrimental effects on bone. For this experiment, the effect fluoride has on soup bones was tested. Mouthwash and a solution of sodium fluoride were used as sources of fluoridation. After the bones spent an adequate amount of time in the fluoride, different tests were conducted to compare the health of the bones, including a modulus of rupture test, which determined the strength of the bone. Experimentation is still in progress.

SBI146: Mollusk Slime vs. Synthetic Glues

In this experimentation, slug mucous/slime was tested as an adhesive compared to other synthetic glues (white glue, wood glue, craft glue). The purpose is to conclude whether or not slime can serve as a proper adhesive and possibly even a safer alternative. In doing so, slime was collected from slugs, applied to a hook which was then attached to a wooden board and allowed to dry. After drying, weight was put on the hook and measured. Experimentation is still occurring and results will be available on the day of presentation.

SBI147: Strawberry Fields of DNA

Does the ripeness of a strawberry affect the amount of DNA it contains? This was the question asked when performing the experiment. The purpose to the question was to find out if overripe, ripe, or under ripe strawberries contain more DNA than the others. If a strawberry is ripe, then it will contain more DNA than a strawberry that is overripe or under ripe. The procedure is as follows. Gather all materials needed for the experiment. Next, put on gloves and safety goggles to work with the DNA. Then, carry out the procedure to extract the DNA of the strawberries by using these steps: Find the smallest strawberry out of the 30 strawberry gathered, pull/cut off any of the green leaves that may be present, record the mass of the smallest strawberry (this will be the mass you get all of the the strawberries tested to equal), put the strawberry inside a plastic bag, seal it and gently mash for two minutes. Next, in a plastic, make your own DNA extraction liquid by mixing together 1 teaspoon of dish detergent, ½ teaspoon of salt, and ¼ cup of water. Stir the liquid until the extraction liquid is mixed well, then add 1 teaspoon of the DNA extraction liquid into the bag with the smashed strawberry. Reseal the bag and gently mash for another minute. Avoid making too many soap bubbles. Set up a test tube in a rack. Next, place a coffee filter inside a small bowl, open the bag with the strawberry and dump the liquid into the filter. Pick up the filter and twist it just above the level of the liquid and hold it over the test tube. Gently squeeze the liquid into the test tube. Measure the amount of liquid in the test tube. After that, measure equal amount of rubbing alcohol as the liquid in the test tube. Carefully pour the rubbing alcohol down the inside of the test tube containing the liquid from the strawberry. Do NOT mix or stir. Let the test tube rest for 2 minutes, undisturbed. Watch for the development of a which cloudy substance (DNA) to appear in the layer between the strawberry liquid and alcohol. Measure and record the mass of a popsicle stick. Tilt the test tube, and pick up the DNA using the popsicle stick. Measure the mass of the the popsicle stick with the DNA attached. Subtract the mass of the plain popsicle stick from the mass of the stick plus DNA to calculate the mass of the DNA collected. Record the data in your notebook. Repeat the entire procedure for each of the remaining strawberries. The final results will be available on the exhibit during the science fair.

SBI148: The Effects of Wi-Fi on Daphnia Activity Levels

The purpose of the investigation is to see if long-term exposure to wi-fi effects daphnia's activity levels. The results of the experiment could be used to see if wi-fi radiation causes harmful effects to organisms, which can be applied to people using wi-fi on their cellphones. The hypothesis is that if daphnia is exposed long-term to wi-fi, then the cultures exposed the longest will have a less activity than those that have not been exposed. The data will be measured based on the activity levels on the daphnia. Results will be available on fair day.

SBI149: Increase Protein, Increase Growth

I am testing meat production poultry(chickens) with protein with Increased Protein Increased Growth. I will add 5 different amounts of protein. Starting from 14% and jumping by twos to get to 22% which is the highest amount of protein. Overall in this project we are testing 100 chickens. All in which are the same breed bred for the same purpose, meat production. Chickens are broken up into experimental groups of 20 are fed different protein. My hypothesis is that the growth rates will increase regularly for 8-10 weeks.

SBI150: Norwegian Saliva Samples

The purpose of my project is to discover traits that can be found using DNA found in saliva and on teeth. I do this by mixing the DNA with certain buffers as well as ethanol and other chemicals. We use pipets in order to measure the exact amount of a liquid we must extract, since it is very important to extracting the DNA from cells. We also must use a vortex machine to help mix the chemicals with the saliva and make sure they are being absorbed. We then centrifuge the saliva samples in order to visibly see the small pellets of DNA. We then pipet out the remaining liquid from the sample to get the DNA by itself, and later let it dry. The result is a, hopefully, unharmed sample of DNA that will later be sampled. My hypothesis is supported than multiple different traits can be found from DNA in teeth, such as hair color, eye color, etc.

SBI151: the Use of Microbubbles and Ultrasound Therapy to Treat Blood Clots

The purpose of this research is to observe the effects of microbubbles and ultrasound therapy on blood clots. Two experimental groups will be set up. The first group will use different concentrations of microbubbles, and the second group will have different blood clot strengths. Data will be collected using ultrasound imaging and the blood clot decay will be analyzed. Data collection will continue over the next couple of years. Current data is showing that microbubbles and ultrasound therapy is an effective treatment method for blood clots. To this point, the hypothesis has been supported. there are several explanations for this, one being that this treatment method attacks the clot at the source and works more aggressively. Multiple tests still need to be performed and long term side effects need to be researched before this treatment method is available for public use.

SBI152: The Effect of Dietary Changes on the Activity Levels and Circadian Rhythms of Gromphadorhina portentosa (Madagascar hissing cockroaches)

Cockroaches display circadian rhythms in their behavior, with predictable responses to light and dark periods. Research suggests that cockroaches are also affected by changes in metabolism. This project aims to investigate whether changes in cockroach diet, which in turn would affect their metabolism, would also affect their normal circadian rhythm and activity levels. The current study has implications for improving understanding of how sucrose affects circadian rhythms and activity levels.

SBI153: Viability of Growing Phaseolus lunatus. on Mars

Colonization of Mars presents humanity with an opportunity for a greater acquisition of resources and land area for human activities. However, to survive on Mars, a viable food source is necessary. This broaches the problem of growing plants on Mars, an environment that lacks any nitrogen fixing bacteria necessary for plant nitrogen uptake. Thus, the goal of this experiment is to examine the viability of using the amount of urea [CO(NH2)2] found in human urine to grow Lima beans (Phaseolus lunatus) in Martian soil conditions. This will be done by germinating Lima beans in controlled conditions with four experimental groups: under-standard earth conditions, earth conditions with urea incorporated, standard Martian conditions, and Martian soil conditions with urea incorporated. Expected results of incorporating urea in Martian soil are that a greater number of Lima beans will germinate in comparison to standard Martian soil conditions.

SBI154: Electromagnetic Fields and Bacterial Mosquito Control

Cell tower electromagnetic fields (EMF) are widespread and may accelerate deadly mosquito growth. To study EMF's affect on a the mosquito control method Bti (Bacillus thuringiensis), Aedes aegypti eggs grown in either cellular frequency EMF or control, and were exposed to Bti. The EMF eggs produced twice as many surviving adults as controls. Additionally the EMF group had double the number of females compared to controls. After exposing the Bti to the EMF and incubating the bacteria, it was found that the EMF exposed Bti had significantly less colonies when compared to the controls no matter the age of the Bti. This data could drastically alter mosquito control efforts globally.

SBI155: Ideal Boron for Lactuca sativa

One mineral plants need to survive is Boron, responsible for cell wall formation, protein synthesis, and sugar translocation. If a plant does not have enough boron the plant will start to experience bud breaking, inhibition of seed development, and leaf distortion. I am researching how much boron is best for Lactuca sativa, specifically. I am going to be transferring the plants boron through a mixture of borax and water in five different amounts. In conclusion I found that 6.759 grams of borax per liter is ideal for Lactuca sativa.

SBI156: The Effect of Temperature on Lipase

The effects of temperature on the enzyme Lipase.

SBI157: The Impact of Cultivating Halophiles along Saline Water Sources on Soil Salinity

Salicornia europaea intakes much of the salt, among other metals, in its environment. Considering the modern issue among agricultural societies in many delta/peninsula countries internationally, particularly in the Asia-Pacific region, in which climate change has caused increased salinity levels in local sources which have traditionally provided freshwater, creating economic instability, halophilic plants, such as the S. europaea used in this experiment, may pose a viable solution. Indeed, society is facing a major question: How can agribusiness be stabilized against salinity?, and perhaps the solution will bring agriculture back to its roots.

SBI158: Essential Oils and Penicillin on Staphylococcus epidermidis

Eucalyptus oil is said to help fight of Staphylococcus epidermidis infections. However, there is no scientific proof on whether this oil truly works. Staphylococcus epidermidis was incubated for 48 hours with 10 plates for control, 10 for eucalyptus oil, and 10 for penicillin. The zone of inhibition was measured, showing eucalyptus oil decreasing bacterial growth with an average of 0.475 cm and penicillin with an average of 1.9 cm. Statistical analysis was applied, showing a significant difference between the groups. Further experimentation will observe if the oils and penicillin combined results in a larger decrease of bacterial growth.

SBI159: How Companion Planting Affects the Growth Rate of Lettuce

My experiment tests what positive affects Companion Planting has on Lettuce. Companion planting is the simple process of planting plants next to each other to help prevent pest attacks, to control pollination, and to maximize use of space. I wanted to test how it affects lettuces' height, number of leaves, and biomass, because those are all qualities of a healthy vegetable. I performed this experiment by planting four seeds in three flats which contained ten cups. Two seeds were Companion (Radish, Spinach, and Lettuce, and the other two were the plant that needed Companion, Lettuce).

SBI160: Travelling Liquids

I chose to do this topic because I wanted to see which liquid would react to adhesion faster. I chose it because it interests me, So that I can figure which one gives off stronger adhesion. For my experiment you would will need 12 empty cups after that you will need to fill 8 cups up with 4 different liquid and leave 4 cups empty.remind you After that you'll need to place different food coloring in each liquid cup, An after that you will need to fold a paper towel and place one end in a cup with liquid and the other end in a empty cup you will do the same with the other cup filled with the same liquid. You are measuring which liquid takes the longest to show capillary action. I am doing this because I found capillary action very interesting and also because I would like to know what liquid had the most effective on adhesion.

SBI161: The Effects of pH of Water on Plants

Throughout this experiment, it is shown how aspects of nurturing a plant can be changed to yield certain results. The main idea of the project is that the results could be used as a tool for larger-scaled farming to gain better results through observation and change. The question addressed was, "How will the pH of water affect the growth of plants?" The data collected so far has been mostly inconclusive due to the project being incomplete. From the data, it would appear as though the group with a pH of 4 is growing best. It sprouted more plants than both other groups and its plants are steadily growing.

SBI162: Grey to Green

This year, I decided to research and experiment on if using greywater to water plants will change the rate of growth, either positively or negatively. My hypothesis was that the greywater would grow the plant just as well as the tap water. I watered two different plant in the same conditions, one with tap water, and one with greywater. I repeated this process for two months. Each time I watered the plant, I measured it. I then recorded each measurement. I then averaged the growth for both plants. All results will be available on fair day.

SBI163: It's Not Easy Being Green

The purpose of this project is to determine the most efficient way to grow algae for the sake of creating biofuel. Biofuel is a potential alternative for third world countries looking to decrease their consumption of biomass, such as wood and coal, for fuel. Chlorella vulgaris algae was grown, dried, and pressed into oil which was then mixed with methanol and sodium hydroxide. This fuel was burned to generate electricity using a thermoelectric generator. To test efficiency, equal masses wood and algae were burned. Their respective voltages and length of time they burned were compared and efficiency was calculated by dividing length of burn by voltage produced.

SBI164: Genetic Websites : Real or Fake?

Commercials from Ancestry.com air every day of televisions across the world, my curiosity of the accuracy of these begin to thrive. My project consisted of me finding my family records through birth and death records of my family for 7 centuries. After this information was found I went to ancestry.com to see if there were similarities and differences between my own research and the data found online. There were many similarities between the two resources which was a shocking surprise. My project shows that online heredity testing is useful and accurate.

SBI165: Effects of Different Foods on Daphnia Reproduction

In my experiment I tested how yeast and fish food, affected the reproduction of daphnia. My question was “Which food source would encourage the most reproduction in daphnia?” I kept the daphnia in plastic cups and fed them daily. I also counted the amount of offspring produced every day. Since I did not balance out the amount of food in the two groups and there was too much food in the fish food group, the water became polluted killing all the daphnia in the variable group which rejected my hypothesis of the fish food being better for reproduction.

SBI166: The Effect of Different Types of Light on Cells

Ultraviolet light is a form of electromagnetic radiation that is found in the sun and manmade bulbs that are used in daily life. However, the three types of UV rays can cause damage to a person’s health, by contributing to skin cancer and burns. In this experiment, I used UVA, UVB, and UVC light bulbs, as well as fluorescent bulbs, to see the different effects that they had on the growth of NIH3T3 cells. My findings supported my hypothesis, which stated that UVC bulbs would inhibit cell growth the most, while fluorescent bulbs would affect cell growth the least.

SBI167: Pulmonary and Cardiac Changes in an Acapella Group

In my experiment, I tested to see how different sections within an acapella group (baritone, bass, alto, mezzo, soprano, and a beat boxer) affected heart rate, oxygen saturation, and blood pressure before and after a practice. I predicted that the sections with tighter vocals chords and sing at a more strenuous octave would have higher levels. Lower octaves, such as bass, would have lower results. I also believe a beatboxer (vocal percussionist) would have the highest results. Being an active member in an acapella group, I wanted to see how my section’s heart rate, blood pressure, and oxygen saturation levels differ from those in higher and lower sections. I gathered the information from my participants’ before I conducted the experiment. I asked for their section and their age. I then use a pulse oximeter and a blood pressure cuff to measure their blood pressure, heart rate, and oxygen saturation before a practice. I repeated the same process after their practice and compared the results. As I noticed, sections whos pitches stayed relatively the same (such as bass, who is constantly in a low octave) had overall lower results. Sections that changed their pitches throughout the routine (such as altos) were seen to have higher results. I also observed that the vocal percussionist’s results were the highest.

SBI168: Natural Characteristics That Lead to Superhydrophobicity

My research objective is to determine how the microstructure of flower petals affects the hydrophobicity of the flower. To quantify the hydrophobicity, I determined the contact angle of a water droplet on various flower petal surfaces. I used scanning electron microscopy(SEM) to analyze the microstructure of the petals. So far, we have found that Gerbera and English Daisies have the highest contact angles(≥130°), and thus, the greatest hydrophobicity. I found the daisies have the highest microstructural relief, which was expected because of their relationship with the prominent hydrophobicity. We will continue quantifying the specific factors that have the greatest influence to the hydrophobicity.

SBI300: Breaking Down The Carbs

The title of our project is “The Digestion of Starch by Amylase”. We used alpha amylase, IKI solution, and starch solution to test different percentages of the starch on the amylase by 1%, 5%, and 10% amylase solutions. With each percentage of amylase, we found no change in the solutions, but we concluded to later on test higher percentages of the amylase solution,as it appears that our bodies need higher percentages of amylase to digest starches. We used the solutions to test the different amounts of amylase, by percentages, and how each one helps humans digest their food.

SBI301: Temperatures effect on gene expression

Shroom protein is essential to apical constriction – process by which cells bend to form tissues. In past experiments, it was discovered that the flies incubated at 25° varied from those incubated at 22° such that 25° progeny matured significantly faster than 22° progeny. The incubating temperature was switched at 4 stages of D.Melanogaster development to observe temperature effects. The wings were then scored by their statistical variation from the control. The further the fly had developed, the less the temperature change impacted it. The same procedure will be reconducted but with male progeny because they show more severe crumpled phenotypes

Chemistry (SCH)

SCH100: Biofuel Energy Optimization Using Calorimetry

The purpose of this investigation is to design two homemade biofuels, incorporating algae and polystyrene (Styrofoam). The efficiency of the fuels will be measured, and energy given off by the fuels will heat water in the calorimeter apparatus. By adding polystyrene, we may not only be able to increase efficiency of the fuel but may also provide a way of recycling this material that is harmful to our environment. It was hypothesized that the polystyrene based biofuel will be the eco-friendliest because it is largely based off of living organisms with no crude oil. It was also hypothesized that the algae polystyrene biofuel will be the most energy efficient because it produces rich byproducts from its combustion. Although fuels are contributing to global warming, creating one that's based off of living organisms and removes a common waste substance, will be environmentally beneficial.

SCH101: Optimization of Automated Fiber Collection Process

I will optimize the drying method involved in the fiber collection process in order to obtain the most optimal scaffold. I will first make multiple fibrous scaffolds through a semi-automated collection process. I will then find the percentage porosity of each of the scaffolds after drying in different locations and using different methods. I will also calculate the average pore size in order to determine which scaffold is the most porous, which will be my defining factor for an "optimal" scaffold. I will also take into account any inconsistencies in my data before drawing a conclusion.

SCH102: Antiodixant Potency

Current research suggests that antioxidants play a positive role in fighting diseases such as cancer and dementia by capturing or neutralizing reactive oxygen species in the human body. Many antioxidant supplements are available on the market. The purpose of my experiment is to determine which antioxidant supplement works best. I will use two different tests to compare antioxidants. First, I will determine which antioxidant supplement inhibits the oxidation of iron powder during rusting. Second, I will determine which antioxidant supplement inhibits the browning of apple flesh. I will test water-soluble antioxidants resveratrol, glutathione, vitamin C, and alpha-lipoic acid.

SCH103: Sensing NO3 using g-C3N4 on rGO

The project's purpose was to prove that if graphitic carbon nitride on rGO with copper nanoparticle decoration has nitrate ions bonded to it, then an electrical sensor will have a change in conductance. Six experimental groups and six control groups were set up. Each experimental group was a different concentration of sodium nitrate, 20uM, 10uM, 5uM, 2uM, 1uM, and 500nM. Each control group was a different concentration of sodium chloride, 20uM, 10uM, 5uM, 2uM, 1uM, 500nM. Data were collected with an I(mA)-V(V) plot. The sensor is a chip with a potential applied which affects the current flow. The difference in conductance from 20uM to 10uM was by a magnitude of 200 mA. The difference in conductance from 1uM to 500nM was by a magnitude of 400 mA. The data proved my hypothesis to be true.The sodium nitrate was able to be sensed. The nitrate was able to be sensed, and the differential in concentration was able to distinguished clearly using an I-V plot. There must be one explanation for this. The nitrate ions have the ability to reduce when in the presence of copper to ammonia to produce an increase in conductance.

SCH104: Nature's pH Indicators

A common way to test for pH is by using pH strips that contain litmus or universal indicator. This experiment was developed to test the accuracy of homemade pH strips versus store bought pH strips using a pH meter as a control. The homemade strips were made from the juice of cabbages and blueberries, which have the ability to read pH because they contain anthocyanin. An anthocyanin is a pigment that can change colors when an acidic or basic substance is added to it ("Anthocyanin."). Known pH values and wikiHow were utilized to develop the procedure. WikiHow was used to learn how to create natural pH strips and accepted pH values were put to use in deciding which substances to test (wikiHow.). All methods of pH measurement (homemade strips, store bought strips, and pH meter) were used to find the pH of various household substances including orange juice, tap water, and dish soap. The purpose of this study was to determine which acid-base indicator was the most accurate. The litmus strips were hypothesized to be the most accurate. The final results will be available at the exhibit on Fair Day.

SCH105: What is the amount of decline of chlorophyll in Fall leaves?

In my project I wanted to see how much chlorophyll had left a green leaf versus in a colored leaf. I think that the amount of chlorophyll will be reduced by 50% between the green leaf and the colored leaf. I already know that because of the different weather conditions, the amount of chlorophyll decreases. However, in the early stages of fall, I don't believe that all of the chlorophyll disappears, but because of the weather, temperature, and loss of some daylight, I do think that a lot of it will have disappeared.

SCH106: Desiccant reusal

The purpose of this project is to recycle the desiccant by heating it up and reusing it for food storage. The principle that the desiccant can absorb moisture at room temperature and release moisture at high temperature. This principle was tested by heating used desiccant up in the oven. A special container was designed to hold food and a removable container to hold the desiccant and allow it to be heated. The design was tested to show that the special containers can hold the food and allow the reheating of the desiccants.

SCH107: Characteristcs of Antibubble Formation

Antibubbles are liquid environments separated by a thin air membrane. Antibubbles can be formed by dropping liquid into a soapy water bath. The duration of an antibubble can be prolonged by keeping it from touching the sides of a container. However, even when the antibubble does not touch any sides of the container it eventually disappears. The air membrane is formed by the polar air molecule found in the atmosphere. Due to electrostatic interactions, the air membrane dissolves into polar liquids such as water. If the anitbubble is placed in a liquid with a different polarity, its lifetime can be extended. Stability and durability of antibubble can be applied for the clinical diagnostic imaging, targeted drug delivery, and improved lubricants. Various temperatures and pH's were tested to simulate different environments. Lower temperatures produced more durable antibubble. When pH was tested, more neutral pH's resulted in longer lasting antibubbles.

SCH108: Fueling the Future

In the United States and all over the world, fueling the future has become a major concern. There are limited resources on this earth and the constant increase in population has had its part in depleting them. Alternative sources of energy have been researched for years. Do-it -yourself diesel has become increasingly more popular among those wishing to save a few dollars and do better for the environment. How much better is it really? With this experiment, it is aimed to distinguish between traditional diesel and homemade diesel and see if citizen's hard work really does make an impact on the fuel crisis we are facing.

SCH110: Carbon Nanotube-Based Flu Sensor

The seasonal Influenza A virus (H1N1) remains a highly contagious and deadly disease worldwide. Rapid sensitive testing options remain limited. Carbon Nanotube (CNT) implementations of field-effect transistors (FETs) have allowed for rapid and sensitive detection of pathogens. The purpose of this research is to develop a novel biosensor for the detection of human H1N1 virus. The sensor uses carbon nanotubes as transducers for the binding reaction between the anti-hemagglutinin antibody and the hemagglutinin viral surface protein. Through a series of steps, the antibody was coupled onto the surface of a carbon nanotube FET, where is was used to detect the presence of viral particles in solution via liquid-gated sensing. Current-voltage measurements across the surface matrix were recorded after the application of the particles, with varying concentrations. The density and spread of the antibodies coupled onto the CNT interface was determined using advanced microscopy. The presence of higher concentrations of viral particles correlated with a more robust signal response in the form of a conductance ratio. The relationship between surface density of antibody-functionalization and the signal response was also determined. This work provides the first step toward the development of a rapid sensitive point-of-care clinical testing tool.

SCH111: Produce Power; A "Current" Event

The objective of "Produce Power, a Current Event" is to find an environmentally friendly compound to replace batteries' present compounds. The main element used now is carbon which adds to our carbon footprint. To conduct this experiment, a nail and penny will both be placed into a sweet potato or carrot. The voltage generated will be read with a multimeter, recorded and averaged over three trials. Also, time will be measured to see how long the current will be generated. The goal is to determine which vegetable conducts the most voltage over the longest time.

SCH112: Chloride Doping of Perovskite Solar Cells

This research project will be looking into how the addition of specific amounts of chloride into the perovskite solution can increase the efficiency of energy reception within the cell. I am studying this because perovskite solar cells are a burgeoning point of research today. I will be addressing the problem through several different levels of testing. I will be looking at several different percentages of chloride in the solution ranging from 105 to 40%. After testing I will be able to begin making conclusions about the true efficacy of chloride doping in the perovskite solution.

SCH113: Thiolated Ligand Quantification on Silver Nanoparticles

Nanoparticle (NP) surface chemistry (both including the NP surface itself and ligands attached to that surface) can impact nearly all of its physical and chemistry properties. Ligands are important for NP stability, however, even basic information about the ligand shell, such as the quantity of ligands, is not well known, especially for silver nanoparticles (AgNPs). The purpose of this research was to quantify the two ligands thiolated poly-ethylene (PEGSH) and 8-mercaptooctanoic acid (MOA) that incorporated on the AgNPs surface and to determine how smaller ligands (MOA) adsobrs to the AgNPs more efficiently than larger ligands (PEGSH). Synthesized AgNPs and various ligand ratios (PEGSH:MOA) 75:25, 50:50, 90:10, 10:90, and 25:75 were prepared.The quantification of ligands was using nuclear resonance spectrometry (NMR) method. The hypothesis was supported by the result of NMR analysis which MOA ligand has higher quantity that adsorbs to the surface of AgNPs than PEGSH, even though, MOA has a smaller ratio.

SCH114: AMD-Analysis of Mine Drainage

This project is a continuation of my past years' efforts in monitoring the quality of abandoned mine drainage, or AMD, processed by a passive treatment facility at the Marchand coal mine in Lowber, Pennsylvania. Two years ago, I tested and analyzed the alkalinity, sulfate, and iron levels of the facility's inlet pond. Last year, I observed the inverse correlation between the pH and dissolved oxygen and the iron concentration's decrease from the inlet through the outlet. This year I plan to add to those findings by studying the sulfates and calcium levels throughout the watershed and into the creek.

SCH115: Optimizing Molecular Nanoforce Sensors

The hypothesis is that electrons donating and withdrawing groups have an effect on the piezoelectric response of the molecule. The goal of my project is to build on the previous research of my laboratory and to find what types of hydrogen-bonded organic molecular crystals have the greatest piezoelectric responses when in an applied electric field. In order to find such a molecule, I needed to continuously make small changes to the molecular crystal until I found the greatest piezoelectric response. This is practically impossible to do by hand, and therefore a large part of my work involved writing program that makes this process easier. This included a program that aligns the molecule with the xy plane, a program that optimizes the molecule and implements a field, and a program that makes the data readable and easy to analyze. Once I wrote these programs, my work mostly revolved around testing different alterations of the molecule to find the one with the largest d33 coefficient. We have concluded that the nitro-benzene-aniline dimer has the largest response out of all of the organic crystals. However, to know more specific information about the exact atoms and layout of the molecule, more experimentation is needed. The hypothesis was supported as change is electron density could either decrease or increase the d33 coefficient, which measures the piezoelectric response. The results show that organic piezoelectric material can be very responsive and therefore very useful, specifically in sensors which is the application that I focused on. Piezoelectric material can measure very precise movements and is therefore suitable for nano scale sensors.

SCH116: Effect of pH on duration of vegetables

Test different types of vegetables organized by minerals and vitamins with vinegar, baking soda, and water to find a way to extend the duration of vegetables in a fresh state.

SCH117: Vitamin C Levels in Organic vs. Non Organic Produce

This project will measure the Vitamin C levels in both organic and non organic produce, using a type of titration process.

SCH118: The effects of epsom salts and water hardness on bath bombs

Hardness of water is caused by compounds of calcium and magnesium, and by a variety of other metals. The mineral mix together in water could cause damage to people skin , plumbing and many other issues. With hard water your body and dishes is not as clean as if you use soft water. In the experiment it would be testing the effects of different amount of epsom in bath bombs on hardness of water. Epsom salt is a salt that is use for soaking in a bath and also could be use as a laxatives. Bath bombs are made to help people skin and with the hardness of water show how it react to the ingredients. My hyptheiss is the high level of hardness of water then the bath bomb with the more epsom would dissolve slower to break down.Results was show which amount of hard water and epsom salt works best.

SCH119: Using Kinetic Sand and Vegetables to Determine Hydrophobic and Hydrophilic Substances

For my science project, I will be trying to find out how kinetic sand would react when put in different types of liquid. My hypothesis is that the kinetic sand would repel the water, and absorb the oil. In order to conduct my experiment I will take the kinetic sand and pour it into a plastic bowl then I will weigh the bowl on a scale. I will pour a measured amount of water into the bowl. Following that I will drain the bowl of the water, and weigh the sand in the bowl. I will repeat the same steps with oil making sure that the amount of sand and oil are the same for both tests. When i'm done with experimenting, I will draw my conclusions from the results. I will find any changes between the sand without water, and the sand in water. Then I will compare the drained sand that had the water, and compare it to the oil with water. This will show me any types of weight changes, or color changes between the different tests. If my hypothesis is correct, I strongly feel that this could help with environmental issues such as oil leaks in oceans, helping to drain the oil. In conclusion, I will test the properties of kinetic sand when placed in different liquids, and see if this can change environmental incidents such as I previously stated.

SCH120: Determination of Vitamin C Concentration by Redox Titration

I am looking for what source of Vitamin C has the highest concentration. Vitamin C is an essential part of any healthy diet. It is known to protect against heart disease and decrease bad cholesterol. It also supports bone, teeth, and hair growth. I chose to do this project because everyone knows they need to obtain Vitamin C as a part of their diet. But in the cold winter months when it is harder to obtain fresh fruits and vegetables, is taking a Vitamin supplement a better alternative? This is what I am looking to see if the concentration of Vitamin C in supplements is more concentrated than juices or fruits.I propose, one dose of a vitamin supplement will have higher concentration of Vitamin compared to fruits or juices. Engineering Goal: Is to be able to identify the best source of Vitamin C available to the consumer. Expected Outcomes: That I will find at least a small concentration of Vitamin C in every source that I test, but the highest concentration will be in the supplements. Once I have determined the standardization of Iodine I will be able to use the volume of Iodine solution used to neutralize my samples. Then I can calculate the grams of Vitamin C in each. I will then convert the grams of Vitamin C into mles of Vitamin C and ivie that by the liters of solution for each sample. This will give me the molarity of each sample which is the concentration of each sample.

SCH122: Metal Matters

Back then, lead was used in paint to make it last longer. Now that we know it's highly toxic, other metal oxides are used in its place instead. My experiment will find the best metal to use in paint. I tested aluminum, brass, copper, and stainless steel in saltwater to see which one would resist corrosion the best. I compared the mass of the metals before and after the experiment to find the % difference in mass. What I found was that was that Aluminum showed 3.75% difference, Stainless Steel showed a .75% difference followed by Brass and Copper.

SCH123: Wavelengths

The experiment I have chosen tests different colors to determine which color allows the most sunlight to pass through. First, I grabbed a plastic sheet. I used markers and wrote each color of the rainbow in bubble letters with the corresponding colored marker. I put a piece of sun print paper in the plastic sheet. Then, I placed the sheet in the sun for three minutes. Finally, I rinsed the paper and dried it. Once the papers were dried, I compared each color’s shade of blue to the color scale. I discovered that red had the darkest shade of blue, which meant that red allowed the most amount of light to pass through. Also, I discovered that purple allowed the least amount of light to pass through because the shade of blue was the lightest.

SCH124: The Best Whitening Toothpastes

The purpose of this experiment was to determine which whitening toothpaste works most effectively. Tiles were stained in coffee, soda, and grape juice. They were brushed with 6 different brands of toothpastes and compared to see which whitens the best. The best toothpaste that showed to be the most effective on all three stain groups was Rembrandt. The second most effective was Colgate, and the third most effective was Arm & Hammer. The common whitening agent in all three of these toothpastes was hydrogen peroxide, which is used very commonly in whitening products.

SCH125: How Permanent are Permanent Markers?

Please visit student's exhibit for abstract.

SCH126: Alpha-hydrogen Bonds in Lewis Acid Control of Asymmetric Catalysis

The Diels-Alder reaction between a diene and dienophile leads to the formation of a cyclohexene. The Diels-Alder reaction was used in the de-novo synthesis of natural products, most notably in the synthesis of steroids, cortisone and cholesterol, and vitamin D metabolites. Lewis acids, such as those originating from Group III (boron and aluminum) are effective catalysts of Diels-Alder reactions of aldehyde functionalities, as they complex to the dienophile making it more electrophilic and asymmetric. E. J. Corey and co-workers have offered explanations for stereochemical control of aldehyde Diels-Alder reactions based upon experimental evidence from model systems of the formation of a "formyl hydrogen bond" between a Lewis acid and the formyl group. We hypothesize that a second previously unconsidered, alpha-hydrogen bond interaction works, when present, in conjunction with the formyl hydrogen bond to give a more complete account of available experimental data reported in the literature. In this study, we analyzed two model dienophiles, dimethylformamide (DMF) and dimethylacetamide (DMA), to differentiate between the formyl and alpha hydrogen bonds with boron trifluoride (BF3) as the Lewis acid catalyst. We used quantum chemistry methods to characterize the structural and energetic formation of the formyl hydrogen bond between the BF3 and DMF and of the alpha hydrogen bond between BF3 and DMA. We calculated the energy of complexation of the aforementioned complexes using the Gaussian 16 software. Our results show that the energy of formation of DMF-BF3 is comparable to that of DMA-BF3 because there is only a 1.1 kcal/mol difference in the energies of formation of these complexes. This indicates that with better catalyst design, the alpha hydrogen bond can compete with the formyl hydrogen bond to control the stereochemistry of the products of the Diels-Alder reaction.

SCH127: The Effects of Colored Light on Chemically Treated Flame Retardant Fabric

A portion of materials in your house are flame retardant. It keeps you safe from the prospect of your house catching on fire; however, flame retardant fabrics are chemically treated and susceptible to losing the treatment after a period of time. This experiment of exposing fr fabric to different light colors in a closed box for a period of time aims to see if shorter wavelengths of light wear out the chemicals faster. Experimentation is currently currently continuing. Hopefully, the results will be that the shorter wavelength colors will have a greater effect in wearing out the chemical treatment.

SCH128: The Hard Boiled Egg

For the past eight years, my family has raised chickens. We use their eggs for cooking a variety of dishes to supply our family with food. One of the struggles that we have had has been hard boiling fresh eggs. When hard boiling fresh eggs in the past, we have found that when an egg is hard boiled, then shell tends to stick to the membrane, and pieces or the albumen will come off. I decided to research why this happens, and what can be done to prevent it. I found that there are many different methods for hard boiling fresh chicken eggs. My problem is, which method for hard boiling fresh chicken eggs will cause the least amount of the albumen to come off in the peeling process? I tested the following methods; just water, adding vinegar, adding salt, adding baking soda, pricking the egg, and the hot start. The hot start method will be the best method in that less albumen will stick to the egg when peeled. The following procedure was completed. Purchase 72 large white chicken eggs from a grocery store. Follow the following instructions. #1 Control: put 12 eggs in a large pot and cover with water. Bring the water to a boil. As soon as the water boils, remove from heat and let sit for 12 minutes. Removes eggs and rinse with cold water. Peel the eggs. #2: Vinegar: Put 12 eggs in a large pot and cover with cold water. Add one tbsp of white vinegar. Bring water to a boil. As soon as water boils, remove from heat. Let sit for 12 minutes. Remove eggs and rinse with cold water. Peel eggs. #3: Salt: Put 12 eggs in a large pot. Cover eggs with cold water and add 1 tbsp of salt. Bring the water to a boil. As soon as the water boils, remove from heat. Let sit covered for 12 minutes. Remove the eggs and rinse in cold water. Peel the eggs. #4 Baking soda: place 12 eggs in a large pot. Cover with cold water and add 1 tbsp of baking soda to the water. Bring to a boil. When the water boils, remove from heat. Let sit covered for 12 minutes. Remove eggs from pot and rinse with cold water. Peel the eggs. #5 Pricking the egg: Prick each egg with a needle on the larger end of the egg. Put the eggs in a pot and cover with cold water. Bring the water to a boil. When the water boils, remove from heat. Let sit covered for 12 minutes. Peel the eggs. #6 Hot start: Fill a large pot with water. Bring the water to a boil. Carefully place 12 eggs into the boiling water. Cook eggs for 12 minutes. Remove eggs from pot and immediately place in ice water. Keep in ice water for 15 minutes. Remove eggs from water and peel. Rate each egg using the following criteria: yolk is showing= 4 points, large chunks of albumen are missing = 3 points, only a little amount of the albumen is missing=2 points, there are a few marks on the albumen=1 point, the albumen has no marks on it=0 points. The egg with the fewest points is the best method of boiling eggs. Results will be available on the day of the science fair.

SCH129: Developing an Improved Marker for Protein Purification

In this project, the crystal structure of Ruby protein will be discovered and modifications will be used to create the monomeric version of the protein. Crystals will be formed by titrating conditions to find those which produce the best crystal specimen. Then, the crystal will be cryoprotected, x ray diffracted, a computer model will be generated. This model will be used to identify the sites where ruby is binding to itself and modifications to the protein for desired outcome (monomeric version) will be made. Hopefully all procedures will be successful and the modifications will be successful and result in monomeric Ruby protein. Then it will be optimized as a lab tool and will potentially lead to the creation of other useful fluorescent protein markers to inform researchers about the status of biological materials.

SCH130: Heat and Peanut Oil Proteins

My project aimed to see if heat had an affect on the allergy-causing proteins in peanut oil. I started by testing unseated peanut oil by placing a few drops of Biuret reagent in the oil since it is a detector of proteins. I would use a colorimeter to find the percentage of transmittance of the Biuret's violet color. This would tell me how much of the proteins were evident. I did the same procedure, but I heated five groups of oils in a deep fryer before adding the Biuret, using the heat settings of 135°C, 149°C, 163°C, 177°C, and 191°C.

SCH131: Effect of Fracking on Buffering

Buffers help aquatic ecosystems resist changes in pH. When chemicals from fracking enter a stream, they may affect the stream’s buffering capacity, lowering a stream’s biodiversity as a result. This experiment uses a titration to investigate how methanol, guar gum, and ethylene glycol, three chemicals commonly used in fracking fluid, affect the buffering capacity of a solution of carbonate and bicarbonate ions. The chemicals were tested individually. It was discovered that the addition of guar gum to a buffered solution significantly lowers its buffering capacity compared to a control whereas the addition of methanol and ethylene glycol have no effect.

SCH132: Pb On the Rise

This experiment was performed to test for lead in tap water of four homes with plumbing 1986 or before and four homes with plumbing installed after 1986. No lead in the drinking water is ideal; however, the Environmental Protection Agency (EPA) has a lead action level of 15 ppb. All homes received their water from the same public water source. I originally used a home test kit, but all the results were negative. So, I then arranged to go to a local water testing laboratory to perform more advanced testing for lead. Two water samples showed high turbidity. One of these water samples contained low levels of lead but was below the 15 ppb.

SCH133: Those Harmful Rays

Many people strive for that perfect summer tan, but the risks that ultraviolet radiation poses on human skin can be detrimental to one's health, so which material blocks the most UV radiation? This project examines which common material blocks the most ultraviolet radiation from the sun by using bananas, replicating human skin, wrapped with strips of various sunblockers. By placing the bananas out in the sun for a certain amount of time, and analyzing the darknesses of the stripes afterwards, I am able to determine the most effective material in reducing the harmful effects of UV radiation. My hypothesis is that the materials that are not transparent or rightly woven will reflect the most UV Radiation, therefore being the most effective in reducing the harmful effects of UV radiation exposure.

SCH134: Kinetic Stability of Fluorescent DNA Nanotags

The purpose of this research was to improve the kinetic stability of fluorescent DNA nanotags. A DNA nanotag is a fluorescent assembly of dtes bound to a DNA nanostructure. When excited, the nanotag gives bright fluorescence, revealing the presence and location of specific biomolecules. The good property of this technology is that these dyes provide brighter fluorescence than existing labels. However, the bad property is that the dyes can dissociate from the DNA structures very easily, leading to nonspecific fluorescent signal. In this experiment, we will attach dyes to PNA (peptide nucleic acid) that hybridize to DNA nanostructures. We will do this because the PNA should dissociate from the DNA slower than the intercalated dyes in the lab's previous nanotags. We will study this new type of DNA nanotag using UV-Visible and fluorescence spectroscopy, flow cytometry, and fluorescence microscopy.

SCH135: Electrolysis of Water

The purpose of this experiment was to try and f ind an electrolyte that will conduct electricity the best. Pure water is not capable of conducting electricity by itself; it needs an electrolyte to conduct electricity. During electrolysis, water splits into hydrogen and oxygen and then the hydrogen is used to fuel cells to generate electricity. My experiment demonstrates this process by dissolving the electrolyte in the water and testing if it can host electricity. I conducted my experiment testing sugar, salt, vinegar, baking soda, hand soap, and lemon juice. Based on my observations, I concluded that salt is the best electrolyte to conduct electricity.

SCH136: Get the Lead Out

This experiment is to determine how the pH of the solutions can affect the results of the lead tests. The findings of this experiment are significant for anyone performing lead tests at home. If the tests are not accurate, there is a chance that lead could go undetected and cause harm to any number of persons. Research Question: How does the pH of the solution used to perform lead tests at home affect the accuracy of the revealed lead concentrations? Hypothesis:The solution with the lowest pH (pure vinegar) will reveal the most accurate concentrations of lead. Procedure: Preparing for Lead Testing: Put on latex gloves, safety goggles, and laboratory apron. Label seven plastic cups and fill with the indicated amounts of water and vinegar. Cups a and b will not have sinkers, so they should have no color reaction when tested. They will serve as controls. a= 0% Vinegar (control) - 50 mL of water, b=100% Vinegar (control) - 50 mL of vinegar, c=0% Vinegar - 50mL of water, d=25% Vinegar - 12.5 mL of vinegar, 37.5 mL of water, e=50% Vinegar - 25 mL of vinegar, 25 mL of water, f=75% Vinegar - 37.5 mL of vinegar, 12.5 mL of water, g=100% Vinegar - 50 mL of vinegar. Place one lead sinker into cups c, d, e, f, and g. Record the time at which the sinkers were added. Cover all seven cups with plastic wrap and store the cups in a place where they won't be disturbed. Following the directions that came with the kit, tests should be done six hours after the recorded time. Testing pH: While waiting to test the samples for lead, determine the pH of each of the solutions. Label and fill seven cups with the appropriate proportions of vinegar and water as in step 2 of “Preparing for Lead Testing”.Read the instructions for the pH paper and then use it to determine the pH of each solution. Record the pHs in your lab notebook. Testing Your Prepared Solutions: After the lead sinkers have been in the solutions for six hours, test the solutions. Put on gloves and safety goggles. Using the eyedropper, fill the plastic test tube that came with the kit about one-fourth full with test solution from cup a. (Rinse out the eyedropper with clean water after each use and dispose of water in sealed container.) Dispense four drops of the indicator solution. Replace the cap and invert the tube (tip over and back) once to mix. Wait 90 seconds. If lead is present, the solution will turn yellow, brown, or black in color. If the solution stays clear, or becomes milky white, lead is not present in the sample. Compare the color of the solution with the color key that is in the kit instructions. Record the approximate lead concentration, in ppm. Dispose of the solution in a sealed container to be properly disposed of later. Be careful not to get the solution on your skin. The solution will have a rotten egg smell. This is caused by the sulfur in the test solution. Rinse the tube with water. Repeat the steps for the solutions in cup #'s b, c, d, e, f, and g. Repeat the entire procedure 13 more times, with fresh materials and solutions, so that there a total of 14 trials. Based on the results of the previous tests, further testing may be completed using decreasing amounts of vinegar. All results will be provided on the day of the PRSEF.

SCH137: Homemade Polarimeter with Chiral Molecules

Chirality is a property of many (usually carbon-based) molecules that causes them to be oriented in an either “right handed” or”left handed” way. Chiral molecules can be used to rotate polarized light. This rotation can be measured with a polarimeter. In this experiment, a homemade polarimeter was built to see if it could measure the rotation. The chiral solutions are different common substances containing either glucose, sucrose, or fructose, each of which might rotate the light a different amount. Polarized light will be shone through these solutions, and the angle of rotation (compared to normal polarized light) will be measured.

SCH138: Understanding Drug Solubility

Different liquids affect the time that pills take to dissolve. Six different drinks were tested: water, milk, orange juice, green tea, coffee, and Sprite. A hydrochloric acid solution was added to each drink to simulate the acid in the human stomach. Tylenol caplets were placed in each liquid for ten minutes on a magnetic stirring plate. The results showed that the coffee had the highest average difference in mass and dissolved the pill the most. Further studies include testing different pill coatings, such as gel capsules. This could improve the way people take pills.

SCH139: Does a Liquid's Surface Tension and Viscosity change with Different Temperatures?

The purpose of this experiment was to determine if a liquid's temperature affectes its viscosity and surface tension. The hypothesis was if the temperature of a liquid increases, then the surface tension decreases and the viscosity increases. Four liquids were tested; milk, oil, soda, and water and three different temperatures (40, 80, and 140 degrees Fahrenheit). Surface tension was tested by filling ten mason jars with each liquid at the three temperatures and recording the number of rice grains placed on a piece of paper was needed to break the surface tension. Viscosity was tested by timing each liquid at the three temperature through a funnel ten times each. Results showed that cold liquids had a higher surface tension then the other two temperatures except for oil which had a higher surface tension at room temperature. Viscosity results showed that viscosities were similar for all liquids at all temperatures except room temperature and cold oil which were both low. Due to the results of this experiment, the hypothesis was rejected for surface tension and viscosity when looking at all liquids together.

SCH140: Replacement reactions involving metals and copper chloride

The purpose of this project is to observe the reactions taking place in a simple replacement reaction and the reasons it occur. For an element with higher reactivity than Cu, Mg is supposed to react with aqueous CuCl2 with the products of MgCl2 and Cu. Experimentation revealed that pure Cu is not produced in the reaction and that unanticipated products were generated. Since the actual experiment didn't follow the theoretical chemical equation, an investigation using other kinds of metals was designed in order to discover if changing reactants would create the same result.

SCH301: Non-Toxic Anti-Fouling Paint

Sub-aquatic life attaches to the hulls of ships as they travel through water, increasing drag and causing ships to expend wasteful amounts of money and fuel. Although extremely effective, conventional anti-fouling coatings contain harmful biocides such as copper and tin. These biocides poison marine life and pollute oceans. In response, this project examines several methods of developing marine coatings based on nanotechnology that prevent the attachment of foulants while remaining environmentally benign. Experiment is ongoing and results will be available on fair day.

Computer Science / Math (SCM)

SCM100: Random Forests for Chemical Shifts

Calculating chemical shift values during run-time of molecular dynamic simulations is an important task, as accurate calculations allow for an accurate assessment of the efficiency of a molecular dynamic simulation. The purpose of this project was to use machine learning to develop an effective algorithm for predicting chemical shifts, focusing on trying to optimize both time and accuracy of the algorithm.

SCM101: Using R to visulaize gene expression data

Next generation sequencing (NGS) is revolutionizing gene expression analysis; it is more accurate, can analyze more genes and produce a more detailed profile of gene expression than previous technologies.This includes RNA-Seq: RNA-Seq are methods that use reverse transcription of RNA to obtain cDNA molecules that produce reads that are then read and aligned to obtain gene expression data. However, Next Generation Sequencing has its share of challenges. The primary one is the large amount of complex data that it produces, which requires expertise in bioinformatics and statistics to analyze and interpret. Therefore, it is often difficult for end-users, i.e, the scientists to analyze their own data. With this project I aim to make a tool that can create effective visualization methods, and allow the user to navigate these visualizations to answer their questions. To do this I used R Shiny to make a simple application that makes RNA-seq data more easy to manipulate. The program was made to analyze how data on a study that analyzed the effect of Dexamethasone (glucocorticoid) and Statin affect the developing mouse cortex. The application takes RNA-Seq data produced by the aligner Salmon and offers multiple methods of filtering and visualizing the data.

SCM102: Predator and Prey Relationships

The overall the goal of the project is to show the predator and prey relationship using computer science and art. Showing a simple simulation of relationship between a wolf and a sheep. As the wolf population decreases the sheep population increases and vice versa. But if there a less sheep to eat then wolves start to starve and die off. Still planning on or thinking about other factors that play in the simulation, such as disease, weather, and resources. The program might be a bit short not to long but just to explain the idea and make it more visual and interactive.

SCM103: What if your heart stops behind the wheel?

According to MedicalNewsToday, 2 of the top 10 causes of death in the U.S. are because of stroke and heart disease. Also, the CDC explains how 47% of cardiac-related deaths occur outside of the hospital. Based on these alarming statistics many people can have a heart attack anywhere, at home, at work, and even while driving. Although rising technologies have created heart rate monitors for people to wear at home, many don’t have a way to stop an accident from occurring while in a vehicle. This puts not only the person suffering from the cardiac disorder in risk, but it also jeopardizes the lives of those around them. This raises the question as to what new technology can lead to a safer and more efficient means of getting medical attention after a sudden cardiac issue while driving?

SCM104: Creating an Intelligent Suicide Alert Application

I will develop an intelligent suicide alert application to notify caregivers if an individual’s typed characters show similarity to those typed by depressed individuals. By utilizing a machine learning algorithm, the program will network the results from all users to provide a score to a caregiver. To keep this data secure, a hash algorithm will be employed and all typed strings will be checked against a dictionary. Once the algorithm is complete, I will work with the American Foundation for Suicide Prevention to further optimize my algorithm and determine the best way to implement it in the real world.

SCM105: A Machine Learning Approach to Classifying Acute Pain

Currently, methods of pain evaluation and diagnosis in the clinical setting are subjective and incoherent. The objective of this project is to classify acute pain in adolescents through the combination of electrodermal activity signals (EDA) and a feature extraction technique called time scale decomposition (TSD) for use in machine learning algorithms. EDA data was used for its connection to the sympathetic nervous system and pain response. Signals were collected from a controlled set of patients. The signal data was then downsampled, filtered and normalized and converted into TSD matrices for feature extraction. Dimensionality reduction was performed on the TSD matrices using k-means clustering. After compiling all patient features, the reduced matrices were used in machine learning to classify acute pain of the tested patients in an effort to eliminate the subjectivity that often prevents pain from being accurately represented in adolescent patients. Final results will be available on fair day.

SCM106: IoT: You've Got Mail

The purpose of this experiment is to illustrate how the Internet of Things can be applied to household tasks enhancing usability and security. An IoT mailbox sensor is constructed and programmed in order to generate data used in authentic contexts and to determine the improvement in functionality. Data collection by the physical experimenter demonstrates the effectiveness of the mailbox sensor. Data points derived from the sensor connected platform, Things Speak API, will be applied and extrapolated to engender meaningful metrics that improve daily life.

SCM107: Gen Z Votes

Many young people choose not to vote because they feel uninformed about the candidates running for office or simply uninterested in convoluted politics. My solution is GenZVotes, a computer program simulating an application that teaches young people about the political climates of their local governments. The Visual Basic.NET program contains a political ideology test, interactive menus of information about leaders and candidates running for local office, and a list of news sources from all different parts of the political spectrum to provide a simple, intuitive user interface tailored to them that helps better prepare members of Generation Z to vote.

SCM108: Using Computational Facial Analysis to Diagnose Sleep Disorders and Improve Sleep Quality

In the US alone, over 50 million adults have an undiagnosed sleep disorder with over 35.3% of adults suffering from health consequences attributed to chronic sleep deprivation. With no easy, non-intrusive and comfortable sleep monitoring solutions currently available, it is difficult to diagnose various sleep disorders. Consequently, I created a software application that employs convolutional image recognition, a novel flash-based pulse oximetry technique, and a relative cognitive test to painlessly use a users face after they wake to estimate how much quality sleep they received, suggest methods to improve sleep quality, and identify what sleep disorders that user may have.

SCM109: Benchmarking Parallel Tempering Parameter Estimation Algorithms

Please visit student's exhibit for abstract.

SCM110: CNN Protein Binding Site Predictor

Please visit student's exhibit for abstract.

SCM111: Comparing Grapheme And Phoneme Models

Utilizing training data for Arabic, Burmese, Farsi, Hebrew, Khmer and Urdu, the research will test the hypothesis that weighted finite state transducers will outperform seq-to-seq models for languages with less training data, while seq-to-seq models will outperform WFSTs for languages with more training data. The initial training data is found on the internet through published articles containing information on the orthography and phonology of each of the six target languages. Once found for each language, what is useful from within those articles will be used in the comparison of WFSTs and seq-to-seq models in G2P (Grapheme to Phoneme). The outcomes will be compared to the "gold standard" training data for each language to find the word error rate per 100 words for each system and language. The expected outcomes are for WFSTs to have the lowest word error rate for languages with less found training data, such as Burmese and Khmer. In contrast, seq-to-seq models will have the lowest word error rate for languages with more training data, such as Arabic. The overall results will show whether weighted finite state transducers or sequence-to-sequence models are best in both gathering and interpreting data for different languages, and G2P. The outcomes and error rates for Arabic, Burmese, Farsi, Hebrew, Khmer and Urdu should support the aforementioned hypothesis, thus showing which system performs better for languages with more or less training data. The outcomes will highly depend on the amount and types of training data found for each language, and will differ in what the word error rates mean for the experiment. The end results will give more insight into the performance of WFSTs and seq-to-seq models, as well as using G2P models for a variety of languages.

SCM112: An Analysis of Non-Modular Cryptography

A meta-analysis was conducted to determine the types of encryption, networks, and cryptography an individual can utilize daily to protect themselves. It became apparent some methods that were commonly utilized were inefficient in delivering their promises. It was determined any encryption utilizing modular mathematics is hard to crack, BitDefender anti-virus software performed the best in terms of speed/effectiveness, and virtual private networks are the single most important pieces to a secure connection. To further my investigation, I compiled a program that simulates what the average hacker experiences (not in terms of interface, but mathematics). I am still undergoing testing, but as of now, the results are showing a clear correlation between longer "breakthrough" times when the program is "encrypted" using modular methods.

SCM113: Utilizing Machine Learning to Optimize Wireless Communication by Reducing Interference

With an increasing number of electronic devices connected the the Internet, our current method of utilizing singular bands for communication oftentimes leads to cluttered and messy router subsystems. As a result, connections, while fast, are often inconsistent and easily dropped. This project attempts to ameliorate the issue by exploring a novel technique known as Radio Frequency Band Interpolation. Essentially, devices are open to be connected on a spectrum of radio frequencies as opposed to only one based upon a machine learning approach. In particular, this project explores the efficacy of such an algorithm in terms of maximum bandwidth and connection frequency.

SCM114: A Novel Solution for Drunk Driving - Voice Recognition Start

The solution of Voice Recognition Start (VRS) responds to the epidemic of drunk driving. 28 people die every day because of it and most solutions have been violable. The user records a voice sample and it's uploaded to the user's car through Bluetooth. The VRS itself is installed through a car relay. It filters through background noise through a filter of 200-2000 Hz. Then, it extracts a speech envelope of 500-750 Hz. Once a human voice is detected, the VRS identifies the user's voice. If the cadence graph deviates by more than 2 mm, the user cannot access their car.

SCM115: Predicting Disaster Effects Using Algorithms

The primary goal of my project is to create a predictive algorithm to estimate the effects of natural and man-made disasters before they occur. I will do this by using various demographics from the area effected by the catastrophe. My algorithm will incorporate realistic environmental factors, and will then be tested using historical records of major weather events. I will use Bayesian analysis techniques to quantify any errors present in my algorithm. My finished product should be used as either a risk-analysis tool to predict the impact of future events or as a real-time crisis resource manager.

SCM116: Redesigning the Clarinet Family

Upon examining various members of the Boehm system (French/British style) clarinet family, certain inconsistencies in design, construction, and playability became apparent. Most prominently, all clarinets from the Eb Alto down possess a fully cylindrical bore that begins to expand only at the bell, unlike that of the Bb Clarinet and higher. In addition, I have noticed multiple intonation and resistance issues from the larger clarinets that are either inconsequential or absent on their smaller, higher-pitched siblings. In response to these findings, I will attempt to analyze these inconsistencies mathematically. A series scale factors and equations will be calculated that aim to put the bore diameter/shape, tonehole size/location bell size/shape in proportion within the instrument itself as well as to other sizes of clarinet. The ultimate goal is to produce a modified alto (as well as bass and Bb clarinets if possible) that yield stable intonation, uniform tone color, and consistent playing characteristics.

SCM117: Polynomial Maps of Finite Fields

Emergence of Bitcoins and the recent Equifax security breach demonstrates the importance of cryptography. Many cryptosystems and attempts to break them rely on algebraic varieties and maps over finite fields. I study iterations of polynomial maps over finite fields where each extension of the base field induces self-maps of points over that extension. I negatively answer a previously open question posed in a recently published paper in this area. I hope to extend these ideas further to answer other open questions as better understanding and characterization of polynomial maps over finite fields are crucial to the security of cryptosystems.

SCM118: Improving Password Security with Text-Dependent Speech Verification

The technological revolution that began in the late 20th century has made the world as we know it today heavily technologically dependent. Before, valuables or private data were protected with a stainless steel lock, but nowadays, most methods of storage has gone digital. In the beginning, passwords were reliable and safe, but with the development of technology and hackers becoming increasingly skilled, protection methods beyond simple digit/number passwords are needed to effectively protect data. This has opened a new frontier for research: voice biometric authentication. This is a method in which a segment of recorded human speech is “spliced” into thousands of readings per second in order to obtain information about the user, such as his/her tone, pitch, etc. Each person’s speech result is stored as a mathematical representation, and, just like the fingerprint, is unique. Therefore, a person’s voice can securely act as his/her password to assets, or other valuable data stored in the digital world. Training of a model is required to produce confidence measures, which are test statistics for accepting or rejecting a user.

SCM119: The Mathematical Principles Underlying Origami

The purpose of my project was to explore the mathematical principles of origami. Many of these principles have led to important innovations such as the heart stent and solar array. My mathematics goal was to verify the Huzita-Hatori Axioms and prove that these axioms can trisect an angle. To verify each axiom, I constructed figures based on the axiom and created a table to show that the figures confirmed the axiom. I also constructed a trisected angle and proved that origami could be used to trisect an angle. Origami has tremendous computational power.

SCM120: Pattern Recognition with Neural Networks

My investigation’s purpose was to create artificial neural networks to recognize patterns, highly applicable in the current technological era. Artificial neural networks recognize patterns by mimicking the problem-solving functionality of the nervous system. Neural networks contain pre-determined weight values and are given several inputs. The input and weight values are incorporated into a function. The function’s result is then compared to a pre-determined desired value, and an error is calculated. Then, the weight values are trained over multiple iterations using the Widrow-Hoff algorithm. Adaline and Madaline networks were constructed, and data is being collected on the training process for both.

SCM121: Material Viscosity Prediction under Normal Swallowing Conditions via High-Resolution Cervical Auscultation

The purpose of this research was to create a machine learning algorithm that is able to analyze signals produced from Cervical Auscultation (CA). CA is a method that can be used to diagnose patients with Dysphagia, a swallowing disorder. The algorithm was created using the MATLAB coding software. Features were extracted from the signals using standard statistical properties. Then, the signals went through a 10-level discrete Meyer wavelet decomposition, from which the entropy rate, the mean, standard deviation and kurtosis were then calculated. These features were then used to train four different types of machine learning algorithms: Linear Discriminant Analysis, Logistic Regression and two types of Support Vector Machines.The Support Vector Machine with the Gaussian Kernel vastly outperformed the other three algorithms, achieving 90% classification accuracy. The other types achieved no greater than 60% classification accuracy. From this study, we have confirmed that swallowing accelerometry can be used to identify characteristics of each swallow. This boosts the viability of cheaper and less invasive methods of diagnosing dysphagia. The signals can also be used to further understand how the features of healthy swallows compare to those of dysphagic patients. Updates to the algorithm could include classification of different materials. The end goal for this research is for an algorithm to be developed that is able to detect whether the patient is dysphagic or not.

SCM122: Speech to Text Software: A Comparative Study

In today's world of ever growing technology, the primary purpose of smartphones and other gadget is to make consumers more productive - completing the necessary tasks as quickly and accurately as possible with ease of use. One aspect central to all of smart phones is texting or communicating speech to text programs; this includes communicating with various artificial intelligence assistants to complete daily tasks. However there are so many programs with different options, making it difficult for consumers to know which smartphones to buy/use to best suit their communication needs. Using the 4 most commonly used voice to text programs, a common series of commands will be tested to determine the best overall program, with criteria in speed of response, accuracy of response (word choice, syntax), and ease of use. Commands will be provided with a standard voice medium (Windows Voice) with varying voice speeds, and background noise. Consenting participants will also test each of the programs with a standard set of commands. Dragon Dictation is hypothesized to be the best overall program due to its advanced code/AI programing that is built into the software.

SCM123: The Effects of UI Design on Memory

With more and more tasks involving some form of computerization, it's important that these applications don't hinder users with a steep learning curve. Three different user interface designs for a program were designed, and users were asked to perform a task in the program, one time with instructions, followed by one time without. According to data recorded by the program, interfaces which display more actions at once tend to have fewer user errors than interfaces with actions organized into menus, and consequently tend to improve the speed at which users complete a task.

SCM124: Different Classification Algorithms

One complex area of Computer Science is classification. Different algorithms are more effective than others with different amounts of data. Using a sample data set, I separated a variable percentage of random testing data and training data, then trained different types classification algorithms to test which algorithm is most accurate with the least amount of data. The two algorithms I worked with were decision trees (which creates a kind of flowchart) and neural networks (which have neurons and weights). According to my data, neural networks, while taking a longer time to process, are much more accurate with less data.

SCM125: Genetic Convolutional Neural Network Optimization for Wildfire Prevention

Traditional methods of convolutional neural network (CNN) hyperparameter optimization are inefficient, too computationally expensive, and rarely result in the most efficient solution. In order to effectively navigate this large sample space of hyperparameter combinations, I propose using a genetic algorithm to select for the optimal CNN architecture. Specifically, this genetic algorithm approach can be proven through application in the prevention of wildfires. An optimized, problem-specific CNN architecture would best provide early wildfire detection and real-time tracking for firefighters to help allocate resources to areas with the greatest need for quick and safe containment, preventing further damage and loss of life.

SCM126: The Fastest Kessel Run

I will be creating an algorithm that is themed with Star Wars. Han Solo said he made the Kessel Run in 12 parsecs. While parsecs is not a unit of time, I'd like to see if that number can be improved by using an algorithm to plan routes. The goal of the algorithm is to be able to get to all the planets (nodes) in the fastest time given a starting location and a speed. There may be certain restrictions place on the planet or ship to make the route harder to compute. This algorithm will be computed using Java and differential calculus. Real world applications exist such as the mailing routes or airplane passages that this algorithm can be applied to.

SCM127: Applying Linear Algebra

1. Purpose-How are the techniques of linear algebra utilized in many different fields? 2. Goal-Explore a range of professional fields that utilize the methods of linear algebra in multiple ways such as economics and the physical sciences. 3. Procedure- Analyze the methods studied in linear algebra and determine fields that use it through research. Analyze Markov Chains and discrete dynamical systems through problems including political systems, economic systems, and predator-prey models. Real life and hypothetical problems are studied, the connection between Markov Chains and discrete dynamical systems, and calculation of eigenvalues and eigenvectors.
4. Results-Results will be present at fair.

SCM300: New Negatives

The American schooling population has taught negative number equations with the identical symbols of addition and subtraction for decades; which causes confusion, lesser efficiency, and effectiveness of a lesser value than possible. Therefore, a more modern teaching less plan has been innovated from the traditional teaching to solve this error by using different symbols from addition and subtraction to represent positive and negative with the conclusion that this is more effective.

Engineering / Robotics (SER)

SER100: Fencer Wireless Scoring System

I sought to prototype a scoring system for the sport of fencing. Current scoring systems available to high school clubs use mobility-impeding wires connected the fencers and can cost over $1000. I aimed to improve upon these designs by incorporating secure wireless communication and reducing the price to under $150. My prototype system utilizes two microcontrollers with built in Bluetooth and signal processing capabilities that relay data from each fencer to a laptop scoring the match. This prototype met both of my design goals and properly scores matches with minimal latency, but lacks the robustness of a commercially available system.

SER101: ResQbot: An Autonomous Echolocation-based Search and Rescue Water Robot for Natural Disasters

In recent years, there has been a significant increase in hurricanes, cyclones, and inland flooding incidents throughout the world. In cases of flooding, the main concerns that those in need of rescue face are being unable to leave their homes or communicate with the rescuers. Because of this, rescuers cannot locate those who need to be rescued and sometimes cannot navigate through the dangerous waters. The purpose of this project was to develop a communication and navigation system, called ResQBot, to allow rescuers to track, locate, and navigate to the position of a person in need of rescue during a natural disaster. ResQBot travels autonomously, looking for human presence using infrared thermography. Using a GPS device, ResQBot plots the location of those in need of rescue on a map. The rescuer can then use ResQBot to guide them to this location. It alerts the user to avoid unsafe waters, and can help to avoid sink holes using sonar technology. ResQBot charts an efficient route for the rescuers, ensuring safety and speed in the rescue operation.

SER102: Using Excess Runoff for Green Roofs

The purpose of the experiment is to design a system to collect excess water from green roofs for reuse. By using soil that retains water and an effective collection system excess runoff can be reduced. A model green roof will be build to test the ability of engineered soil to retain water and support the production of cash crops. The moisture levels in the soil and the percent of water collected from the model will make up the data. Conclusions have not yet been reached due to ongoing experimentation.

SER103: A Novel Control Algorithm for Teleoperated Robotic Surgeries

The purpose of this project was to create an intuitive control mechanism for robotic arms, to be used for precision applications, specifically robotic surgeries. This project consists of three main parts: building the sensor array to collect data while the operator is controlling the robot, programming the sensor array and relaying it's information to the robot, and testing and refining the algorithm previously mentioned. So far, I am in the stage of completing the algorithm that takes the data from the sensor array and relays it to the robot. My next step is to test out the algorithm, and maybe pass the data through a filter to regulate it more. After testing it, it will undergo one last pass of refinement, and then it is ready to be presented. I have not yet collected all of my data, so I do not know the results.

SER104: Automated Status Reporting and Control of Systems Using IoT Sensor Data

Technology consulting firm Gartner projects that 6.4 billion connected things and devices will be in use worldwide this year, up 30 percent from last year. And Gartner forecasts that number will grow by more than three times, to nearly 21 billion by the year 2020. There is no uniform and automated way to get the status reports on the health of these systems. Any failure of the critical system or equipment can lead to financial losses and loss of life in extreme situations. Engineering Goal: Investigate and design an automated status reporting mechanism that can diagnose and control the state of systems using IoT (Internet of Things) sensor data. Procedure: 1) Identify the devices and systems that need automated status monitoring and control. 2) Using IoT (Internet of Things) sensor data, acquire the vital statistics data from the devices and systems. 3) Gather and analyze the sensor data using advanced analytics techniques. 4) Build an automated system to diagnose the system performance. 5) Implement an automated mechanism to report the system performance. 6) Investigate a mechanism to allow self healing of the system. Data Analysis: A combination of graphs and visual data representations will be utilized to show how each data element performs.

SER105: Wood Stove Temperature Regulator

This research aims on designing an automated mechanism that regulates room temperature by adjusting the air intake to the stove. We have selected cheap components that can be found for few tens of dollars and a simple design that can be replicated by every DIY enthusiast. Our goal is to make a real-life usable design that anyone can assemble and operate.

SER106: Automatic High Beam Adjusting System

my project is to make a system that could automatically shut down the highbeam when the intensity of light is sensed at a certain level. For example, when the opposite way has a car coming, the light level will go above the intensity line, which means closing the highbeam. This will prevent car accidents and save the driver's time when they have to shut the highbeam down when there is no more need. In order to do that, a light sensor that identifies the intensity of light and decides to adjust the light.

SER107: Efficient Shapes of Small Hydro Turbines

Rationale: While I was researching small water power plant turbines, I realized that there is not enough research about efficient number of blades in one turbine and degree between blades and the center. In researches, I could only find approximate number of blades and degree between blades and the center: around 5 to 12 blades and from 106 to 165 degree is the most efficient way. So I wanted find out exactly how do number of blades and shape of if give impact to energy efficiency. Also, there are other shapes of blades. Then I started to wonder how does it effects to the energy that will be made. Engineering goal: Small hydro power plant gives small amount of energy to places that need small amount of energy. For examples, people who live in a deep mountain will use this generator to make energy that they can use. Despite of small amount of energy that it produces compare as other hydro power plants, it is more eco- friendly and needs less money to maintain and install. By knowing and developing the efficiency of small hydro power turbine, I want to help people who lives in area that is hard to get energy. Hypothesis: If the turbine has 12 blades and has less than 165 degree with the center will produce the largest amount of energy. Steps: 1 research 2 design, 3 make, 4 test. Procedures: Make models of turbines that have different number of blades and have different degree between blades and center. Measure the amount of energy that has collected from the turbines. Compare the results. Measure the amount of energy again in different conditions. Compare the results and do analysis. Data analysis and results: I will use table, graphs and pictures to analysis my results. 5 references:

SER108: The Viability of Cylindrical Loudspeaker Enclosures

Bad speaker enclosures distort input audio by making frequency response of the output irregular. Internal waves bounce off parallel surfaces inside the enclosure creating standing waves. Enclosures with fewer parallel sides reduce resonance. I hypothesized that with fewer parallel surfaces, a cylindrical enclosure would have less resonance than a rectangular enclosure. I built speaker enclosures and measured frequency response in a sound isolation booth by playing a log sweep. At high frequencies (1k-10k) the cylinders I tested had flatter responses than the rectangular enclosure. However, at low frequencies, cylindrical enclosures were more resonant, possibly due to thinner walls.

SER109: Skyscrapers Standing Tall

The purpose of this experiment is to see the most stable skyscraper design against extreme winds. I did this because I was interested in architecture and will like to test it more in the future. This can help humans moving forth when designing skyscrapers in windy areas. I believed that the design 4 will do the best under wind because it is the most aerodynamic. I modeled the skyscraper out of heavy styrofoam and use a small desk fan to simulate the winds on a skyscraper. I then saw which model shook the most or if it even fell. I also taped the skyscraper down to the table the same way as the other models. Data and analysis will be available on competition day.

SER110: Self Powered Engine

Use trial and error, following a procedure, to determine if it is possible to create a self propelled engine.

SER111: Sound to Electricity

For this project, the researcher will test the possibility of converting sound energy into electrical energy. They will use a piezoelectric piece to capture and transform the energy. The researcher will use varying pitches to find the frequency that produces the most electricity, of which they believe the higher the pitch the better. The researcher will record their results and compare them to see the most effective frequency. All data collected by the researcher will be available on competition day.

SER112: Farming of the Future

There is a large decrease in farmland due to the growing population. My project provides a simple and compact way to grow plants inside using hydroponics so that everyone can access fresh produce. The seeds were started in micro blocks before being transferred to the hydroponic system. A few weeks after they were transplanted, they started to vine and fall over. I constructed a plant stand out of dowel rods to allow the plants to continue to vine and grow. In the end, all the plants in the hydroponic system died due to the temperature of the water.

SER113: The Effect of Mass on Articular Cartilage Deterioration Within the Knee

Osteoarthritis in the knee occurs when mechanical stress leads to the damage of articular cartilage. Obesity increases the risk of one developing osteoarthritis. The purpose of my project was to determine how mass affects the rate and amount of cartilage deterioration within the knee. I constructed a model knee in order to accomplish this. In addition to simulating motion, the knee I designed allowed for the effects of excess pressure to be recorded via cartilage deterioration. I predicted that as the amount of mass applied from the femur to the articular cartilage increased, the amount and rate of deterioration would also increase. Foam discs acting as cartilage were massed before and after being exposed to mechanical stress and motion. This procedure was repeated 30 times per variable group. I repeated the entire experiment twice and calculated the change in mass caused by the deterioration. All data was recorded in my data book.

SER114: Electromagnetic Induction Powered Mobile Charger

Portable chargers have become a necessity, for cell phones are constantly needed on the go. Most portable chargers are either solar powered or require charging at home before they can be utilized. However, a charger powered by electromagnetic induction/relative motion eliminates the need for a sunny day or wall socket. This project's aim is to develop a more convenient and practical charger. Powered by shaking, the magnet within will pass through a group of copper coils to create an emf current. The project remains in continuation, and at later times will be compared to efficiency of other charger types.

SER115: Alternative Gadget to Replace ITF Standards

The purpose of this research is to develop a mechanism that can replace the expensive ITF (International Tennis Federation) standard equipment. Measurements for the internal pressure of tennis balls are found by using highly nonlinear solitary waves which propagate through a chain of solid spheres and are picked up by a piezoelectric sensor. The time of flight of the solitary pulse when it reaches and returns to the sensor from the tennis ball can determine the stiffness of the ball. If these measurements are accurate and can be paired with a pristine ball's maximum bounce height, then these devices could provide a cheaper and more space efficient alternative.

SER116: Robot for Powder Distribution

My experiment's objective is to test the design of a powder dispensing apparatus for efficiency and accuracy when delivering powder. The experiment will be conducted at follows; each powder quadrant will be filled, and then held open for different time intervals. The amount of powder that is dispensed over this interval will be measured and then compared to the amount of powder that was dispensed during the other time intervals. The relationship between time and the amount of powder should be proportional; as the time interval over which the powder was dispensed decreases, so should the amount of powder that is released, and vice versa. My design is optimized for consistent and accurate powder distribution. It uses an air piston for precise door actuation, and a slightly larger, solid hole for the powder to fall through, decreasing the probability of jams and allowing for ideal powder. I intend to conclude that the amount dispensed is proportional to the time that it is released, with the graph of my variables being linear. This would signify that my design is capable of accurate and effective powder delivery, with reliable consistency; soothing that is needed when 3D printing objects that require multiple powders.

SER117: A Cover For Darkness

Light pollution, the artificial lighting of the sky, can cause many problems, including interrupting mammalian circadian rhythms, disturbing ecosystems, and wasting resources. To combat this problem, I conducted a lighting audit of my high school parking lot and analyzed the results. I developed specific recommendations to reduce light pollution by decreasing excessive light and by retrofitting light fixtures to eliminate misdirected light. Finally, I am building a model of a cost effective light cover that will reduce or eliminate misdirected light at my high school, thereby reducing the overall amount of light pollution. My results are not yet complete.

SER118: Which species of mushroom produces the strongest building material?

Purpose:To determine which mushroom species grows strongest mycelium. Hypothesis:The bricks grown from Portobello mushrooms will grow the strongest. Procedure:Prepare 2,250 grams of sterile wood chips. Put 50 g into 45 different bags, label 15 with each species of mushroom. Distribute the mycelium that corresponds with each label on the bag. Allow to grow for 3 weeks then dry out blocks that result in a 77° C. oven. Place one block onto testing apparatus and begin to place weight in the bucket until the block breaks completely in half. Repeat for each mycelium block. Results will be available on fair day.

SER119: Viscosity and Pendulum Dampening

This experiment investigated the relationship between the rate of decay in a pendulum's motion and the concentration and dynamic viscosity of the medium through which it oscillates. A preliminary experiment was conducted to isolate the effects of the viscosity of the medium. In the second part, the pendulum was allowed to swing through air, serving as the control group, then through solutions of various concentrations. The times and velocities at the equilibrium position were recorded as the pendulum oscillated and were used to calculate the rate of decay in the motion. Data and conclusions will be available at the fair.

SER120: Efficient Magnetic Resonance Imaging of the Brain

In this project, I investigated how to use three-dimension display software which is installed in the scanner, and the image processing that could be combined for better MRI acquisition. I expect that the imaging processing aided the MRI planning, and could improve the accurate targeting of an interesting region without excessive additional preparation time, < 5 min.

SER121: Building Optimum Performance Levees

This project will be evaluating what types of materials make the strongest levee. I will do this by creating levees made with variations of dirt, sand, clay, and rock. These will then be evaluated by attempting to break them with a constant force. The composition of the "best" levee will be replicated with different interior wall angles to find which one will hold the most water.

SER122: Testing the Structural Integrity of Buildings During Earthquakes

This project will begin with the creation of four different types of buildings using the same materials for each. Then they will be put through an earthquake simulator and then the building's ability to stand in sand, soil, rock, etc. will be evaluated.

SER123: Best Truss Designs

The purpose of this experiment is to find which truss design is the strongest. I will find this, by building and testing different truss designs, including,Common Truss, Hip Truss, and the Regular Gable Truss. To test the designs, I will place weights on the structures, increasing in weight, until they break. To ensure that I will be testing the design, and not the material, I will use the same amount of the same type of material. My project will try to find a truss design that will be able to better withstand weight, such as objects thrown on roofs due to hurricanes, and other natural disasters. Results will be available at competition.

SER124: iSolar

Renewable energy sources are becoming a more prominent feature of society today, as our endeavor to pull away from fossil fuels and save the environment increases. My engineering project focuses on the renewable source of solar energy and making a more efficient use of this source in a practical portable charger. To do this, I bought solar cells, soldered them together, and then hooked that part up to a circuit board and battery pack. Also, I folded the cells for a smaller size. This research is still ongoing and changes are still being made to the design to maximize efficiency.

SER125: Does the amount of air pressure in a soccer ball affect the time it takes to reach the net?

Purpose: I love playing soccer and it has always had such a great impact on my life. But sometimes the ball is flat and it just doesn't fly right or is harder to play with. I wanted to do an experiment that i would be able to take back to my coach to help with the pressures in our soccer balls. It was a really fun experiment and I'm glad I did it. I learned a lot and took it all back to my coach. My hypothesis is if the ball has more air pressure, it will travel faster to the net. Results will be available on the day of the science fair.

SER126: Automated Cabinet

A device that opens and closes cabinets controlled by a limit switch. The device is a rack and pinion design; it utilizes a gear, servo, and track. Its purpose is to help disabled and older people open kitchen cabinets. The actual device is made from Tetrix parts and was programmed through RobotC. Parts had to be switched from Lego to Tetrix for better results and consistency. Data will be analyzed through its success rate and total operation time.

SER127: Improving Autonomous Vehicle Performance Using Infrastructure-Based Sensing

Automobiles are becoming safer, cleaner and more affordable. The next generation of automobile innovation is the self-driving or autonomous vehicle. The technology has a lot of possibilities to benefit humans. However, to become a reality, the technology must overcome key issues in safety and navigation. The goal of this project is to improve autonomous vehicle performance through data that is already available in the surrounding infrastructure.

SER128: Distracted Driving Detection and Prevention using Sensor Fusion and Machine Learning

Distracted driving transpired a total of 19,561 deaths in a span of six years from 2010 to 2015 in the United States only. Furthermore, teenagers have the highest crash rate on the roads out of all age groups, and 60% of teenagers were distracted at the time of a car accident. In this engineering study, a portable and cost-effective glove is designed that is equipped with various sensors using a machine learning algorithm to monitor distracted driving for teenagers. Additionally, an application is created that logs this information and alerts parents about their teenager's statistics while driving.

SER129: Hinge Lock

I have decided to create a device, a hinge lock, that could potentially increase security, particularly in schools. It will be used in the event of a lock down. The lock will slide over the hinge of doors to prevent the door from being opened. I used a program to create a prototype of the lock and printed it using a 3D printer. I then machined the lock out of metal. The metal prototype will then be tested using various hinges, specifically the types of hinges found in school buildings. I will follow the listed steps to test the prototype. First, I will use set up a wooden post that can be drilled into and made to be still (unable to move or give way) and a push/pull spring scale. I plan to buy a hinge identical to that which is used for the doors, and connect it to the unmovable post. I have wood here at home that I can cut to be as wide as a school door and connect to the other side of the hinge. Then using a rope that will be tied to the wood, I will connect the push/pull spring scale to the rope and pull till it breaks or something gives. The results of the home trials will then lead to further trials on actual school doors. All results and data will be provided at the day of the science fair.

SER130: Acorns Take Root in the Economy

The purpose is to use acorns as a renewable resource for manufacturing paper, insulation, and yarn with the soft inner lining and mulch with the outer shell. For yarn, the fibers were too small to twist on a spindle. As paper, the fibers easily broke apart. The fiber slowed the cooling process compared to no insulation. After ten minutes a thermometer in an ice cooler dropped by 6℃ when surrounded by fiber. The thermometer alone dropped by 12℃. For mulch, the shells soaked for a week, showed no decay, and maintained its hardness, which indicated it would withstand weathering.

SER131: Computerized Trainer to Improve Reaction Time in Post Concussion Athletes

The purpose of this experiment was to create a computerized trainer to improve reactive time in post-concussion athletes. MRIs and other medical imaging technology don't show the effects of traumatic brain injuries all the time. Also, concussions impact an athlete's ability to react to their environment at regular speed. Procedure: 1. Design and build a circuit to control one LED and one push button using the Arduino single board computer. 2. Test and debug a program to blink an LED on button press. 3. Design and build a circuit to control two LEDs and two push buttons using the Arduino single board computer. 4. Test and debug a program to blink an LED on button press. 5. Test and debug a program to light an LED and turn it off on button press. 6. Solder the LED lights & control wires into a Trellis board & assemble. 7. Test & debug a program to test N Trellis boards for lighting LEDs and responding to button presses (N=1). 8. Repeat steps 6 & 7 to control N=2 Trellis boards (32 LEDs and buttons). 9. Repeat steps 6 & 7 to control N=3 Trellis boards (48 LEDs and buttons). 10. Repeat steps 6 & 7 to control N=4 Trellis boards (64 LEDs and buttons). 11. Test & debug a program to operation a concussion reaction test using N=4 Trellis boards. 12. Record results.

SER132: Internal Injury Prevention

My project was on creating better body padding that could be used in sports or other necessarily applications. The torso is not as protected as it should be. This leads to players getting broken ribs and damaged internal organs. How I did my experiment was I replicate a human torso using aluminum for the ribs and different sizes of balloons for the organs. Using pendulum with a spring to bring it down. I did test with five pads that I made. To measure, I used a ruler to measure slits made in the balloons.

SER133: Most effective Optical Camoflauge

My project is based upon the need for a camouflage for not only camouflaging the wearer but will also disrupt anyone trying to target them. Disrupting the line of sight of the individual who may be targeting a soldier thus it may save many soldiers' lives. To find this pattern of camouflage, I am going to test different existing patterns and make a new pattern as well. The test will include a series of targets created from the patterns and will test the locations from center for a specific number of minute it takes to find the pattern. Based on the data I will conclude which pattern works to conceal a soldier from sight most effectively.

SER134: Electric Field Dectector

The static electricity field detector will light up when a static electricity field is nearby. It is based on the principle that the transistor will darken with the presence of a negative electric field. After an object obtains a negative charge, the field detector will light up when the object is close. The transistor's drain and the negative pole of the light emitting diode are hooked up. The source and one end of the resistors are hooked up. The negative battery and other side of the resistors are hooked up. The positive end of the light emitting diode and the battery are also hooked up. The on-line versions have the light emitting diode darken in the presence of a negative field. The reason why this detector does the opposite is that this design is laid out differently. This design is less sensitive. However, it does allow for more accurate results than the on-line version. Often, walking around nearby will cause the light to dim with the on-line version, making it hard to test and demonstrate.

SER135: One Arm Robot

Purpose: The purpose of the goal is to build a small pneumatic arm that will move objects from point A to point B. Procedure: Build a pneumatic powered arm using wood, syringes, a swivel, valves, 4-way air splitters, clear vinyl tubing, and an input air pump and output air pump. Data: The one arm robot has made impressive improvements. It is now able to lift 20 ounces, 2.5 times more than the previous system. Conclusions: The arm would be implemented perfectly into a factory with small foods or anything that would not be usable if contaminated by hydraulic oil.

SER136: Copper-assisted chemical etching for silicon nanostructures

This project seeks to determine the viability of what is potentially a cheaper way to perform MACE (Metal Assisted Chemical Etching) for surface treatment of photovoltaic solar cells. MACE is an inexpensive way of creating nanostructures that absorb more light and increase the efficiency of a silicon solar cell, but current etchants use silver as a catalyst. To lower the cost, this research project explores the use of copper as a catalyst instead. As of this date, insufficient data has been gathered to draw conclusions about the feasibility of the process, but this data will be present in the presentation.

SER137: Portable Solar Cell Phone Charger

I decided to design and make this charger so that when there is no electric and you want to charge your phone, you can. I designed the case in a computer program called “Inventor” and printed it in a 3D printer. Then I soldered the wires in a phone cord to two solar modules, and wired them in a series circuit. The solar panels help with saving energy and using sun power, but they are somewhat inconvenient because it would take 83.87 hours to charge my phone (with no efficiency loss, meaning my phone is completely turned off).

SER138: CVFOR Object Following and Avoidance

The objective of this project is to create an algorithm that utilizes machine learning and a camera to allow small robots to navigate a space while avoiding obstacles and following an intended object. This is intended to take technologies used in advanced self-driving cars and putting them to use in smaller cheaper robots. I am going to utilize TensorFlow to utilize and adapt current neural network models to control a robot. The end goal of this project is to have a model that can run on a raspberry pi with at least 10 predictions per second and to begin to train it. Currently, a model called alexnet has been used to control a driving simulation game and attempts to follow a ball. The main problem with this current model is it lacks time perception, so the current goal is to try different methods of giving the algorithm time perception without increasing its size.

SER300: Here Comes The Sun

The purpose of the experiment was to design a toy car that ran on solar energy and had the solar panels rotate to continually face the sun. The car was built by soldering solar panels together and attaching them to a servo motor. Then an Arduino was used to code the servo to rotate to make the solar panels always face the sun. It did this by reading photoresistors. This car is powered by solar energy, rotates the panels to face the sun, and cuts down on money spent by consumers and waste of materials like batteries.

SER301: Arrow Location

The purpose was to create a more efficient way to find arrows. For test #1, we placed an arrow at 10-40 yards and recorded the time it took to locate them. Once we completed this, we did the same with the arrow containing the tracker. For test #2, we shot the arrow containing the tracker 100 times consecutively to test durability. Our data showed that our tracker saved 14 minutes, and an average of 3 .7 minutes per test and the arrow did not break after 100 shots. In conclusion, our arrow tracker was both efficient and durable.

SER302: Hydroelectricity: A Necessity in Pittsburgh

Pittsburgh is an area with a plentiful amount of bodies of water, there is no doubt that the city should use these resources through building hydroelectric generators in the rivers. A need for this experiment was issued to find out if Pittsburgh’s resources and locations can be used effectively. Splitting the experiment into two steps, the first analyzing the effect that the density of water can have on the electric output from a hydroelectric generator. The second tests each of the three rivers of Pittsburgh to see which is most ideal to for placing generators in based on its density.

SER303: The Affect Of Launch Angle On The Projectile Range Of A Trebuchet

The purpose of this project was to ascertain how different physical parameters affect the range of a trebuchet using calculations and physical experiments, and determining the optimum launch angle and sling position. Calculations were used to determine the lengths of materials used to build and test the trebuchet. The average distance the projectile traveled in Trial 1 was 29.5 yards and 42.6 yards in Trial 2. It was concluded that the projectile range was directly affected by the launch angle and sling position.

Earth / Space / Environment (SES)

SES100: Plant Growth vs. Pollution

Earlier this year, I was in New Delhi, India visiting family. Recently, the pollution levels there had increased so much that the people there can't leave their house without masks. After witnessing this situation, I began to wonder how the pollution was affecting its surrounding environment. My idea was to compare two plants; one would be affected by pollution similar to that of India, and one would be growing in a regular environment. My hypothesis for this experiment was based on my observations of my plants over time, seeing if the polluted ones looked different in comparison to the non-polluted ones.

SES101: Reducing Roadkill and Fusing Fragments

New roads are being built everywhere. Because of this, roadkill rates are immense, and threaten species that are already endangered. Habitat fragmentation is another consequence of the increasing number of roads in our society. I wanted to give possible victims another mode of crossing the road, to fuse fragmented habitats and reduce roadkill numbers. For 6 days, I examined the behavior of harvester ants when they were put in a situation with an actively used road and a bridge or tunnel to cross the road safely. My data supported the theory that these alternatives could improve this everyday problem.

SES102: The Effect of Climate Change on Natural Disasters

The purpose of this investigation is to explore a possible association between the strength and frequency of natural disasters and climate change. Hypothesis- If the strength and frequency of tropical cyclones, tornadoes, tsunamis, and earthquakes in the northern hemisphere in the past 50 years is plotted relative to annual temperature changes, I predict there will be a positive association between temperature increase and hurricane and tornado strength and frequency, while earthquakes and tsunami rates would stay consistent. Procedure Retrieved statistics on the annual number, max speeds in kilometers per hour, and minimum barometric pressure in hectopascals of tropical cyclones affected the Northern Hemisphere since 1967. Retrieved statistics on the annual number, max speeds in kilometers per hour, minimum barometric pressure in hectopascals of tornadoes affecting the Northern Hemisphere since 1967. Retrieved statistics on the annual number, measure of surface waves in kilometers, and magnitude on the Richter Scale of earthquakes affecting the Northern Hemisphere since 1967. Received statistics on the annual number, average tsunami height, and potential energy based on the Murty & Loomis Magnitude scale of tsunamis affecting the Northern Hemisphere since 1967. Analyzed data by graphing out each variable to find a positive, null, or negative correlation between the weather-based natural disasters listed above and the increasing global warming of the last 50 years.

SES103: Analyzing Water Quality Using Real-Time Sensor Devices

Pittsburgh's 3 rivers (The Monongahela, the Allegheny, and the Ohio) have been effected detrimentally for many years, and since the majority of Allegheny county gets their water from the 3 rivers there has to be a change in the data received that requires a thorough investigation on the water quality for the citizens of Pittsburgh. The solution is looking at CSO'S (Combined Sewer Overflows) and the implementation of new low cost real-time sensors on the banks of the rivers to collect more concentrated data to see the multiple variables like dissolved oxygen and total dissolved solids correlate. Our goal is for those correlations to improve and to reduce CSO involvement to little or none at all in the rivers so water quality can improve for the citizens of Pittsburgh while also practicing good sustainability rules to help reduce CSO involvement as well.

SES104: Weedkiller Effects on Zebrafish Embryos

Weed killer is used extensively throughout neighborhoods in the united states and much of that chemical runs off into local streams and other bodies of water. It is my hypothesis that weed killer would affect aquatic life negatively. Through my research I have found that some weed killers are potential hormone disrupters, carcinogens or mutagens. Some have been banned in other countries. This research is important for its obvious medical and environmental impacts. For my experiment, I am testing zebra fish embryos in different percentages of weed killer containing glyphosate and water mixed in petri dishes. I will breed two adults overnight and collect the embryos the next morning. Than separate them into counts of ten eggs per dish. One will be regular tank water as a control and the others will be the percentages of the weed killer. I plan on using percentages of much less than what is sprayed on lawns to simulate typical runoff. After some research I determined that concentrations of 5 mg/L, 10mg/L, and 15mg/L would be sufficient to notice potential negative effects on the growth and development of the embryos. I will keep track of the development of the fish eggs for 5-7 days, and take note of any changes. Additional trials will be determined by the initial results from the first trial. For my data I will take pictures, and as well mark the differences I see each day. I will record my data with pencil and a notebook to stay organized with my experiment. I will be comparing the development of my zebra fish embryos in the concentrations of weed killer with the control embryos to detect any developmental delays. I will also be using diagrams and photos showing typical zebra fish development.

SES105: Throwing Shade at Shade Balls

The purpose of this experiment is to illustrate how the Internet of Things can be applied to household tasks enhancing usability and security. An IoT mailbox sensor is constructed and programmed in order to generate data used in authentic contexts and to determine the improvement in functionality. Data collection by the physical experimenter demonstrates the effectiveness of the mailbox sensor. Data points derived from the sensor connected platform, Things Speak API, will be applied and extrapolated to engender meaningful metrics that improve daily life.

SES106: A New Solution to Pollution

Finding a new effective way to clean up oil spills is important because oil spills are harmful to the ocean and other bodies of water along with the wildlife. The oil pollutes the water and it covers animals. The oil destroys the insulating ability of animals with fur. It even kills some animals. The oil also coats birds feathers and their water repellency is destroyed, which exposes them to things in the ocean. The most common way now to clean up oil spills is using booms and skimmers. Booms just float and they are placed around the oil spill to contain the oil and then skimmers come and suck up the oil like a vacuum. The way oil spills are being cleaned up now is not as effective as it should be because the booms are not full proof and oil can get past them. Only about 20 percent of oil is actually able to be cleaned up from the water, so the purpose of this experiment was to try to find a new and more effective way to clean up oil spills. Hypothesis:If oil that is spilled in a body of water is magnetized using magnetite, then the oil in the water can be cleaned up using magnets. The final results will be available at the exhibit on the day of the Science Fair.

SES107: Gauging and Estimating Health of The Allegheny Arboretum

An arboretum is a collection of woody trees and shrubs. For my science club project, I chose to work with a specific arboretum in my hometown, Indiana, PA, located on the campus of IUP (known as the Allegheny Arboretum), to search for any potential dangers to society. My data includes the type of tree, quality of life, and damage code. I found a few trees that could potentially be a problem for Indiana citizens. I believe the data collection of trees in this campus are imperative for everyone living in this area because trees are involved in our everyday lives.

SES108: AMD - Mathies Mine Analysis

Twenty-five acid mine drainage samples were collected from the Mathies Mine runoff to determine if the Pennsylvania Department of Environmental Protection’s remediation efforts have been successful following the mine’s closure in 2001. Using the proxy of the inverse relationship of dissolved oxygen and iron concentrations it is apparent the manmade limestone embankments are having no effect when compared to data from over a decade ago. In addition, no other techniques such as phytoremediation were utilized to improve results. One runoff pool contained algae and it was there that the iron readings were lowest so future analysis should focus there.

SES109: NaCl --> H2O

This project's purpose is to find out how much water is yielded from saltwater using desalination, how much time it takes, the effect it would have on the oceans' ecosystem, and how it could be done world-wide. This project will compare heating ways to see which will desalinate the water most efficiently. This would affect the society by providing a realistic alternative for water when there is no longer enough fresh water for everyone. The hypothesis for this science fair project is if salt is extracted from water using thermal desalination, then it will be possible to use saltwater to drink worldwide. In addition, it was hypothesised that if water is tested to desalinate by heating it in the oven, on the stove, and under a heat lamp, the oven would take the least amount of time and would be most efficient. The engineering goal of this project is to create an alternative drinking source for when fresh water is unavailable by desalinating water. The final results of this experiment will be available at the exhibit on Fair Day.

SES110: Is Panax Ginseng a Repellent?

Is Panax Ginseng a repellent? Caffeine has already been studied and been said to work as a repellent. Panax Ginseng is a caffeine alternative, so I decided to see if it could also repel bugs. By working with Armadillidium vulgare in a trail system, I recorded their behavior when they come into contact with a crop that has been treated with Panax Ginseng. My results say that it does not work as an effective bug repellent

SES111: Copper Corrosion with Water

The purpose of my experiment is to test the corrosion of copper in basic and acidic solutions. In my experiment I will test the levels of copper left in water, soda and vinegar after I leave pennies in them for ten minutes. The information I gather can be used to show what will make the copper corrode. It will show that in copper pipes when the water is at acidic levels to corrode the pipes, it will add copper into your water making it harmful to drink for many reasons. My results will be available on competition day.

SES112: How Fast Will a Comet Liquify Due to its Magnitude

The purpose of my experiment is to see how long it will take comets of different sizes to melt. I will be testing to see how long it takes for different levels of ice inside of balloons to melt. My information will be able to show how long it takes for different sizes of comets to melt. According to NASA, comets are a main reason for water on Earth, and by seeing how long it takes a comet to melt we can see how long it will take for Earth to flood. My results will be available on competition day.

SES113: Fertilizer Combination Effects on Algae

This experiment was conducted to see the effects of two chemicals, urea and ammonium nitrate, on algae. The purpose was to simulate fertilizer runoff, and see if the chemicals would alter Euglena growth/survivorship. It was conducted at the scientist's house in an enclosed room with the celling light monitored to be turned on for twelve hours and turned off for twelve hours off each day (10:00 a.m. - 10:00 p.m.). The data was collected using a spectrophotometer, and different concentrations of the chemicals were added to Euglena, soil water, and spring water for a total of 30 test tubes. The results show that increasing concentrations of the chemicals were correlated with inhibited growth.

SES115: Green Roofs

The purpose of this research is to explore under which constraints and conditions allow a green roof to be considered successful. Types of soil, water filtration techniques, various plant behaviors and aesthetics, and styles of containers will be explored. The most effective result from each category will be combined into one style of container. The unit will then be placed on a roof. the results will determine if my strategy was successful. The most suited result from each category would work well with the results from other categories. the specified plants would grow to create an eco-friendly, aesthetically-pleasing environment.

SES116: The effect of salt on freezing point of water and seed germination

Road salt has been harming the environment for years. In this experiment I wanted to find out which type of salt should be used on roads. I did this by adding bean seeds to each type of salt mixed with water and watched the germination process. Results will show which type of salt has the best effect on germination.

SES117: Effects of Fertilizer on Plants

I am going to see the effects of fertilizers on plants by administering different concentrations of fertilizer to plants, then measuring the biomass and rate of growth of those plants.

SES118: Increasing the Efficiency of a Solar Panel with a Thermoelectric Generator

The purpose of this experiment was to try to improve the efficiency of a photovoltaic panel by adding a thermoelectric generator. A thermoelectric generator was made using heat from the sun as the heating source, and the natural weather outside as the cold side. By coupling the thermoelectric generator with a solar panel, any sunlight not converted into electricity was lost as heat, and was used by the thermoelectric generator. This was done by trapping the escaped heat in a sealed box, which in turn heated up, and warmed the one side of the thermoelectric plate.

SES119: What's Quaking?

The purpose of this experiment was to see what type of soil would be more stable for construction during an earthquake. The hypothesis was that natural soil would keep a replica house in place during earthquake like movements better than other soils. The first step of the procedure was to create a shake table using an online guide and a replica house. Then, the house would be packed down onto the shake table using different soils. Last, the shake table would simulate an earthquake and the investigator would record how well the soil kept the house in place. Results will be available on competition day. The soil that keeps the house in place the best is the best to use in construction.

SES120: Does it Pay to Paint?

The researcher will study the effects of acid rain on aluminum roofing. Utilizing nitric acid to mimic the acid rain, the roofing pieces will be analyzed dependent on their masses. If the painted roof is exposed to ‘acid rain’, then it will not lose as much mass as the roof that is not painted. Investigation will be done by preparing roof pieces and pouring acid onto the pieces over a period of time. The researcher will weigh and observe the pieces and finalize the data. Results will be available on fair day.

SES121: Methane Digester for Gas Production

Methane digesters use manure to make methane gas if it is in an anaerobic (without oxygen) environment. The purpose of this experiment was to show people that a methane digester can be used for industrial power. It could also be applied to families with little amounts of energy in their homes. I gathered my materials, made two methane digesters, and analyzed my data. I will record the amount of methane being produced, along with its percentage by volume. I will record the color of the manure slurry in each methane digester. RESULTS AVAILABLE ON COMPETITION DAY.

SES122: Steam is Still Great

The purpose for this experiment is to find and use a more efficient system for heating water to turn it into steam and use the steam produced to power a low pressure steam turbine connected to a generator to produce electricity. My hypothesis is if I can create a certain amount of pressurized steam, I can then use that to produce enough electricity to be a viable option as a renewable resource. My procedure would be to use the sun, if possible, to heat the water inside the heat box. I would then have the steam produced run into the turbine that would be connected to a shaft that would turn the generator. All data will be available on fair day.

SES123: Abating the Global Food Crisis

For this project, the researcher will grow pea plant seeds in pots containing various combinations of compost mixtures. The examination in this experiment is if the stimulative properties of banana peels and eggshells will have an affect on the germination of pea plant seeds when soaked in water.The researcher believes that a larger amount of bananas rather than eggshells in the compost must encourage greater seed germination because bananas exceed the pH of eggshells. Plants grow best in a pH of 6.0-7.0 and banana peels are closer to the preferred pH than eggshells are. The purpose of the experiment is discovering if using a compost made of banana peels and eggshells encourages accelerated growth in plants.

SES124: Can Magnetism Aid in Electrolysis?

Carbon dioxide is greenhouse gas that (in excess) has been affecting global temperatures, and creating long-term climate problems. Many processes now are taking it from the atmosphere for storage. A more practical way of removing carbon dioxide from the atmosphere is breaking the bonds between carbon and oxygen into basic components. I intend to find out if there is an energy efficient way to separate these bonds. While using mechanical energy created from magnets, then converted into electricity as a source of usable energy, I will attempt to carry out carbon dioxide electrolysis. Experimentation is still continuing.

SES125: Absorbing Oil

My experiment purpose is to see which material is the best to use for oil cleanup. My hypothesis for my experiment is that polypropylene will work better than any other material. My research question is, which material is best for oil cleanup? I expect polypropylene will that perform better than all the other materials. I will test the absorbents for how much oil they absorb. I will do this by weighing the sorbent before and after the test. Final results available on test day.

SES126: Does Saltwater or Freshwater Algae Produce more Fuel in Varying Conditions?

The purpose of this project was to compare the ability of freshwater algae and saltwater algae to produce fuel at different temperatures. It was predicted that freshwater algae will produce more fuel at lower temperatures and saltwater algae will produce more fuel at higher temperatures. To test this, 100g of algae were incubated at room temperature for 48 hours. After incubation, algae was dehydrated and pressed to extract biofuel oil. Mass of extracted oil was recorded and the process was repeated at varying temperatures for both types of algae. Results available at fair.

SES127: Earthworm Earthworks

The effect of the earthworm species Lumbricus rubellus on soil pH and heavy metals content was studied. The ability of earthworms to neutralize soil pH and reduce heavy metal content aids in soil remediation and increases productivity and growth of plants. Heavy metals, such as Pb, Zn, and Hg, have significantly detrimental effects on human and environmental health. Many are linked with developmental disorders, brain and nervous system defects, organ failures, and reduction or cease of some plant growth. Earthworms can reduce the amount of heavy metals/pollutants in the soil. They can break them down when they absorb and ingest the soil particles, and in turn release castings as a form of excrement. These castings are extremely valuable to the soil, and one of nature's top fertilizers. They contain elements such as phosphorus, calcium, nitrogen, and potassium, all of which aid in plant growth. Worms can also neutralize the pH of the soil that passes through them. Due to their small size and relative little intake of soil compared to available soil, not all earthworm-inhabited soils are very close to neutral. However, in a small scale controlled environment, this neutralization of pH may be able to be seen more easily than wild samples. The same goes for heavy metal content. The more worms in the soil, the more heavy metals will be broken down and the less of them in the soil. Thus, with worms, the soil moves towards a healthier condition which increases environmental and animal/human health.

SES128: Decomposition of Plastics

Plastic waste is a huge issue, as it takes hundreds of years to decay. My experiment puts biodegradable and biobased plastics in a landfill simulation to see if Galleria mellonella larvae are the answer to our problems. I wanted to know what mass-produced environmentally safe plastics are the best at degrading. To do this, I would mass the amount eaten, after a week, from Walmart bags, KFC bags, and Carolina Biological’s packaging. When comparing data, the Walmart bag degraded the most over that period of time, meaning I had to reject my hypothesis that the packaging would degrade the most.

SES129: Effect of Enzymes on Plants

The purpose of my experiment was to test how enzyme concentration affects substrate production. In order to test this I used turnip peroxidase as the enzyme and hydrogen peroxide as the substrate. I used 18 test tubes in which nine of them were used to put the substrate solution and nine of them were used to put the different enzyme concentration. The substrate test tubes consisted of the substrate hydrogen peroxide, distilled water, and guaiacol. Guaiacol is a color indicator. When reacted with oxygen, guaiacol turns a browner in color. Based on the results of my experiment, the test tubes with a higher enzyme concentration was browner in color which indicated there was more oxygen being produced. This means the higher enzyme concentration affects how much substrate is being produced.

SES130: An Inexpensive Passive for Bioremediating Liquid Manure

Purpose: To create and inexpensive method for bio remediating liquid manure. Hypothesis: If liquid manure is filtered through sphagnum moss, sand, and corn roots, then the effluent water will be free from bacteria and nitrates. Procedure: Collect all needed materials. Construct testing apparatus. Poor the liquid manure through testing apparatus. Let the liquid filter through the filters naturally and freely. Finally Once all of liquid has gone through the testing apparatus, take the liquid to a certified laboratory to be tested for coliform.

SES131: This is your plant, this is your plant on acid... rain

In this project I planned to show the effects of carbonic acid, a main component of acid rain, on the ecosystem. I did this experiment by separating 4 plants into different pots then watering them with different concentrations of water and carbonic acid. The plant water with the least acid grew to 5.3cm, the second most acidic plant reached 4.7 cm, the most acidic plant only reached 3cm. I have determined that carbonic acid causes serious damages and should not be overlooked when compared to nitric and sulfuric acids.

SES132: Voltage Output in Solar Panels

The researcher will be testing how temperature affects the solar output of a stationary solar panel. There will be various trials that will be done to find my data using different temperatures. The researcher will be using a program called Logger Pro which measures the voltage output to determine which temperature affects the solar output the most. The data will be available on presentation day.

SES133: Mycoremediation and Phytoremediation with Fracking Fluids

This project addresses the issue of environmental contamination in the presence of fracking runoff fluid. Especially in the Pittsburgh region, fracking is a booming business that leaves a substantial mark on the environment. This project compares specific species of mushrooms and specific species of plants in their ability to re-mediate and remove some of the impact fracking may have on the environment, specifically testing the soil acidity and composition of chemicals. In addition, the two organisms will be combined in a experimental group and compared to the effectiveness of the organisms independently. Data will be collected, and results will be communicated appropriately. The highest quality of aseptic technique and safety precautions will be followed at all times.

SES134: Vermiculture and Cafeteria Waste

I plan to have two containers of worms that have garden soil as bedding and two that will contain worms with shredded newspaper. I will take the original mass of the worms in each container and keep track of their biomass each week for about eight weeks.I will periodically check the population by sifting the worms from the soil and weighing the worms from each container, then find the percent increase in each container per week. I intend to find which type of bedding material is more conducive to worm growth.

SES135: What's Up With Water

The purpose of my experiment was to determine the concentration of heavy metals in the water supply of ice rinks around the country. I used heavy metal test strips to analyze the samples. There was variation of heavy metal concentration over the different samples. In addition, most of the samples exhibited lower concentrations of heavy metals. This is significant because it poses less of a health risk to people than higher values. Since the tests that I used provided a level that described the summation of a few different metals, further research could include testing for specific heavy metals.

SES136: Neutralizing Malathion Pesticide

My experiment is used to determine if activated charcoal is able to neutralize the negative effects of malathion pesticide. This experiment was another idea to help clean up chemical or pesticide spills. I found out that activated charcoal is used in water filtration systems to separate any organic chemicals and chlorine in water. It will also reduce the quantity of lead in water. So I added activated charcoal thinking if activated charcoal is able to separate chemicals, chlorine, and lead from water. I will determine if the pesticide is neutralize by the deaths of four flies in a time span of five minutes.

SES137: Detrimental Detergents

In this modern and developing world, we have often neglected the environment and the impacts of our actions. We blindly use products ignorant to how they may affect our world. These products include the countless detergents and cleaners people use in their homes. To conduct my experiment, I measured the affects of four different brand cleaners—Lysol, Tide, Seventh Generation, and Better Life—on algae growing using a spectrophotometer to read the absorbances. I found that Tide produced the most drastic results, followed by Lysol, Seventh Generation, and finally Better Life, which had almost no deviation from the control.

SES138: Study of Lead in Pittsburgh Water

The purpose of this research was to determine whether certain features of a home (age of home, location, etc) increase the likelihood of the home having elevated lead levels in its water supply. The data, provided by the Pittsburgh Sewer and Water Authority (PWSA), gave the average water lead level per block for the years 2004-2017. Statistical analyses included calculating means, standard deviations, and other descriptive summaries. Modern machine learning methods were used to relate characteristics of homes to lead levels to try to identify potential risk factors.

SES139: Mitigating Phosphorus in Water Runoff

Three filters were tested with a phosphorus solution to see which could reduce the most phosphorus. The reduction of phosphorus will help to stop the growth of unwanted algae and weeds. The filters that are used for these test are construction wattles EPA certified.

SES140: The Effects of Acid Mine Draining and Industrial Facilities on Bodies of Water

I will be conducting research on the water of Little Chartiers and Chartiers Creek at six locations: before industry, after industry, at the confluence, after the confluence, and further downstream. I will be looking for the quality of the water and how industry affects it. I used the following parameters: pH, conductivity, dissolved oxygen, total dissolved solids, temperature, salinity and color. Chartiers creek is surrounded by many former coal mines and industrial facilities. I will be testing the water with a Hanna H19829 multi-parameter meter.

SES141: Producing Biofeuls From Algae

My experiment will test what type of algae produces the most biofuels. The experiment will test several different types of algae to determine which one can produce the highest amount of oil that can be converted to biofuel and find the conditions that the algae best thrives. The algae will be tested under various pH's. These conditions include water at a pH of 7, strongly acidic water, acidic water, strongly basic water, and basic water. My procedure will include growing the algae, extracting the oil, and separating the biofuels from the lipids. In order to grow the algae, pools of algae will grow in water under a sunlamp, and constantly be at a temperature of 22 degrees celsius, which is room temperature. The algae will be grown for the same time period of four days. The algae will grow in pools of water containing a specific pH. Once grown, the algae will be squeezed into algal oil. The oil will then be put through a process called transesterification, in which the biodiesel will be released. Transesterification will be accomplished by adding a methoxide solution (a mixture of methanol and lye) to the algal oil. Once the fuel is separated, the oil will be measured to determine which algae produces the most biofuels.

SES142: Water Source vs. Plant Growth

The Water Crisis is a worldwide issue, in which a region's demand for freshwater exceeds the supply. This crisis occurs due to water supplies becoming contaminated with bacteria or chemicals. In this experiment forty plant were grown using a variety of water sources, alluding to the crisis. The control was filtered water and the other sources were pool, tap and pond water. The plants' height was taken to compare how the water source affected the progression of growth. The control group showed the lowest results for height, which disproved my hypothesis that the control would show the most growth.

SES143: Solar Eclipse: Temperature change during totality

The NASA.gov website posted a request for citizen scientists to record atmospheric observations during the August 21, 2017 total solar eclipse. One request was for recordings of air temperature readings. A viewing location was selected in Santee, South Carolina. Cloudy weather forced a change to Greenville, SC. There, totality started at 2:09 p.m. and lasted 2 minutes, 6 seconds. A thermometer was located out of direct sunlight. Recording began at 12:42 p.m. and ended at 6:00 p.m. Temperature drops of 3° to 5.6° F were recorded, with the lowest temperature of 87.7° F occurring 20 minutes after totality.

SES145: Maximizing Output of a Microbial Fuel Cell

Currently, over 1.5 billion people do not have access to electricity. This includes 79% of the population of 3rd world countries, the 50 poorest nations. I sought to find a solution to these problem and provide a source of electricity that was easy to make with readily available materials utilizing readily available natural resources as fuel. For this, I turned to microbial fuel cells. A microbial fuel cell harvests the microbial activity in biomass and converts it into a usable energy source. It is built around the principle of a Redox Half Reaction, which uses microbes to generate electrons. Currently, MFCs are contenders for large-scale applications in waste-water treatment. However, most microbial fuel cells either generate a very low voltage(between 0.01 and 0.035mV) or require specialized materials and less abundant sources as microbe-containing biomass, which means that MFCs are currently only applicable on a large scale. The goal of my project was to optimize the efficiency of a cheaply constructed microbial fuel cell by experimenting with different microbial solutions under varying environments like a controlled pH or higher temperature. The bacteria I decided to test were bacteria found in mud collected from a still body of water(ex. Pond), and lactobacillus, a microbe found in dairy products. The hypothesis for my project was that if stillwater mud and lactobacillus solution are inoculated into a MFC constructed from cheap and readily available materials, then the MFC will be capable of generating a consistent voltage. The fuel cell, as previously stated, was constructed entirely from recycled, reused, or repurposed materials. Further results will be available at the competition, as additional tests are have yet to be carried out.

SES146: Effect of Reflected Light on Growth

Vertical farming has grown in popularity over the past decade and for good reason. It will be vital for the future when the planet is overpopulated and horizontal space is limited. The method is already very effective, but can it be more efficient? Using different colors of reflected light it may be possible. Because blue and red light are absorbed most by plants, plants with blue or red reflective surfaces should experience the most growth of all the plants. Plants were grown individually with one plant per pod and thirty-six per group. Equal water and soil were given to each plant and were placed in a grow tower. Opaque plastic covers were placed around each plant stem. They were measured every two days with a biomass taken at the end. Initial results indicated white having healthier plants while yellow had the most overall height growth.

SES147: Air Quality and Cancer Mortality Rates: Comparison of regional trends across counties

Long-term exposure to fine particulate matter (PM2.5) has been well known as a strong risk factor of all-cause mortality1–3. To understand how air pollutants affect our health beyond respiratory system, we tested the association of regional trends in PM2.5 levels and cancer mortality rates from 2000 to 2014 across counties in the US. Two hundred twenty eight core-based statistical areas (CBSA) across the nation with air quality trend data publicly available from US environmental protection agency (EPA) have been reviewed for weighted annual means of PM2.5 level from 2000 to 2014. The regional PM2.5 level trends were compared with mortality rate trends of cancer in general and tracheal, bronchus, and lung cancer archived in Global health data exchange (GHDx) for the counties matched to CBSA over the same time period based on Spearman's correlation analysis. To compare with other pollutants, we also analyzed the regional O3 level trends in 188 CBSA with the same mortality rate trends.

SES148: Filtration for the Nations

The researcher tested to see if different low cost water filters were more effective in removing bacteria. The hypothesis is if contaminated pond water is filtered through three different filters, then the water filtered through the tarp solar filtration will have the least amount of bacteria remaining. The researcher gathered all materials and assembled filters, then swabbed water for bacteria before and after filtration. Then the researcher recorded the data and reported the results. Results will be available upon competition day.

SES149: Accessible Drinking Water

This project attempts to address the lack of clean drinking water globally by retrofitting dehumidifiers with active carbon filters. The end goal of the projects is to analyze the quantity and quality of water collected by a dehumidifier for potential use as drinking water. A prototype of this device will be presented at the science fair and the resulting data from the study.

SES150: Lead Adsorption Using Banana Peel

Heavy metal contamination in water is a major issue globally; banana peels could be the solution. In this project, I wanted to discover how pH and temperature affect lead adsorption by banana peel. The initial ppm of lead in a solution was measured and compared to ppm after adding peels; this procedure was repeated at different pH's (2, 4, 7, 10, 12) and temperatures (5, 20, 40, 80℃). pH's closer to 7 and higher temperatures increased adsorption, and conditions of pH 7 and 80℃ were optimum. This data could make banana peel a viable solution for heavy metal contamination.

SES151: A-Salting the Earth

My project is "Road Treatments on Aquatic plant life". This experiment deals with earth science and biology. The purpose of this experiment is to see what effect road treatments have on aquatic plant life. I used 5 substances on 30 individual moss balls, each substance was be tested at 5 different amounts. Every week I increased the amount given to the moss ball. Many of the moss balls became discolored, lost density, broke apart and changing shape. Salt proved to be more detrimental, calcium chloride and sand/salt were equal, ash was less and magnesium chloride proved to be least.

SES152: Ecological Footprint Analysis

The purpose of this experiment is to determine whether people living in urban or rural areas have a greater ecological footprint. Multiple people living in different areas will be given a survey. The data will be compared and determined which areas have a greater Ecological Footprint. Out of 9 questions, urban areas were found to be more environmentally friendly in 6, while rural areas were found to be in 3. Some factors of this may be the space between houses and need for transportation, the amount of meat consumed due to access, and other different lifestyle habits.

SES153: The Effect of Aspirin on Plant Growth

This experiment was done to find out which concentration of aspirin helps bean seeds grow the most. This is important because it may help farmers in the future when they are growing plants. This was done by testing three seeds each with different amounts of aspirin water. The results will show if aspirin helps plants grow and if using more aspirin could help the plant grow or kill it.

SES154: This paint's temperature isn't for me

Any colored surface builds up heat from light shining on it. My experiment was meant to find which color when used to paint a shadow box would build up the highest temperature. To do this I constructed six shadow boxes out of cardboard boxes and painted them yellow,white,red,blue,green,and black. Then I set up a light that would turn on and off at sunrise and sunset and I would record the temperature of the boxes at sunset for ten days. After ten days the boxes painted blue,black, and green all built up the highest temperatures thus proving my hypothesis that those colors would build the higher temperatures.

SES155: Cost Effective Net Zero House

Many people believe that the impact from continuing to supply electricity to homes from traditional sources of energy, mostly fossil fuels, will be devastating to the planet's climate in the near future. One of the biggest reasons is that a significant percentage of the energy produced is wasted getting the power from the traditional generation locations to the homes located many miles away. A possible solution is to have each home generate most, or even all, of its electrical power needs. The purpose of my project is to examine the amount of power needed, the possible home based generation sources, and the amount of investment needed to design and build a home that can provide all of its own electrical power needs. My approach is to research the typical power consumption of homes, the available alternative home generation options, the optimum application of one or more of these options in typical homes, and the costs for the installation of these home based generation options versus the anticipated costs of energy purchased. I then plan to develop a model optimized designs that will provide a break-even point before year 20 after installation.

SES300: Electrolysis & 3D printing for Coral Reefs

Coral reef bleaching is a devastating environmental consequence with a variety of causes from naturally occurring weather events like El Nino to global climate change. One method of combating this habitat loss is through the creation of artificial coral reefs. The project looks to apply new additive manufacturing techniques and materials in order to analyze the potential use of 3D printing to create coral reefs. Through the use of conductive filament and filament infused with limestone, attempts will be made to create habitable artificial coral reef structures. Final results will be presented at the science fair.

SES301: Enhanced Water Collection with Drones at Different Depths

Water quality issues are a reality for many regions of the world, limiting the access and availability of safe, usable water to millions of people. Several of these issues have resulted from heavy pollution and the lack of awareness of current water quality at a local, state, or even national level. Last year, our project set a basis for a more effective, efficient, and feasible method of water collection, in order to improve the understanding of a water body's safety. The project involved modifying a drone to allow it to collect water from different portions of a water body without compromising the integrity of the water samples. Although the project produced a revolutionary method of water collection, we are continuing the effort by building upon our idea of using a drone to collect water samples by implementing a device that will allow us to collect water samples at certain depths of choice. The use of a pressurized collection device will be built, based upon physics principles such as Bernoulli's Principle and buoyancy, in order for the collection device to only open at certain depths. This updated method of water collecting will allow for more accurate tests and better analysis, which will lead to more awareness of the environment.

SES302: Color and Climate

The issue of climate change is highly relevant and multifaceted, and places like California have endeavored in paving roads and painting roofs white to counteract the Urban Heat Island Effect which increases energy demand, air conditioning costs, air pollution, greenhouse gas emissions, and causes other negative effects. To determine how effective these efforts are, this experiment compared the heat absorption and albedo of white-painted and conventional samples of road and roof materials. It was concluded that there is a significant heat absorption and albedo change for roof and road materials when painted white, making efforts to reduce urban heat effective.

Medicine / Health / Microbiology (SMH)

SMH100: The Effects of Spices on Drug Dosage

Organ transplant patients take certain medicines to prevent the rejection of transplanted organs. The doses of these medicines are personalized to each patient. Observations in patients from different ethnic groups indicate that the average oral dose of some of the medicines used in certain ethnic groups are lower than what is used in Caucasians. The reasons for this observation is not completely understood. It is likely that the type of food consumed by different ethnic groups may contribute to this observation. The different kinds of spices that are used by different ethnic groups in preparing foods, contain chemicals that have been shown to alter how certain enzymes and proteins behave in our body. The objective of my project is to study how certain spices used in Indian cooking, such as pepper and turmeric affect the enzymes that metabolize drugs used in transplant patients.

SMH101: Mechanism of Mesobiliverdin against Oxidative Stress in Retinal Cells

Age-related Macular Degeneration (AMD) is a leading cause of blindness in Americans age 50 and older. Currently, there is no cure or effective treatment. AMD is believed to be caused by oxidative stress-induced degeneration of retinal pigment epithelium (RPE). Furthermore, cell senescence recently emerged as a fundamental ageing mechanism that contributes to diseases including AMD. Mesobiliverdin IXa (MesoBV) is a minor biopigment found in various organisms and has been reported to have beneficial effect on pancreas function. The objective of this study is to determine if MesoBV protects the RPE cells against oxidative stress by inhibition of oxidative stress-induced senescence. Human ARPE-19 cells were treated with various concentrations of oxidant, sodium iodate (0.1mM-100mM), in the presence or absence of MesoBV (1uM-5uM) for 5 days. Cell images and cell count were obtained after 1, 3 and 5 days of treatment. At the end of the experiment, cells were analyzed by flow cytometer for senescence detection. Results showed that MesoBV itself increased cell growth and protected RPE cells from sodium iodate-induced cell damage. Flow cytometry data revealed that sodium iodate at 2mM induced senescence, and MesoBV (2uM) inhibited the sodium iodate-induced senescence. The beneficial effects of MesoBV on RPE cells demonstrate the potential for its use as pharmaceutical product or nutrition supplement to prevent or treat AMD.

SMH102: The Path to Treatment :Homeopathic or Allopathic?

For my project I am testing which remedy works better Homeopathic or Allopathic. Nutrient agar was placed into a petri dish, swabbed with common sourced bacteria and then five disks of antibiotics were put into the petri dish. I swabbed the boys locker room door and the handicap door button. I chose this area because I know that has plenty of bacteria. My antibiotics were Ampicillin, Penicillin, Streptomycin, Tetracycline, and Erythromycin. I also had a few natural remedies which were Vitamin C, Zinc , and unpasteurized honey. I will check the petri dishes weekly measuring inhibition zones.

SMH103: Identification of Vibrio species from North Park Lake in Allegheny County Pennsylvania

Vibrio cholerae is a bacterium that causes the human disease cholera. The purpose of this research was to identify Vibrio cholerae in the North Park Lake, in Allegheny county, Pennsylvania, and to test if the isolated species have the ability to cause disease. From various locations in the park, 19 water samples, one goose feces, and 1 sample of clam shells were collected. They were put into alkaline peptone water, which promotes Vibrio growth. All of the samples were incubated at 37℃. Then, they were plated onto TCBS agar, which selects for Vibrio growth and incubated at 37℃ overnight. There were two different types of colonies observed: yellow and green. One colony each from twenty plates were used for polymerase chain reaction to make a portion of the 16s rRNA gene which was then used for DNA sequencing. The DNA sequencing showed the presence of nine Vibrio species, nine Aeromonas species, and two Providencia species. I will continue to work on this project to study the Vibrio species that I isolated to see if they can cause disease in people.

SMH104: Treatment of Tumor Hypoxia

In this experiment, stable perfluorocarbon nanoemulsions (PFC-NE) were formulated within a synthetic hydrogel as an important first step in the ultimate goal of this study, which is to treat tumor hypoxia via hydrogel delivery of oxygen loaded perfluorocarbon nanoemulsions. The hypothesis was that the nanoemulsions utilized could be incorporated into a hydrogel for sustained delivery, while maintaining colloidal stability. (Janjic et al., JACS 2008) and (Janjic et al., Spie 2016). After DLS (dynamic light scattering) analysis was achieved for the nanoemulsion individually and for the nanoemulsion after encapsulation, it was found that the PFC-NE retained its colloidal properties and stability.

SMH105: Antibiotic Properties of Herbs

The purpose of this experiment was to determine what herb has the most effective antibiotic properties. It was predicted that the herb oregano would be the most efficient. First, a 4-quarter petri dish was inoculated with either E. coli or B. brevis. Then, 1% spice/saline solutions were prepared using one of oregano, thyme, cumin, allspice, or sage. Sterile disks were soaked in the spice solutions and applied to 3 quarters. A control disk soaked in sterile saline was placed in quarter 4. Dishes were incubated for 72 hours and zones of inhibition were measured. Results available at fair.

SMH106: Sugar Content in Smoothies

In this experiment I wanted to find out how much sugar and fats are actually in smoothies because they are claimed to be a healthy drink but with all of the ingredients used I think there's no way that smoothies don't contain any sugar. How I'm going to do is by using benedict's Solution to test for any sugars, I'm going to make homemade smoothies and also use store bought smoothies to determine which one contains the most sugar. For the homemade smoothies I am going to use specific ingredients such as Fresh fruits like bananas, strawberries, and also the apple strawberry blend juice. For the store bought smoothies I'm going to use the same flavor because that might contain more sugar than the homemade drink.

SMH107: Effects of Cleansers on S.epidermidis

Test several different types of facial cleansers to see their ability to inhibit growth of Staphylococcus epidermidis cultures. Measure zones of inhibition in three cultures, calculate averages and compare results as well as active ingredients.

SMH108: Biofilm Growth on Various Surfaces

Biofilms are a problem in the worlds of medicine and biology alike. A biofilm can be defined as a thin self-protective resistant layer (film) of microorganisms like bacteria, yeasts, or fungi that form on solid or liquid surfaces (or living tissue). Polystyrene, stainless steel and plastic will be used to grow biofilms using the bacteria Pseudomonas fluorescens, and the results will be stained with Crystal Violet. As a result of the experiment, it may be possible to determine which material grows the most prominent biofilm based on the chromaticity of the samples.

SMH109: Are These Common Water Sources Potable or Non-Potable

This project will test water sources for potability, using three types of agar and nine different water sources. The water samples will be plated in the agar and then incubated. Bacteria from the samples will then be placed into Phenol Red Broth in order to test the potability.

SMH110: The Effect of Naturally Occurring Chemical Agents on Bacteria

This project's purpose is to determine whether certain naturally occurring chemicals are antimicrobial to E coli.

SMH111: Mucilage Filtration of Water

The purpose of my experiment is to see if cactus mucilage can filtrate Citrobacter fruendii. My experiment included putting bacteria, and cactus mucilage into test tubes, and letting them incubate and then conducted a bacteria count. The p values of the control and mucilage group show there is a significant difference between the two groups. Although there is a significant difference in the two groups, there ended up being more bacteria in the mucilage group, disproving my hypothesis.

SMH112: Effect of AMPs from A. maculatum on the inhibition of bacterial growth

The purpose of this research was to see if AMPs collected and purified from A. maculatum are effective in inhibiting the growth of malicious pathogens.The peptides were collected and processed using a speed-vac system, and then run through an SDS-PAGE gel to determine quantity. During these procedures, bacteria were prepared on agar plates, and then inoculated to form stock. The peptides were then added to a 96 well plate to perform a GIA to calculate the MIC. After the experiment, amac AMPs obstructed the most growth of the bacteria, showing that Amac amps are highly effective in counteracting various pathogens.

SMH113: Data Analysis of Breast Cancer

In this study, I used Bayesian networks (probabilistic graphical models that represent variables and their conditional dependencies) to analyze gene expression and clinical data from breast cancer samples from The Cancer Genome Atlas. The objective of this study was to observe the clinical variables of menopause status and patient outcome and their interactions with each other and with gene expression, making separate Bayesian networks focused on only one variable. After preprocessing the data for the gene expression and both variables and constructing the Bayesian networks, I observed the connections that were deemed significant by the models. I found that a patient's menopause status does not correlate with the outcome of their cancer (relapse vs. non-relapse). In the menopause models, I found a significant connection between the genes RUNDC1 and ESR1 in post-menopausal tumors only, not pre-menopausal tumors, meaning that treatments of breast cancer focused on these genes may be more or less effective based on the patient's menopause status. Meanwhile, in the outcome models, I identified multiple genes that were significantly correlated with the outcome variable. A literature search on these genes revealed that many have already been shown to be prognostic markers in other types of cancer, and may behave similarly in breast cancer. These findings are prime candidates for further research.

SMH114: Potential Triclosan Resistant E. coli

Purpose:Determine if E.coli can be resistant to Triclosan. Hypothesis:E. coli will develop a Triclosan resistance. Procedure:Inoculate 50mL of Nutrient Broth with E. coli and incubate. Prepare 50mL of each of following Triclosan–NutrientBroth solutions:.0156,.0313,.0625,.1250,.2500,.3125,.5000mg/L. Inoculate Triclosan-NutrientBroth with 2loops of E.coli and incubate. After 72hours, record concentration of E. coli present using Spec.20. Then prepare a 10-7serial-dilution and inoculate agar plate with 1mL of the serial-dilution and incubate. Record average colony count on plate. Inoculate 50mL tube of the.0313mg/L Triclosan-NutrientBroth solution with 2loops of the.0156mg/L solution and incubate. Repeat using remaining concentrations of Triclosan-NutrientBroth solutions chosen. Conclusion:Results available at fair.

SMH115: The effect of hand soap on Staphylococcus Aureus

Many kinds of bacteria can cause many different types of diseases today. The purpose of my experiment is to test what kind of hand soap both antibacterial and regular can get rid of the bacteria to prevent diseases from spreading. To do that, 20 agar gels plates were made, each gel plate was streaked in Staphylococcus aureus. 4 different soaps were put on 4 plates, over the course of 2 weeks the bacteria is grown and measured. After 2 weeks the Dial antibacterial soap showed the best results.

SMH116: Utilizing Saliva as an Early Diagnostic Tool

Saliva may be used instead of blood in determining health.The pH of saliva, specifically is inexpensive, noninvasive, and quick to determine. Moreover, any fluctuation in the pH of saliva could be an indicator of another factor, such as drug abuse. Furthermore, an app could then be created to monitor health if a correlation between the pH of saliva and health could be found. Does the pH of saliva fluctuate enough to be quantitatively measured? Is there a correlation between the pH of saliva and another factor?The objective of this study is to analyze trends of the pH of saliva and determine its relevance to health. Specifically, to determine if it can be used as a diagnostic tool.

SMH117: Effects of Repeated Roundup Exposure on Antibiotic Resistance in Human Gut Bacteria

Antibiotic resistance is a growing public health concern. While treatment of bacterial infections with antibiotics most commonly leads to antibiotic resistance, exposure to substances other than medicinally prescribed antibiotics can lead to resistance as well. When bacteria are exposed to unwanted substances, the bacteria attempt to remove them. Often, this leads to a mutation to remove the toxins and the method of removal can potentially work on antibiotics as well. Thus, exposure to Roundup®, a growth inhibiting substance, could lead to collateral antibiotic resistance. Final results will be available during the presentation.

SMH118: What Acne Medication Works Best?

My experiment is testing which over-the-counter acne product is most effective at killing E.coli bacteria. My hypothesis is that the product containing Benzoyl Peroxide as an active ingredient will kill the most bacteria. For my experiment, I grew E.coli bacteria on agar plates and added a different acne medicine to each plate. My results will be available at the science fair.

SMH119: The Effect of Vitamin C on Bacteria

For my project I am testing which dosage of Vitamin C is most effective against common sourced bacteria. Nutrient agar was placed into a petri dish, swabbed with common sourced bacteria and then Vitamin C were put into the petri dish. I will check the petri dishes weekly measuring inhibition zones.

SMH121: Measuring the content of fat in pepperoni at different temperatures

The purpose of this experiment was to determine how much fat content is in pepperoni in different temperatures. To conduct this experiment pepperoni was heated to different temperatures and then acetone was used to extract the fat.

SMH122: Do You Kiss Your Mama With That Mouth?

This project will test different mouthwashes and a baking soda solution to determine which one is most effective in killing bacteria.

SMH123: Which type of examination glove causes the least amount of bacterial transference?

The purpose of this experiment was to determine which type of glove inhibits bacterial transference best. It was predicted the gloves will inhibit bacterial transference from different surfaces in the following order: Nitrile, Neoprene, & Latex. To perform the experiment, a sterile glove was placed on the testing apparatus. The glove was dipped in bacterial solution for 1 minute; allowed to dry for 1 minute. The glove was then dropped onto a sterile microscope slide and left stationary for 30 seconds. The microscope slide was cultured and incubated. After incubation, bacterial colonies were counted. Results at fair.

SMH124: Do Accent Nails Affect the Accuracy of Pulse Oximiters?

The purpose of my project was to determine if glitter accent nails affect the accuracy of a pulse oximeter. I hypothesized that glitter accent nails will negatively affect the accuracy of a pulse oximeter. First, I randomly selected a subject. I then determined which color of accent nail would be placed on the 2nd,3rd,and4thdigit of the subject's left or right hand and which digit would be tested first. Using the pulse oximeter, I recorded the oxygen saturation and heart rate of each digit and the control (no glitter accent nail). I repeated procedure for 29 more subjects. Results at fair.

SMH125: Will sutures infused with nano silver particles inhibit bacterial proliferation?

Question:What concentration of silver nanoparticles when infused into sutures inhibits bacterial proliferation best? Hypothesis:The greater concentration of silver nanoparticles the more it will inhibit bacterial proliferation. Procedure: Inoculate 50mL of sterile nutrient broth using S.epidermidis, incubate at 23ºC for 72hrs. Prepare a 0%(Control),15%,30%,45%,60% and 75% silver nanoparticles solution. Soak the sutures in the 0% silver nanoparticle solutions for 72hrs. Pour bacterial solution from step 1 onto sterile agar petri dishes. Place one suture on petri dish and incubate for 72hrs. Repeat steps3-5 silver nanoparticle solution being tested. After 72hrs of incubation record average zone in inhibition. Conclusion:Results available at fair.

SMH126: Understanding Lactose Intolerance

Several members of my family are lactose intolerant. They have to restrain from consuming some delicious food and drink products, like cheese, pizza, milk, ice cream, etc. Why do they have to restrain from these foods? What do these foods have in common? All these foods are dairy products and therefore have lactose, a natural sugar molecule found in milk items, in them. Lactase helps breakdown lactose into galactose and glucose. This helps the body absorb the components of lactose better. If someone is lactose intolerant, it means that their body does not produce enough lactase to breakdown lactose. Lactose intolerance leads to a lot of discomfort like cramps, bloating, diarrhea, etc. I would like to observe how much time it takes for there to be higher levels of the breakdown of lactose when liquid lactase is added to a certain type of milk.

SMH127: Gene Methylation is a Driver of Cellular Differentiation for Intrinsic Subtype of Breast Cancer during Carcinogenesis

The intrinsic subtype of breast cancer is a major factor considered in the development of individualized treatment regimens for patients. An understanding of when and which molecular changes drive the different intrinsic subtypes of breast cancer may lead to being able to create a better strategy for managing breast cancer patient individualized treatment in the clinical setting. In a previous study, I found that PAM50 genes associated to the HER2 subtype of breast cancer are expressed through gene amplification (unpublished data). Additionally, I demonstrated that the expression of luminal and triple negative subtype associated PAM50 genes is controlled by gene methylation (unpublished data). In this study, I analyzed gene methylation data of normal breast tissue, ductal carcinoma in situ (DCIS), and invasive ductal carcinoma (IDC) of intrinsic subtype genes through hierarchical (HCA) and multidimensional clustering (MCA). The data show that there is a statistically significant difference in gene methylation in normal breast tissue but differentiation of intrinsic subtype may occur during carcinogenesis with increasingly prominent differences of gene methylation level seen between DCIS and IDC.

SMH128: The Effect of Cacao on Staphylococcus epidermidis and E. coli Survivorship

This study was conducted to determine the effects of cacao on Staphylococcus epidermidis and E. coli survivorship. The purpose was to analyze any significantly toxic effects on the life of the microflora of the body. It was conducted using sterile materials at Central Catholic High School. The data was collected by growing the cells in an incubator and counting the colonies. The results show the effect of the cacao reflected in the number of colonies counted, and shows no significant effect on the basis of statistical analysis.

SMH129: Glycolysis Linked Regulation of Cytokine Production in T Lymphocytes

Cytokine production by T lymphocytes is vital for an immune response against cancer, but it is suppressed in the tumor microenvironment (TME). When activated T cells are in a hypoglycemic environment like the TME, glycolysis is inhibited and cytokine production decreases dramatically, but mRNA transcription does not change. To understand how glycolysis regulates cytokine production, I inhibited glycolysis in activated T cells and quantified cytokine protein and mRNA production. My results showed that inhibition of glycolysis prevents cytokine protein translation by the binding of a glycolytic enzyme (LDH) to cytokine mRNA. Manipulation of this pathway could enhance immunotherapy of cancer.

SMH130: Engineering Synthetic Helper Cells that Recognize Abnormal MUC1

Muc1 is a protein found on all epithelial cells and is distinctive on cancer cell due to its abnormal glycosylation. We targeted cancerous MUC1 by engineering SynNotch cell receptors that produce any therapeutic gene of interest upon binding to MUC1. Our plan was to create a synthetic notch cell that releases a therapeutic gene of interest upon recognition of tumorous MUC1. We began by cloning MUC1 antibody fragments, H15K6 and H15K6, using the following techniques: PCR, restriction digestion, gel purification, ligation, bacterial transformation, and using mini, midi, and maxi preps. After cloning, we packaged the DNA into lentivirus, titered the virus at 0, 0.05, 0.5, 1, 5, and 10, and transduced it into human T cells which were isolated from a blood sample through PBMC. We confirmed receptor expression and characterized the level of MUC1 on different target cell lines using flow cytometry/ We then tested the activity of the engineered MUC1 SynNotch cells in vitro by co-incubating them with MUC1 positive and MUC1 negative cancer cells.

SMH131: The Effect of Cinnamon on Blood Sugar

I have family members struggle with the effects of diabetes. For my project I aim to find out if adding cinnamon would affect the rate at which sugar is metabolizing. I will place sugar, yeast and water in a test tube to simulate body's breakdown of sugar. The test tube will be placed in a warm water bath to simulate body temperature. I will then measure the gases produced with a gas pressure sensor to determine the rate at which sugar is metabolized, I will be adding varying amount of cinnamon for each experimental trial to change the rate at which sugar is metabolized.

SMH132: Cure it Quick

The purpose of this experiment is to determine which brands of advil will dissolve quicker in stomach acid. I will be using ibuprofen(the generic brands) from Walmart, Target, CVS, Rite Aid, and Dollar General. Along with that I will use Advil from a local pharmacy. As a substitute for stomach acid, I will be using vinegar because vinegar has the same pH level as stomach acid. This will be tested by placing a capsule in the vinegar and weighing them in fifteen minute intervals. I will collect data by timing how long it takes for the capsule to dissolve in the vinegar.

SMH133: I Didn't Order This!

The purpose of this experiment is to determine which kind of menu, paper or plastic coated, carry more bacteria cells that result in higher Relative Light Unit numbers. My hypothesis is that plastic menus will carry less bacteria than paper menus because plastic can be wiped off and paper cannot. Procedure: 1. Gather materials: menus 1-10 paper and plastic. 2. Collect sample from menu surfaces with sterile ATP Swabs. 3. Place swab in Luminometer; plunge, shake for five seconds, close and measure results. 4. Record results. 5. Compare paper vs plastic menu RLU data. 6. Calculate results and draw conclusions.

SMH134: Does Genetic Makeup Impact Opioid Effects?

In the past few years, the opioid crisis has been rampant in America, although researchers have been unable to identify the factors that cause it. In my experiment, I will test if technological pharmacogenomic testing will show genetic mutations in opioids that could cause harmful effects in the human genome. Data analysis is ongoing.

SMH135: NDUFA6 Gene and TBI Outcomes

Traumatic brain injury (TBI) is one of the leading causes of death and disability in the US. Recently, as sports-related injuries and vehicle accidents have become more prominent, TBI has left thousands of individuals with life-long mental and psychical deficits. There is great variability in the outcomes sustained after a TBI—ranging from a headache to permanent vegetative state. It may be possible that some individuals can have better/worse outcomes based on their genetic makeup. It has been proposed that single nucleotide polymorphisms (SNPs), or variations, of mitochondrial genes have an association with these outcomes. The gene of interest in this project is NDUFA6, which is an essential subunit of the mitochondrial complex I pathway in which ATP is created. Many TBI patients lack sufficient ATP, in turn leading to adverse effects on their bodies post injury. In order to test for a genetic association to TBI outcomes, an allelic discrimination assay test will be performed to observe allele combination variability within the NDUFA6 gene. Those results will then be used along with prior data within a dichotomized statistical analysis based on outcomes after 3, 6, 12, and 24 months along with demographic factors to view whether a certain allele combination promotes a better or more adverse TBI outcome. The results of this research may be linked to prior and future genetic knowledge in hopes of diminishing the effects of TBI on our world's population.

SMH136: Let's Talk Pressure

This experiment was set out to test the effects that a conversational form of talking can have on the average individual's blood pressure. The inquiry resulted from the belief that that average small talk conversation with a nurse or medical profession may be influencing the common measurement, which may in turn influence a diagnosis. A misdiagnosis can have many unexpected outcomes and effects. Through this experimentation process and collection of data, a conclusion will be made. If it is found that an effect is to be had, a need for change will develop. The experiment took place within the walls of Southern Garrett High School with an aggregate of thirty student test subjects. It is hypothesized that if a subject has their blood pressure measured when in conversation with another individual, then the measurement during this test will be increased from the measurement taken when not talking. The concluded results of the experiment will be available at the presented exhibit on March 23, 2017 (Fair Day).

SMH137: Does GMO Corn Syrup Inhibit Bacteria?

Purpose: Determine if GMO corn syrup inhibits bacterial proliferation better than Non-GMO in different concentrations. Hypothesis: GMO corn syrup will inhibit bacterial proliferation better than Non-GMO in high concentrations than low concentrations. Procedure: 1.Prepare/inoculate nutrient broth with E. coli and incubate. 2.Inoculate agar dish with solution. 3.Prepare 0%(control),25%,50%,75% solutions of GMO and Non-GMO syrup. 4.Place disk in GMO solution on dish. 5.Incubate/determine/record zone of inhibition. 6.Repeat for all. 7.Prepare 0%,25%,50%,75% solutions of GMO and Non-GMO syrup with inoculated broth and incubate. 8.Perform serial dilution of GMO solution and inoculate dish. 9.Incubate/record colonies. 10.Repeat for all. Conclusion: Available at fair.

SMH138: Effects of Aeration and Dissolved Oxygen on Gram-positive Pathogens

Gram-positive pathogens (e.g. Enterococcus), though facultative anaerobes, were tested for higher dissolved oxygen sensitivity rendering aeration as a feasible water-treatment mechanism internationally. Streptococcus salivarius (analog) was reactivated and grown in Brain Heart Infusion Broth at 5 DO levels (controlled by repurposing home-aquarium devices). Bacteria was counted utilizing an algorithm (thickness to surface area) created to be affordable and prevent numerous dilutions which would alter DO levels. Results showed highest growth at 0.0 mg/L and ~3.3 mg/L, lower growth at ~0.2 mg/L and ~2.4 mg/L, and least growth at ~0.9 mg/L.

SMH139: Natural Vs Synthetic Antibiotics

My project goal was to see if natural antibiotics could provide a better result for treating bacterial diseases than synthetic antibiotics. I tested the effects a synthetic antibiotic, ampicillin, against two natural antibiotics, garlic powder and vinegar, against a benign strain of E. Coli. My hypothesis for my project was if I subject bacteria to a synthetic antibiotic, ampicillin (in solution form) and natural antibiotics such as garlic powder, and vinegar oil, then I think the vinegar oil will destroy the most bacteria cultures.

SMH140: Salt Effects on Bacterial Growth

Create five different concentrations of salt in chichen broth. Subculture each solution every other day for a total of ten days. Count number of bacterial colonies grown from each. Analyze data and draw conclusions about effects of salt on bacterial growth.

SMH141: Biofilms and Catheters

Catheters are used in hospitals when a patient is unable to drain urine from the bladder themselves. However, when left in for extended periods of time, it increases the risk of infection. The cause of most infections are from the bacteria Escherichia coli. When exposed to warm, wet conditions, they form a biofilm which makes them more resistant to antimicrobial products. This can cause problems, because biofilms are difficult to prevent once the catheter is in the bladder. Because there are few effective ways to prevent this, one method of sterilization that could be used is ultra-violet (UV) light. Exposure to the light will break down a bacteria's DNA. This could be a possible solution to the growing amount of catheter caused UTIs. The hypothesis states that the longer a catheter is exposed to UV light, the less E. coli grow there will be. This was tested by exposing catheter pieces to different amounts of UV light. The catheters were then placed in petri dishes and left to grow for 2 weeks. Growth was then measured. The experimenting is still ongoing and result will be available at the time of presentation.

SMH142: Which acne wash can zap that zit away?

The purpose of this experiment was to see which acne wash is able to get rid of acne. This is done by taking E. coli and striking it on a agar plate after taking a disk that was dipped in an acne wash and placing on the middle of the agar. Growing over a couple of weeks. The results will show which acne wash is able to get rid of the most bacteria.

SMH143: Can Silver Nanoparticles Inhibit Coagulation in Blood?

The purpose of this experiment was to determine if a colloidal silver solution negatively affects human blood coagulation. It is predicted that as the concentration of silver in the blood increases, the amount of clotting will decrease. An electrolysis apparatus will be used to create varying concentrations of silver colloidal solution. The solution will be mixed with a 5mL sample of human blood and inserted into a platelet aggtegometer and clotting after one minute will be recorded. Results available at fair.

SMH144: Specific Mutation Pinpointing in Chd1

CHD1, otherwise known as Chromodomain Helicase DNA Binding Protein 1, is a coding gene in DNA. This means, according to Uniprot, that the protein " Regulates polymerase II transcription" This makes such a protein so vital. In studying its function, we are able to look at what can happen if something were to mutate in its function. According to Oncogene, " Among the most frequent alterations not associated with a known cancer gene." CHD1 is known to cause cancer. In my previous year study, I found three specific genes in CHD1 that mutated when introduced to random mutagenesis. This year, my project has even further implications. I am working to find which combinations of the three mutated genes are vital to CHD1's normal function, which can potentially find causes for genetic diseases, such as prostate cancer. A hypothesis will be formed as experimentation continues; however, based on previous research with CHD1, I would hypothesize that all three amino acids will be important for normal CHD1 function since many tests were done on the protein, so if these mutations lasted through all of the experimentations, they should be important to its function. As with any new research project, many questions have been/ will be formed during the experiment. rounds of successful gels were run. This year, I look to continue my research and gain more concrete results.

SMH145: Effect of Antibiotics on Catalase Activity in Yeast

The objective of this experiment was to determine whether different concentrations of Streptomycin, a prescription antibiotic used to treat bacterial infections, affect catalase activity. Yeast, the model organism, was used to determine the effect of the different concentrations. Catalase is an enzyme found in the liver of most living things, and is used for the breakdown of hydrogen peroxide, which may be harmful to humans, into water and oxygen. By exposing activated yeast to an antibiotic and then adding hydrogen peroxide, I was able to measure the pressure of the oxygen, and draw conclusions on the effect based on that.

SMH146: What is the best thing to do before bed?

The purpose of this experiment was to determine out of three common nightly activities, which one resulted in the best night of sleep. There were three activities being done before bed; reading a book, reading on a tablet, and watching a movie. Based upon these activities, I came up with my hypothesis. Out of the three activities, reading the book will be best for your sleep. This is based on the idea that blue light from electronics is bad for your sleep. To start this experiment you need a device to track your sleep. You will also need a cellular device to view the app for the device. Make sure the device is charged enough to last throughout the night. Each night for 10 days, you will read a book from 9:00-9:30. Set alarms for these times to remind you to begin and end the activity. Set your alarm for 6:10, 6:12, and 6:15 to alert you to wake up the next morning. When the first two alarms go off, remain in bed. When the 6:15 alarm goes off, get out of bed and go about your day as normal. Record your data from the sleep tracking app. Record the following information; total time asleep, awake time, REM time, light sleep time, and deep sleep time. You will also need to record the percentages for each category. After the 10 day period, average the data for each day. Repeat the previous steps for reading on a tablet and watching a movie. Calculate the mean, median, and mode for each activity; reading a book, a tablet, and watching a movie. Also record any observations you have for each activity such as how you felt after you woke up the next morning or how long it took you to fall asleep. The final results of the experiment will be available on the day of the science fair.

SMH147: Diffusion Through Biogels

This projects centers on the use of various biogels to serve as potential delivery mechanisms of drugs through bacterial secretion and diffusion through a biogel matrix. Currently a method of creating numerous, identical low-melt agar cubes has been achieved utilizing SLA 3D-printing of photo-reactive resin. Throughout the remainder of the experiment, data will be collected on the rate of diffusion of ampicillin through the biogels as a model of potential drug delivery.

SMH148: The effect of Alum on purifying water

The purpose of this project was to determine if Alum (aluminum sulfate) helps to purify water. This was tested by adding different concentrations of Alum to impure water (tap water), using untreated tap water as a control. Effectiveness was measured by counting whether or not the bacteria Coliform was able to grow using the diverse samples. In all experimental groups, regardless of concentrations, the number of Coliform colonies decreased significantly, thus proving that Alum was effective as a water purifier.

SMH149: The Effect of Handwash on the Amount of Acne

In this experiment I wanted to find out what type of facial wash worked best to treat acne. This is important because nearly 8 out of 10 teenagers suffer from acne and using facial wash is one of most common ways to treat acne. This was done by culturing acne causing bacteria and putting the facial wash on a disk to measure the zone of inhibition. The results will show which facial wash works best against acne.

SMH150: Does activated charcoal infused with nanosilver particles inhibit epidermal bacterial proliferation better than cotton cast padding infused with nanosilver particles?

Purpose: determine which type of cast padding inhibits bacterial proliferation in a cast the greatest. Hypothesis: activated charcoal fabric containing Nano Silver will inhibit bacterial proliferation the greatest, then cotton cast padding containing Nano Silver, then normal cotton cast padding. Procedure: soak cast padding in Nano Silver particle solution, apply casts to volunteers to wear for 96 hours, take samples from casts each day, perform serial dilutions for each of the samples after 72 hours of incubation, inoculate petri dishes for each sample, perform colony counts for petri dishes after 72 hours of incubation. Results: available at fair.

SMH151: Fipronil Effects on Stem Cell Behavior

This study was conducted to determine the effects of the chemical fipronil in the insecticide Taurus SC on C2C12 stem cell proliferation and differentiation. Its purpose was to investigate any inlfuences the chemical might have on cell survivroship, proliferation, and differentiation. It was conducted under a sterile hood at Carnegie Mellon University using T75 and T25 flasks and well plates. The data was collected by performing cell counts from the T25 flasks and by taking images from the well plates cell cultures. The results show that fipronil may heighten stem cell growth rates and that it has little effect on myotube formation, a marker for differentiation.

SMH152: HPV-16-Positive Oropharyngeal Cancer Cells Require Viral E6/E7 Oncogene Expression for Survival

Aims: Epidemiological data suggests that HPV-16 is etiologically related to oropharyngeal cancer, but experimental evidence lacks. Our study looked to experimentally prove that HPV-16 causes oropharyngeal cancer. We used an shRNA-mediated knockdown approach gene silencing to knockdown the expression of HPV-16's E6/E7 gene in HPV16-positive cell lines, and observe its effects on tumorigenesis. Methodology: 4 different HPV16-positive oropharyngeal cancer cell lines were used. We transfected lentivirus to infect cells with shRNA, and selected infected cells with puromycin. qRT-PCR was used to determine knockdown efficiency across cell lines. We used a WST-8 cell viability assay to record cell proliferation (measured for 11 days after seeding). Finally, immunoblotting was used to analyze protein expression levels. Results: The two cell lines with most efficient knockdown were used in further assays. Both cell lines showed significant growth retardation. Immunoblot analysis suggests this was due to cellular apoptosis, as PARP and cleaved PARP proteins were present in infected cells. After infection by E6/E7-targeting shRNA, p53 and Rb protein levels stabilized in each of the infected cell lines (with significant knockdown), indicating that tumor suppressor pathways are reactivated with the silencing of E6/E7. Conclusion: Ultimately, we see reduced tumorigenesis in cells with E6/E7 knocked down, indicating that it is required for malignant growth. We conclude, thus, transcriptionally active HPV-16 causes cancer in the oropharynx.

SMH153: Optimizing a Microemulsion to Reduce Toxicity

The purpose of this research was to determine the effects that removing a surfactant will have upon a microemulsion delivery system, and specifically whether it will be beneficial to the efficiency of the emulsion. The control group was the original microemulsion, which contained three surfactants and a fixed amount of other ingredients. The environment was also controlled, and the same tests were performed on both microemulsions. The tests were stability of size and polydispersity, centrifugation, and needle tests, which were used to determine the optimization of the second emulsion. Stability was the biggest determinant of the success of the emulsion, which was probably explained by the variability caused by additional ingredients. Future directions are the incorporation of the emulsion into a hydrogel, for real-world application.

SMH154: Microneedle Array-based Cutaneous Delivery of Protein Vaccine for Immunization

Skin, our body's most accessible organ that contains an extensive array of immune responses relevant cells, is the ideal site for immunization. Protein (e.g., tumor antigens: TA) vaccine is a clinical promising solution to immunotherapy of various diseases including cancer. Microneedle arrays (MNA) target skin with minimal invasion in a clinical applicable convenience and painless manner. I hypothesize that MNA can be used to deliver protein vaccine into the skin microenvironment for immunization. To test the hypothesis, in this project, TA in the lysates of tumors were left unlabeled or labeled with DyLight 488 N-hydroxysuccinimide ester (DyLight 488) (resultant protein vaccine TA or DyLight 488-TA). The biocompatible and dissolvable polymer, low viscosity sodium carboxymethyl cellulose was used to prepare MNA, which were then tip loaded with DyLight 488-labeled or unlabeled TA (resultant MNA-based protein vaccine MNA/DyLight 488-TA or MNA/TA). Human skin epidermal/dermal explants, which were prepared from surgically discarded de-identified fresh human skin tissues, were intradermally administrated with protein vaccine TA or DyLight 488-TA by using a syringe, or cutaneously immunized with MNA-based protein vaccine MNA/DyLight 488-TA or MNA/TA through patch immunization. The immunized human skin explants were cultured in the cell culture dishes in a cell culture incubator. One to five days later, skin tissues at the immunization site were removed and rapidly frozen. Sections were cut by using a cryostat microtome and subsequently stained by Haemotoxylin and Eosin or Immunohistochemistry. The stained sections were evaluated under a (fluorescence) microscope. I found that vaccine proteins could last for five days in the cutaneous microenvironment after the MNA patch immunization but not the traditional intradermal injection. My data demonstrate that protein vaccine can be effectively and durably delivered into the skin microenvironment by MNA patch immunization and have the important implications for the design of MNA-based protein vaccine via cutaneous patch immunization for the prevention or treatment of various diseases including flu and cancer.

SMH155: Sex Differences of vSMC Functionality in BAV Patients

Bicuspid aortic valve (BAV) is the most common congenital heart disease in the world and occurs when the aortic valve is formed with two cusps as opposed to three. Men are three times more likely to be born with BAV than women and present at an earlier age with side effects of it. Although this difference exists, it is not understood why. By looking at the functionality of vascular smooth muscle cells (which comprise the aorta) through cell proliferation, immunocytochemistry, and 3D collagen gels I am expecting to find lower functionality in male than female cells. Upon completion, two of the three assays showed results of lower functionality by having lower proliferation, abnormal growth patterns, and insignificant rates of contraction for the male cell populations. These results point in the direction to suggest that there is a difference at a cellular and tissue levels between male and female vascular smooth muscle cells, beginning to explain the negative fate which men have when faced with BAV.

SMH156: DIY Emergency Water Filter

As a result of recent natural tragedies, thousands of people find themselves with no clean water or power. I designed an emergency water filter, limiting myself to materials that I had at home. For each prototype, I tested the water before and after filtration for the particles per million (PPM), conductivity (µs/cm), and temperature (℃). After multiple designs, I settled on a design with a funnel filled with sand, two t-shirt layers, two coffee filters, and two screens. The filter successfully removed 446 PPM from the solution, but did not fully disinfect water.

SMH300: Wrestle the Vessel

This experiment examined which amounts of gelatin and agarose created the best artificial substitution for an organic blood vessel. We hypothesized that if model blood vessels are put through tests, then the thicker textured blood vessel with the widest valve would survive best because the thickness would provide durability and then wide valve would prevent blood from clotting, and allow blood to pass through faster. To do this experiment, we created a 6% solution of gelatin, agar and water. After creating these solutions, we let them cool and put them through a series of tests to assess their durability. In the end, our hypothesis was supported. The blood vessel composed of 1.75 gelatin, and 1.25 agarose, was made thicker and stronger by the gelatin. The gelatin also provided the smoothness of the surface of the blood vessel, which allowed the water to pass through at a quicker pace. In the future, we'd test the differences between the properties of gelatin – a protein – and agarose – a carbohydrate.

SMH301: Antibiotic Resistance Crisis: Solved by Copper

The antibiotic resistance crisis is a problem that involves bacteria, overtime, becoming immune to antibiotics. This crisis can be solved by making more antibiotics, and using the new ones more than the older ones. As a group, we believe that if copper is added to bacteria, then the growth will be inhibited or prohibited, because the copper attacks too many vital parts of bacterial life for reproduction to occur. We will be testing this by doing multiple trials using copper to kill three different types of bacteria: Staphylococcus epidermidis, Pseudomonas fluorescens, and Lactococcus lactus. We will also have a control, for each bacteria to see its natural growth. These bacteria will also be tested against two common types of antibiotics: Ampicillin and Kanamycin.

SMH302: dog kisses heal everything

The purpose of our project was to help identify if dog saliva can be used as an antibacterial agent. Our category is health and medicine. The procedure we used for our project was to gather 10 dogs and swab their mouths to then spread the saliva onto a petri dish with bacteria to see what will grow. Pictures were taken every day for a week. we also looked at the percentage of bacteria that had grown. Our hypothesis was supported by having some dogs had saliva that acted as an antibacterial agent.

SMH303: Nervous Synapse Measuring Prosthetic Arm

The creation and development of a prosthetic limb has been a vital focus of the modern generation as the implications of the technologies prove significant in the future. It involves a reconstruction able to enhance the human kind in a way that doesn't factor in genetics or disability. Yet the connection between the body and a previously inanimate object is yet to be feasible, with current technologies in feasible markets reaching costs of over 40,000 dollars. The complex systems behind engineering prosthetic arms exist, at relatively lower costs. Yet it is the connection between the brain and the prosthetic that proves to be tremendously expensive. Thus, we look to an inexpensive way that still includes a collaboration of neural function between organics and machine requiring an analysis on neural processes and patterns.

SMH304: Effects of Dietary Fat or Sucrose on Body Weight and Glucose Homeostasis and Interactions with an Antihistamine

Antihistamines are a commonly-used medication that have many side effects, the most well known being weight gain. The purpose of this study is to determine if the weight gain is caused by the medication alone or is affected by diet as well. Mice are given four different diets with varying levels of sugar and fat, and weight gain is assessed daily, then antihistamines are injected into some to discover if they affect more weight gain. When completed, this experiment can be applied to human subjects, and new adjustments could be made to antihistamines to help prevent weight gain.

Physics (SPH)

SPH100: Hooked!

In my experiment, I will test different knots. Knots are used by outdoorsman and the Military every day. Sometimes, their lives depend on the type of knot they use. The inspiration for my experiment stems from losing several lures and fish while fishing due to failed knots. In my experiment, I will determine which type of knot allows the least amount of slippage and is the strongest. These characteristics make a knot safer. The results of my experiment will be available on competition day.

SPH101: Electric Motors

In my experiment I will be testing to see if the number in loops wire produce a simple electric motor. I'm taking copper wire and wrapping around a D size battery to make intervals of three, to see if the different number of loops affect the conductivity.

SPH102: Rainwater Free Minivan Rear Window

The purpose of this project is to find out how water gets from the ground to the rear windshield while the vehicle is moving. The principle that caused water to get on the rear windshield was through air pressure and turbulence. This principle was tested using videography and an air pressure meter (barometer) to record water spraying onto the rear windshield. An air flow system was designed to prevent water from getting onto the rear windshield. The design was tested to show that we can reduce the amount of water from getting on the rear windshield.

SPH103: Electric Coil Motor

For my science fair project, I was testing to see how 4 batteries, each with different voltages (1.5V, 3.0V, 4.5V, and 6V), would affect the revolutions per minute (RPM) on a coil motor. My hypothesis was that the highest voltage battery, in this case the 6V, would produce the highest RPM on the coil motor. In order to to make this electric motor, I first wound together a strip of coil with the two ends sticking out. I then got two strips of metal and attached the ends of the coil to it. After this, I wired the 4 different batteries to the metal strip in order to make the coil motor spin. However, I had to have a way to separately turn on each battery to accurately test the RPM of the coil motor. To do this, I acquired for levers, wired them to the batteries which then led to the metal strips that would activate the coil motor. After testing each battery several times I got the results. The results of the equations supported my hypothesis and the highest voltage battery (6V) made the electric coil motor acquire the highest RPM's.

SPH104: Robotic Ball Shooter Mechanism

I tested the impact of motor speed and tire materials on the velocity of balls shot with a robotic ball shooter. I built a shooter using two opposite-spinning wheels driven by 12V motors controlled by an arduino. I recorded the sound of the ball launch and impact three meters away and used an audio program to measure the elapsed time precisely and calculate the average velocity. I tested wheels with different tread durometers (30A-60A) and four different tire materials: foam, rug mat, sandpaper, fleece. The softest rubber wheel had the highest velocity and the non-rubber tires decreased velocity.

SPH105: Harnessing the power of the sun

The purpose of this experiment is to determine if a tent can be efficiently heated with solar panels. It is hypothesized that a tent can be efficiently heated with solar panels. After all materials are gathered, construct a heater with several solar panels. Attach to tent, and place a thermometer inside tent. Place in sun and check temperature of tent every half an hour. Once tent has reach desired temperature, record data and shut off heater, allowing system to completely cool. Run a total of seven trials. After experimentation, take all data and analyze results. Hypothesis: It is hypothesized that a tent can be efficiently heated with solar panels because of the multiple solar cells' ability to capture the solar radiation. Procedures: 1. Gather all materials. 2. Build solar panel heater and attach to tent. 3. Place thermometer inside tent and place tent outside. 4. Start heather and record temperature of interior of tent every half hour. 5. Once tent has reached desired temperature, record time and shut off heater, allowing system to completely cool. 6. Run a total of seven trials. 7. Analyze data. Materials: Nylon tent, Solar panels (2), Heater, Thermometer, Glue, Safety, Never touch live wire, Exercise caution with a thermometer.

SPH106: Slippery When Wet

I am going to be doing my project on the pros and cons on having different road surfaces to make travel safer when roads are slippery, windy, or wet. I thought this would be an effective project because many of the roads in our area are being changed as far as the surfaces and I would like to know if it is cheaper and If it safer. I will be testing this on wood 2x4's with a coat of textured spray paint to simulate a road, I will be testing this by sliding and rolling objects across these boards The results will be different every time because they all have different measurements of cuts for different road surfaces. To test the effectiveness of the grooved pavement, I will use a force sensor and motion detector to determine the coefficient of friction of the surface.

SPH107: How Surface Roughness Influences Friction

The purpose of the experiment was to understand how roughness affects friction. The static frictional coefficients of wood, paper, aluminum, rubber and cardboard on two inclines of plastic and cardboard were calculated. The static coefficients were calculated by finding the angles at which each material started to slide by manually increasing the angle of the incline. The roughness of each material was visually measured with a microscope. It was found that materials with higher roughnesses were yet lower in static friction on certain inclines, thus disproving the hypothesis that states that the roughness of the materials directly correlate to friction.

SPH108: Precipitation Insulation

In undeveloped countries, people need a cheaper way to insulate. I will insulate by using water. I will be comparing the heat of the house between different trials. I would have to do multiple trials to be sure that my results are scientifically accurate. I think that an efficient way to test it would be to put it over an open container with a heat lamp pointing at it, and then the temperature measured inside over time. I hypothesise that a moderate amount of water will have the most insulative and most realistic results.

SPH109: Safe Probing of Transmon Qubits

Transmon Qubits are very susceptible to Electro-Static Discharge, or ESD, which can end up destroying the qubit. To combat this issue we need to make something called an Anti-ESD Probing Box. This consists of two metal pads connected by a junction sitting on top of saphire, which is very effective at electrical insulation. When we make this probing box we can measure the resistance of the junction, which tells us about certain quantum properties it will have when cooled to micro-kelvin temperatures. With this information we can measure this over time an not only can we tell how the resistance changes over time but we can also find out how the quantum properties change over time.

SPH110: Typ UV & Temp Aff Speed Photochromatic Lens Changing

Purpose:Determine if temperature and cost affects how rapidly a photochromic lens changes color when exposed toUVA,B,C light. Hypothesis:As the temperature and cost decreases the length of time that it takes the lens to change color will increase when exposed toUVA,B,C light. Procedure:Place the testing apparatus containing the photochromic lens being tested in a temperature control chamber at23°C(control). Expose the lens toUVA light and using a UV light meter, determine and record the length of time required for the lens to change color and repeat for29more tests. Repeat steps1-2at temperatures of 0°C and32°C, and then with UVB,C light. Conclusion:Results available at fair.

SPH111: Driving Blind

It is possible to adjust the mirrors of a vehicle so that there is a very small to almost no blind spot. However, do people use this setup or are they leaving themselves with unnecessary blind spots that increase their chances of getting in an accident? Data was collected about the field of views of volunteer teachers' and students' cars. It was found that almost all of the volunteers did not have the optimal side view mirror setup and were left with considerable blind spots.

SPH112: Does the Length of Fletching on a Crossbow Bold Effect the Depth of Penetration?

The purpose of this experiment was to determine if the length of fletching on a crossbow bolt effects the depth of penetration the bolt has on its target. Fletching in lengths of 2.54cm, 5.08cm, 7.62cm, 10.16cm, and 12.7cm were attached to crossbow bolts. The crossbows were braced 1.5m away from a ballistic gelatin target and fired. Depth of penetration was measured. Results available at fair.

SPH113: Measuring the Speed of Light

The speed of light is a very important area of physics but may sometimes be difficult to understand. This experiment shows how to easily and accurately measure the speed of light, and to understand this universal speed limit in more detail. The problem the experiment answers is: which candy item measures the speed of light most accurately? A microwave emits micro waves that travel at the speed of light. Therefore, if one can calculate the wave speed, one can calculate the speed of light. To do this, five different types of candies were put into a microwave at separate times and hotspots were measured to find the wavelength. A calculation was used to find the wave's speed. Because all electromagnetic waves travel at the speed of light, one is able to calculate and visualize the speed of light based on the microwave's frequency and wavelength. On average the chocolate crunch bar had the closest number to the actual speed of light which was 340,060,000mps. The percent error of this from the actual speed of light was 13.4%. The data proved the hypothesis to be incorrect because the milk chocolate bar did not measure the speed of light most accurately. The estimations of all the food items tested are close to the actual speed of light with some outliers, and the mean, median, and mode were all relatively close to the speed of light. This experiment concludes that the speed of light can be accurately measured by using just a microwave and food items.

SPH114: Effects of Circularly Polarized Light on Plants

The purpose of the project was to determine if left-handed circularly polarized light (CPL) increases plant growth more than that of right-handedness. Two experimental groups, one of plants receiving light through a left-handed CPL filter, and the other through a right-handed filter, along with one control group, receiving unfiltered sunlight, were used. All three groups had the same access to fertilizer and time under light. The quantitative measurements, height of plant from seed disk and leaf width, were taken twice per day, at hour 0 and hour 12 of light exposure. Data were collected for 30 days. Results will be presented.

SPH115: What effect does the shape of tubercles have on turbine efficiency?

Purpose: To determine what influence of the shape of tubercles have on the rotation of a V.A.W.T. Hypothesis: The conical tubercles will cause the V.A.W.T. to rotate the fastest. Procedure: 1. Obtain materials. 2. Build testing apparatus. 3. Attach hemispherical tubercles to the blades of the VAWT. 4. Turn on the hair dryer for 1 minute of running before measuring the RPM of the VAWT, then record the RPM. 5. Repeat step 4 29 more times. 6. Repeat steps 3-5 with the conical tubercles. Conclusion: Final results available at fair

SPH116: What LED light produces the best current from a solar panel?

My purpose is to determine which color of LED will produce the greatest amount of amperage and voltage within a solar panel. My hypothesis, in decending order of amperage and voltage is all combined lights, ultraviolet, blue, green, yellow, red, and infrared. To perform this experiment. I made sure all of my lights had the same lumens of brightness. Then, I assembled circuits on perfboard that contained current limiting resistors, attached a solar panel to perfboard, and attached voltmeter and ammeter to the solar panel. Light combinations were tested sequentially. Results available at fair.

SPH117: The Best Asphalt for Western PA

This year i wanted to see the types of asphalt would change during the test. That i did with putting it in different temperatures. Then putting pressure on it to see when it would break. I wanted to do this because in western pennsylvania we have such a change in temperatures. That it's unreal we have had 26,000 pot holes in 2006 through 2012. It can do a huge damage on cars and other personal items and can cost a lot if it keeps coming and i want to find a way to fix this problem.

SPH119: Hull Design and Drag in Boats

The purpose of this experiment was to determine what effect a boat's bow design has on drag through water. It was predicted that the inverted bow will have the least amount of drag through the water. Weighted foam blocks will be carved into different bow shapes and partially submerged in a moving water tank. A spring scale will be used to measure newtons of drag force acting on the boat. Results available at fair.

SPH120: Acoustic Phone Speaker Amplification

The project “Acoustic Amplification” has progressed throughout the year. So far, with current progress, there are many different types of objects that can amplify sound in an effective way. These materials include cardboard, paper (scrapbook), common plastic (PVC), and aluminum foil (successful at reflecting high frequencies). Some shapes that seem viable in the creation of a cost-effective phone speaker include cylinders, spheres (with flat bottoms), hexagonal prisms, and rectangular prisms. Once experimentation has concluded, the most viable materials and shapes will be combined to form a cost-effective acoustic phone amplifier. Results will be available on fair day.

SPH121: Wait... What's the Weight?

My science fair project this year will be on whether or not the weight of a drone will affect the battery life. My hypothesis is that the weight will not affect the battery life of the drone, but the altitude. The methods of I will be using is simple. I will gather the required materials, such as the drone itself. Then I will do multiple tests, some with no added weight, then a minimum weight added, then a decent amount. All information will be available on fair day.

SPH122: How Sharp is your Hearing? The Knowledge of Pitch

My project goes into the Physics category. The purpose of my experiment was to see if someone who plays an instrument with a set note can hear if a note is out of tune as well as someone who plays an instrument with no set note. For a single participant, a note was played at 440 hertz, which is the normal hertz level, 420, 400, 460, and 480 hertz. It was found that people who play any instrument, set note or not, can hear if a note is out of tune. People who do not play instruments cannot.

SPH123: Railgun Launch System

Current rocket payload delivery systems are complex, ineffective, and expensive. Although it is currently the only way to deliver a payload into orbit, another option exists. By launching a payload with a railgun, fewer mechanical systems that could cause an error would be needed, little to no fuel would have to be launched with the payload, and it could be powered with renewable energy. If successful, it will be a much less expensive and simpler alternative to rocket based payload delivery systems, allowing for more extraterrestrial exploration and experimentation. This experiment will test different sizes, shapes, masses, speeds, and materials for their capacity as a railgun to orbit delivery system. If a reliable payload capsule is found, a method for launching the capsules will be researched as well. The project is completely free of any hazards or ethical issues as it will be an advanced computer simulation. The computer simulation will terminate a given model once any force acting upon it becomes too great, keep a record of the maximum forces that acted upon it during launch, and possibly contain a visible representation of certain components.

SPH124: How does a fin formation affect rocket acceleration

During the experiment that was conducted, Vitamin C levels in different types of orange juice were tested. To do this, I combined cornstarch, water, and iodine. Then, I put 5 ml of that into 5 different test tubes, added orange juice, and then compared colors of the juice. The juices used were orange juice from concentrate, concentrated orange juice, high and no pulp orange juices, and fresh squeezed orange juice. I compared them by color, then assigned point values to which one was darkest so I could get more quantitative data.

SPH125: Fingerprint Distortion on Curved Surfaces

Fingerprints are used in forensic science for identification. However, when fingerprints are lifted from crime scenes, they do not always appear on flat surfaces. This experiment assesses fingerprints on cylindrical objects against their control counterparts. This was done by lifting up the cylindrical object, dusting it, photographing the prints, and “lifting” them. Prints were then assessed with comparisons of five points found on the control. Fingerprints on the aluminium can were the least distorted, having the lowest average distortion.

SPH126: Effects of Magnets on an electric flow

For this experiment, different types of magnets (neodymium magnet and ferrite), were put on copper wires and electricity was run through the wires to see how the magnets would affect the flow of electricity. From the results so far, it seems that both the magnets reduce voltage, but by differing amounts. More data will be available on presentation day. This is important to know because magnets are common items in people's homes, and if put in the wrong place, they could negatively affect electronics left nearby.

SPH127: Wood's Resistance to Splitting

This project, "Wood's Resistance to Splitting", was complete to improve and optimize reparations for winter in Garrett County, MD. The problem of this experiment was, which type of wood commonly found in Garrett County is harder to split with a wood splitter and why? The types of trees used were black cherry, black locust, red oak, and white oak. Assuming the diameter and length of each sample is similar, then the wood species with the highest dry density will the hardest to split. This would be the black locust. Each tree sample had to be cut down, but they all had to be in the nine to twelve inch diameter range and be dead (no green trees). The 25 ton wood splitter is used with a pressure gauge that needs to be installed. The volume of the wood block needs to be recorded by filling up a 32-gallon with water then recording how much the water has risen. With these numbers, the volume can then be configured. Record the weight, the pressure to split that appears on the gauge when the wood is split, and the moisture content (%) with the moisture meter. With these numbers, the wet and dry densities can be analyzed. The results will be available during the science fair.

SPH128: Dancers in Motion: The Physics of a Pirouette

The purpose of this experiment is to determine the impact of weight on a dancer's ability to perform circular rotations, specifically a pirouette. A video camera will be utilized to record the complete number of revolutions per dancer. This will be completed in a three-step process of pre-weight, four weight variables, and post-weight. Dancers will be asked to perform five trials of each, totaling 30 trials. Data will be digitally analyzed using a video editing software to determine the time of each pirouette performed by each dancer and trial. Results of the experiment will be available on fair day.

SPH129: Math and the Sun: Varying Angles of Solar Panels

Solar energy is a prominent source of energy in today's world. Clean, efficient, and cost-effective, solar energy harvests radiant light and heat from the sun and converts the energy into electrical energy, powering homes, schools, and businesses and providing accessible energy to developing countries. Solar energy is collected using a system of photovoltaic panels pointed towards the sun to absorb its rays. This experiment will investigate the effect of different angles of light incidences on the output power of solar panels and also determine which angle of light incidence produces the most output power in order to maximize the efficiency of solar panels.

SPH300: Heated Snowboard

We plan on heating up the base of a snowboard in order to decrease friction and make it go faster. We will use math and physics to determine the speed difference to scientifically prove our results. We will be using heated film to heat the bottom of the snowboard. We will have to attach the heated film to the bottom of the snowboard, then cover it with P-tex and wax in order to protect the film. We will test the speed when the base is heated and when it is not heated to find the difference in speed.

SPH301: Let the Body's Hit the Floor

In this experiment, the decrease of body temperature on different materials was recorded to determine how much heat was lost in a matter of five minutes. Forensic Scientists use this to determine time of death of a person. The project started with gathering loaf pans to hold many surroundings. Hot dogs were placed into the surroundings for five minutes and recording data every half second. This experiment showed that more heat dropped when the surrounding was salt water. The total heat decrease was 15.63842852 degrees. The least amount of heat loss was leaves which was at 5.331219875 degrees.