78th Pittsburgh Regional Science & Engineering Fair

Senior Division

Student Project Abstracts
March 31, 2017

Notes to Judges

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

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

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

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

Project Numbers are assigned as XYYABC

- X: 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: Demystification of Stress

Stress is a rapidly increasing problem in the lives of adolescents today. Academic pressure combined with social and parental pressure can have lasting impacts that most people don't realize. According to various sources, stress can immensely harm not only performance, but also the brain, in general, as well as cause health issues. To address this problem, I decided to design an app to address many of the aspects of this issue, and to assist with the management of stress. I also wrote multiple algorithms to help with the coding. Future work includes making and implementing this app on the market.

SBS101: The Science of Lie Detection

A) The purpose of the researcher's experiment is to discover how most of her participants will lie to certain questions that will be asked. Of course, the questions are very odd and random on purpose. The researcher expects the participant's faces to become red, turn away, or smile a little. B) The procedure will be as follows. The testing will be done at school. The researcher will be testing students 6th through 8th grade. The researcher will ask a select few questions to each participant. About 20-25 students will be tested throughout this investigation.

SBS102: HPV Awareness and Prevention in Teens

The purpose of my project is to inform people about HPV, cervical cancer and pap tests, then persuade them to get the HPV vaccine. Volunteers will be recruited via email to participate in a test, partake in an informational presentation, and then take a secondary test to see if the presentation had any effect. The data will be analyzed using statistical sampling methods. These findings will add to the current data on HPV awareness began to fix the lack of vaccination for this vaccine.

SBS103: Who Is Paying Attention?

The purpose of this project was to determine what age group of people gave the most accurate eyewitness reports. My hypothesis was "If all the age groups are shown the same video clip and then asked questions about what they watched, then the younger people (14-29) will be able to give the most accurate eyewitness report." To test this experiment the procedure used was 1. Pick a video clip. 2. Make a list of questions about small details in the video to ask the participant. Also have a list of answers. 3. Make age groups 14-29, 30-49, and 50+. Gather 12 participants for each age group (36 participants in all). 4. Record each participant's age. 5. Assign each participant into the appropriate age group (14-29, 30-49, 50+). Then assign each person a number. 6. Explain to each participant they will be watching a short video clip and then answering some questions. 7. Make sure only one participant is in the room while watching the video clip at a time. 8. Show the participant the video clip. Do not tell the participant what to pay attention to during the video. 9. After the video give the participant the list of 16 questions (that will be the same for everyone) that have to do with details from the video. Ask the participant to answer as many questions as they can remember. If they don't know the answer they can guess or skip the answer. Make sure not to help the participant at all. 10. Repeat steps four through nine for all participants. 11. Check the participant's answers to see how many questions they got correct out of 16. 12. Analyze which age group answered the questions with the most accuracy. Final results will be available on Fair day.

SBS104: Dominant Vs Recessive

The purpose of this experiment is to see if genetic traits are linked to academic performance. My finding could help better place students in academic courses. If someone has more dominant genes then they will be more academically inclined. The researcher will gather 20 participants and record the participant's physical genes in his/her notebook. The participant will take a small test that the researcher made. Once all the participants finish, the researcher will find the average that each participant got on the test and record in his/her notebook. Results will be available on fair day.

SBS105: Personality: A dog and It's Owner

There is a very popular saying about dogs, "Dog's are a man's best friend." Everyone has heard it. Many people and their friends have similar personalities, so this sparked the question, "do dogs and their owners have similar personalities?" The hypothesis was "If a person has a certain breed of dog, then the dog's personality will reflect the owner's." This experiment will help the society by finding the correlation between the personalities of a dog and its owner, and then using that to help future dog owners determine what breed of dog would best pair with their personality. To test this hypothesis, the following procedure was followed: Materials: 4 owners of Labrador Retrievers, 3 owners of German Shepherds, 4 owners of Golden Retrievers, 4 owners of Beagles, 4 owners of Yorkshire Terriers, Computer, Survey for Personalities on computer, Procedure: Find five personality traits for each breed of dog. Create a survey based on the five dog breeds' personalities. Make sure to include a question for each of the dog breeds' five personality traits. Find 4 owners of each of the dog breeds to take the survey. Ask participants to take the survey. They will not use their name, but rather a code that has been assigned to them containing the first letter of the dog breed's name and a number. An example would be GR3 for golden retrievers. They will be answering the questions based on their own personalities, not the personalities of their dogs. Record whether or not there is a correlation between the dogs personalities and the owners'. The final results of this experiment will be available at the exhibit on Fair Day.

SBS106: Creating 3D Art to Educate the Visually Impaired

Art history education is lacking in schools for the blind and visually impaired, in their attempt to explain 2-dimensional art and art history. Tactile models created by teachers are usually helpful but are overly simplified to different shapes of textured paper. This project creates 3-dimensional tactile models that display famous pieces of art using 3D printers and Fusion 360. The final prototypes are printed and analyzed for their effectiveness at conveying style and compositive of the art piece. It may potentially be tested by blind or blindfolded participants for further testing of effectiveness.

SBS107: Eye Development in Genders

The purpose of this investigation is to see how males and females see differently. If a female was exposed to a color vision test, then they would score higher than a male. If a male was tested on sensitivity to movement and detail, then they would score higher than a female. The first step is to gather all materials. The participants were asked to take a color vision test. Then they were tested on sensitivity to movement and details. The results were recorded. Finally, the data was analyzed. Results will be available at the Student's exhibit on Fair Day.

SBS108: The effect of print font on comprehension during studying in high school students

The psychological processes of fluency and disfluency dictate how the human brain understands and remembers information; this is especially impactful in the academic setting. While the beneficial effects of disfluency generally result from unfamiliarity of information, students cannot easily recreate this situation while studying; thus, I was lead to pose the question: how does unfamiliarity in the presentation of the information while studying exhibit disfluency also? Previous studies have concluded that students who lighten, darken, bold, and/or italicize the text of their academic information do understand and remember the information better and more consistently that those who use standard text, but no studies have addressed difference in text fonts in this situation. A series of studies testing this theory answered this question. In this study, high school students read five short stories in a randomized order, took a ten minute break from the information, and then took five quizzes consisting of five questions that correspond with each of the five short stories. The results showing a correlation between less common text fonts and percent of correctly answered questions are proof that high school students can use text fonts that are less familiar to them in order to understand and remember their academic information more successfully than they would with standard text font.

SBS109: Does Colour Affect Human Response?

Colours are a part of our everyday lives and are used to convey different messages, ideas and warnings. This project examined how different colours affect reaction times, and which colours have the greatest impact. To test the reaction times, each subject used a timer to determine how long it took to notice the colour change from white to the variable colour. Two colours exhibited a significant difference. The colour with the fastest reaction time was DeepPink, and the slowest, AliceBlue. Overall, warm colours had faster reaction times than cool and neutral ones.

SBS110: To Dye or not to Dye?

Artificial Food Coloring has been linked to many negative side effects. This experiment focused on a way to advertise products with natural food coloring in order to sway the consumer's preference. In this experiment, cupcakes with natural and artificial food coloring were presented to several different groups of students with increasing levels of information about food colorings. Based on appearance alone, the students preferred the cupcake with artificial food coloring. However, the experiment proved that presenting the ingredient list alone was enough to sway the consumers to the natural cupcake. Adding information about the side effects did not change the consumer's preference.

SBS111: Rewards vs Punishments:The Bigger motivator

The purpose of my experiment is to find out if are children more motivated by rewards or punishments. In any type of military branch soldiers are punished if they fail to follow the orders given. However most of the time they do what they're told and never have this problem. Therefore I expect the test group receiving the punishments will be able to come up with better results than the test groups receiving the rewards.

SBS113: The Mandela Effect

The purpose of this scientific experiment is to know if a majority of high-school age students unknowingly support the Mandela Effect. The Mandela Effect is a term used to describe a large group of people remembering and event/detail incorrectly. Creating a survey with seven Mandela Effect questions, with two or more possible answers for each question, twenty students took the survey and the results of the survey supported the hypothesis, 72.15% of the total amount of answers of all questions supported the hypothesis, 25.71% did not support the hypothesis, and 2.14% of the total amount of answers was invalid.

SBS114: The Effects of Meditation

Students are often really stressed before tests, as they are worried that they might under perform to their expectations. Being stressed frequently can lead to many health complications. In my experiment, I decided to examine the effects of meditation on the mind of a test taker, to see if this thousand year art could help alleviate stress. Participants took three tests: the first without meditating at all, the second after meditating for one minute, and the third after meditating for three minutes. Experimentation is still going on, and results will be presented at the fair.

SBS114: The Effects of Meditation

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SBS115: Distracted Driving: The Effects of Music on Reaction Time

Music is such a part of life that humans are unaware of its effects. I tested the effects of music/multitasking on reaction time. Participants took a reaction time test: with no distractors, favorite music, least favorite music. I hypothesized that people would have a faster reaction time with favorite music than least favorite music. Though the hypothesis was supported, patterns emerged. Most participants had a faster reaction time when listening to their favorite music and slower while listening to least favorite music. Conclusions indicate that faster reaction times occur when listening to favorite music.

SBS116: The Crime in Racial Profiling

In the experiment, The Crime in Racial Profiling, I look to study the racial biases people have. I hypothesized that if tested to see if some groups were thought to be more "criminal" than others, then it would be people of color who were most "criminal". First I gathered ten photos; black male and female, white male and female, Asian male and female, non-black Hispanic male and female and middle eastern / Indian male and female. All of these photos were monochromic from a previously published source. They were put into a survey in which each photo asked the same few questions. The questions were based around if they believed the person in the photo would commit a crime (what crime they would commit), if the person looked sneaky, and if the person answering the survey would feel safe with the person. After collecting data from 27 adults, it can be concluded that the most responses and responders was with the White Male photo, second being the Middle Eastern Female photo. From this alone it would appear that the most "criminal" of the ten photos and six races would be the white male, rejecting my hypothesis.

SBS117: Generational Affects On the Fear of Death

This project tested the hypothesis that generational differences affect a person's fear of death. Using a 15 question survey, 20 people answered questions relating to how they view death and their generational experiences. The findings conclude that a persons' view on death is influenced by their generation. Older generations were affected more by historical factors (i.e. war), whereas the younger generations have yet to live long enough to develop a real fear of dying.

SBS118: Memory vs. Mnemonics

The purpose of my investigation is to determine if photo mnemonics is more efficient for younger students or older students to help remember words while studying rather than traditional studying. The researcher will bring a group of twenty younger students into a quiet room split them into two groups: experimental and control. Have experimental study the list of words (with mnemonic) and the control without the mnemonic. Then the participants will wait three minutes. They will be asked to write down the list of thirteen words. Then repeat with the older students. Results will be available on competition day.

SBS119: The Heart of Music

This project will observe the effect music and the tempo of music has on heart rate and blood pressure. Participants will be listening to different songs, and their heart rate and blood pressure will be monitored for comparison.

SBS120: Blobs and Beyond

The purpose of this experiment is to discover if people in the same age groups see similar images when viewing ink blots. If I show the same inkblots to separate age groups, then each age group will get similar results and see close to the same thing within their group. Each group will see something different from another group. Procedure: Choose 10 inkblots. Separate participants into the following groups; ages 10-19, 20-29, 30-39, 40-49,50-59, 60-69. Test at least 5 people from each group. Show each person a series of 10 inkblots and record exactly what they see for each image. Record and compare the data. Final results will be available on fair day.

SBS121: The Influence of Gender on the Stroop Effect

This project will test to see if gender influences reaction time by giving students written words to read aloud, written in different colors. Times will be compared between male and female participants.

SBS122: Subliminal Messages

Please visit student's exhibit.

SBS123: Who has more of an artistic ability, males or females?

Problem-Who has more of an artistic ability, males or females? Hypothesis- Males will have the higher average score of graded drawings because researchers have discovered that males are more creative than females. Procedure-Pick an image for each participant to draw. Find 10 males and 10 females. Give each participant the image to draw. Collect all the drawings. Give the drawing to the art teacher for her to grade them on a scale of 1-10. Analyze data-Find mean, median and mode of the data. Draw conclusions. Final Results- As my experiment came to an end, I concluded that my hypothesis was correct. The males average score was 6.7, where the females average was 5.3. Since males are considered to be more creative than females, I figured that males would have a higher average than females. The median of my data was also higher for males than females, but the mode was higher for females than males. As I watched the participants draw the picture, I noticed that males tended to draw it quicker than females, but it also seemed to be easier for the males than the females.

SBS124: Memory Mnemonics

The researcher will experiment on two groups of participants to decide if using the mnemonics technique is more efficient rather than regular studying techniques. The researcher will take one group and give them a mnemonic to help remember a list of words. The other group will only be given a list of words with no mnemonic. The researcher believes that the group of participants using the mnemonics technique will remember the information more efficiently. Results will be available on competition day.

SBS125: Eyewitness Testimony: The Influence of Misleading Questions

The purpose of this investigation is to determine whether the influence of misleading questions affect eyewitness reports. The researcher completed this project in order to help criminal investigators find the most accurate way to word questions to eyewitnesses. To investigate, the researcher will prepare two different classes of students to watch the same video on someone committing a crime. Then the researcher will create two questionnaires, one asking misleading questions, and the other asking typical questions. By doing this, the researcher was able to determine that misleading questions in fact do influence eyewitness testimony.

SBS126: The Halo of Health Care

The purpose of this experiment is to determine if a person's political views are influenced by the halo effect. This is the tendency for people to form an impression of an idea, allowing that to influence their opinions on aspects associated with it. Participants completed a questionnaire identifying their political affiliation before rating attributes of a health care plan. After a week, the participants completed a second questionnaire, identical except for the title. It is expected that the title of the questionnaire ("ObamaCare", "HealthCare", "TrumpCare") will have an effect on how participants rank attributes associated with each plan.

SBS127: Do Males or Females Complete Tasks Faster While Being Distracted?

Question: To determine if males or females complete cognitive, manual, or hand eye coordination tasks faster during auditory and visual distractions. Hypothesis: The male and female brains process information differently and the hypothesis is that the female mind will perform faster with distractions than the male brain. Experimental Procedure: Randomly select 60 people and obtain consent. Test cognitive ability. Test manual ability. Test hand eye coordination. Visual distraction, flash bright light at testing area. Auditory distraction, pre-recorded rhetoric speaking. Perform data analysis of the results. Conclusion: See results at the fair.

SBS128: Background's effect on reading comprehension

The purpose for this experiment was to see what kind of impact background had while reading. Most times people assume distractions are a bad thing. My experiment was to see if background had an impact on reading a paragraph in front of it. This is, the background being the distraction and the words in front of it being what someone is trying to focus on. I had participants read two different paragraphs with similar details. In the same allotted time for each paragraph. The only major difference being one paragraph had a background and the other was on a plain piece of paper. I recorded the data as participants recited to me what they remembered. The same questions were asked of each participant for specific details. My hypothesis was that more people would remember more details from the paragraph with no background. This is because it is thought that backgrounds can add confusion. Resulting in lack of fact retention. Especially if you are trying to memorize something in a given amount of time. The results were very surprising and will be available at the exhibit.

SBS129: Adult Coloring-Stress free or Stressful?

Adult coloring books have been gaining popularity over the years, partly due to their claims of reducing anxiety and promoting relaxation. My experiment focused on using heart rates to determine how relaxed a person gets after coloring. Each day 10 testers were given a picture, easy, medium, or difficult, and were given 15 minutes to color. Their heart rates were recorded at the beginning and end of the 15 minutes, and were then averaged together after 15 days. The easy and medium heart rates increased and the difficult heart rate stayed the same, rejecting my hypothesis that coloring promotes relaxation.

SBS130: Does Dating Affect School Performance

My experiment studies the correlation (if any) between dating and school performance. My hypothesis is that if there is any consistent correlation between the two it would be slightly towards the idea that single people show better school performance. When it comes down to it I just wanted to know if single people are smarter. For my experiment I made 60 slips of paper, designating 30 to "daters" and 30 to "non-daters", thanking the recipient for partaking in m experiment and asking them fill out their GPA and if they were, at the time, dating. I also had an area that asked for the mean of their class grades but didn't make it mandatory (example: if John Doe had an 82 in his 1st period, a 94 in his 2nd period, an 87 in his 3rd period, and a 79 in his 4th period I would ask for that 82, 94, 87, and 79). After determining their grades in all their classes I would add their grade numbers (ex. 342) and divide them by the number of classes, in this case four (ex. 85.5). The higher the grades or GPA the better school performance of an individual. Then I find the average of all the means of each group. Example: if the daters had an average of a 3.8 GPA and the non-daters had an average of a 3.5 GPA, I could thus determine that the daters had an all-around better school performance. I asked 60 random students of Southern Garrett High School. I only conducted one trial. Specific age could have been an uncontrolled variable that changed the outcome. Controlled variables included relationship status and age range. Final results will be available on Fair Day.

SBS131: Effects of Service Dogs on University Students Stress Levels.

Many college students returning to second semester classes often experience homesickness and stress. The purpose of this project was to determine whether therapy dogs could help lower the stress levels of university students during finals. The researcher created and distributed a survey to approximately 250 students in three different college campuses during finals week. This project shows the results of analyzing such surveys.

SBS132: Texting While Walking

This project was created to test the effects of texting while walking by testing students abilities to walk in a straight line while typing a message on a phone.

SBS133: Console vs Mobile

This project is meant to see if the preference of gaming devices in current society. By handing our surveys and tracking the age, gender, and preference of each participant, it will be clear what each demographic prefers. THe results are separated into several categories that can be combined for a final result. The separate categories track age and their preferences, gender and their preferences, and the mix of age and gender and their preferences. After collection this data, the conclusion was that our of all of the surveys, mobile was chosen as the favored gaming device.

SBS134: Does Age Affect a Person's Ability to Multi Task?

Purpose: To determine if an individual's age affects their ability to respond to audio or visual task while typing. Hypothesis: 30-40 year old's will multitask more accurately and efficiently. Procedure: Collect all materials. Pick one individual. Determine test subject's age. Have subject type a paragraph in silence. Have subject type different paragraph with an audio distraction and a visual distraction. Repeat Steps 2 through 4 with fourteen more individuals in same age group, totaling fifteen middle schoolers, fifteen high schoolers, fifteen 30-40-year old's, and fifteen 50-60-year old's. Conclusion: Available at fair.

SBS135: eHealth: Equity and Efficiency

According to the National Cancer Institute, in 2016 there will be an estimated 1,685,210 people diagnosed with cancer and 595,690 people will die from the disease. A person's risk for cancer can be reduced by having a diet rich in fruits and vegetables, staying physically active, avoiding extreme sunlight, and having access to information about cancer prevention. Social media serves as format for doctors and hospitals to facilitate cancer preventative conversations between those affected by cancer and those who are at risk. For example, research shows that people use Twitter and Facebook as means to connect with post-cancer patients, to receive second-hand medical advice, and to learn more about prevention methods. Topics related to cancer prevention can be educational" (informative), motivational (encouraging people to get screenings), and promotional (fundraising events). This project will examine what cancer prevention related category of tweets reaches the largest audience on Twitter. By using NVIVO11, tweets will be tagged and then grouped based on characteristics, and spread will be determined by number of retweets. The results could potentially change the way organizations share information about cancer, and thus impact a wider and more diverse population of people.

SBS136: Human Pheromones: A Study in the biochemistry behind human attraction

This project was designed to prove the evolution of humans compared to other mammals and our primate ancestors. As well as show the evolution of human behavioral science and attraction and to show what effects this change might have on human society.Hypothesis:Humans have evolved beyond needing pheromones and the Vomeronasal glands.Procedure:Determine exactly what a pheromone is as well as the Vomeronasal organ (VNO) in both humans and other mammals.Gather and understand previous research based upon the functionality of the human VNO. Research and read previous experiments completed by past scientists. Gather similar research behind the attraction chemistry behind other mammals and the organs they use to sense pheromones.Compare and contrast the differences and similarities between humans and other mammals. With the proof of your research determine why humans no longer use the Vomeronasal organ to attract mates.Conclude why human biochemistry has evolved. Determine the effects might this have on our human society.After the research has been conducted and information collected, a survey will be created to distribute among participating adults. The results of the survey will provide further information regarding the evolution of the absence of the VNO. My final results will be available at my exhibit on fair day.

SBS138: Does Competition Affect Memory?

If students think a test is "competitive", is performance impacted? 34 students were split into 3 groups; all took the same 2 memory tests of 20 words each, by looking at a list for 20 seconds and writing down the words remembered. However, the 1st group was told the tests were "Test 1" and "Test 2"; the 2nd group was told they were a "Practice Test" and an "Actual Test"; the 3rd group, a "Practice Test" and "A test used to competitively rank you against peers". The improvement/decline between the two tests for all 3 groups is being analyzed.

SBS139: You Can't Handle the Truth

As many people and scientists know, people now are very forgetful. This project is to prove that eyewitness testimony is not an accurate piece of evidence for court and should not be used in our criminal justice system. My hypothesis is that if I ask questions 1-5 days after I show them the video then the answers to the questions will not be accurate.

SBS140: The Posting Predicament

Social media is one of the biggest forms of communication at this time. This is how most people communicate, not just for personal lives now, but for their work related lives as well. Many people have cell phones where they can access the internet from almost anywhere, and most workplaces also allow their employees access to computers as well. I am going to conduct a study on how social media affects the workplace. My hypothesis is that social media is a huge disruption to the workplace. My subjects are going to be of any age, gender or race. It will all be anonymous surveys, and no personal information is collected. I will analyze all the answers I get from my subjects and turn it into numerical data from which I can transfer that into simpler tables and graphs to make it easier to comprehend. Data will be available upon competition date.

SBS141: Your Inner Werewolf

The researcher will be testing to see if the lunar cycle has an effect on human psychosocial conditions. The hypothesis is that if the lunar phase is full, then the human will experience atypical emotional responses during that phase. The researcher will gather 40 participants giving the participants valid and reliable surveys about daily conditions over the next two lunar cycles. Then the researcher will gather the completed survey. Results will be available on fair day.

SBS142: Let Me Think On It

The project will determine whether meditation or physical exercise has an effect on test taking abilities by guiding groups of students through meditation and exercise and comparing the test results of each.

SBS143: Analysis of the Stroop Effect Across Disciplines

Teachers from different content areas will read text in a timed period. First they will read the written words. Then they will read a different passage but identify the color of the words.

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SBS144: Does the Ratio between Facial Features Affect Facial Appeal?

This project is about the golden ratio, or the perfect fraction, and how it's applied in the human face. Many studies show that in 5 milliseconds of meeting someone, your mind has made judgements about them based on their appearance, most importantly their face. This project is useful in many ways, such as picking a spokesmen for a company, or for advertising models. The goal of this project is to see if in 5 seconds, a participant will find a golden ratio face more appealing than a normal face, and if they can distinguish the golden ratio in a face.

SBS145: Color's Effect on Vocabulary Learning

We all know that color has an effect on our brains. It can change the way we think or react without us even knowing. But can colors affect how we learn language and vocabulary? I will be exploring the relationship between color and vocabulary retention with the help of Dr. Natasha Tokowicz. We will be teaching subjects with no prior knowledge of German words in German using different background colors to see if the color of the background has an effect on how the word is learned.

SBS146: Saving the Queen- a global problem

Effect of honey substitutes on learned memory, regenerative growth and oxidative stress-Potential impact on bee colonies and the global food supply Colony collapse disorder is a serious problem that can negatively affect the world's food supply. Honeybees (Apis mellifera) pollinate our crops but lately worker bees are abandoning their hives in droves. Scientists are baffled on what really causes this phenomenon. Insecticides, the food that we feed bees,and bacterial infestation are suspected factors. I compared different samples of common beekeeper provided hive nutrition as well as abandoned honey from a collapsed colony, and studied their effect on learned behavior, cell growth and oxidative stress using visual and spectrophotometric measurements in an in-vivo stem cell model.

SBS300: Hotelling's Law, Human Behavior and Emerging Econometrics of Product Differentiation

This project examined the prioritization of market share and product distribution between competing firms in traditional markets where products have minimum differentiation, as explained by Hotelling's Law. This project also examined the e-commerce marketplace and emerging technologies where products are now customizable and made-to-order, a principle called maximum differentiation. It is our hypothesis that increased differentiation opportunities allow competing firms to escape the shortcomings of Hotelling's Law, and a new economic paradigm is emerging that explains consumer behavior and decision-making. The project's results, explained by economic theory, mathematics, and statistical techniques, will be available at the Science Fair.

SBS301: The Effects of Alphabetical Order on High School GPA

The purpose of this project is to determine the effects of alphabetical order of students in a grade on the graphed slope of the alphabetically listed weighted GPAs. After reviewing alphabetically listed GPAs for six different graduating classes and conducting a research-based survey on the usage of alphabetical order in primary education, it was found that four of the six graduating classes had a negative slope. It can be determined that the significant use of alphabetical order does affect the weighted GPAs of high school students.

SBS302: Drug Risk

The purpose of this experiment was to find out if questioned, will subjects feel someone is more at risk when addicted to prescription drugs or if they're addicted to illegal drugs? This will hopefully inform people that there is not only a risk to illegal drugs but to prescription drugs as well if a dependent is addicted. The method to obtain this goal was to conduct a survey to produce data. After finding the results, they show that most people believe illegal drugs put an addicted person at more of a risk than prescription drugs do when someone is addicted.

Biology (SBI)

SBI100: Temp Effect on Shrm Expression

Overexpression of SHRM allows us to understand kidney disease and prenatal spinal diseases. Studied extensively in mice, SHRM has the potential to be overexpressed in drosophila, specifically in the wings. Overexpression of SHRM in wings, leads to crumpling. Variation of SHRM expression may be due to fluctuating incubation temperature. I wanted to test different incubation temperatures, and their effect on SHRM expression. I found that as temperature increased (25C), all drosophila would express a severely crumpled wing phenotype. At lower temperature (18C), there is very little crumpled wing phenotype. Room Temperature is optimal for the variation of SHRM.

SBI101: Radiation Effects on Tagetes Transgenerational Germination

Because the future of agriculture is a concern for farmers near Fukushima, the purpose of this experiment is to better understand the impact of radiation and generational effects on plant progeny, specifically x-rays and Tagetes patula. Tagetes seeds exposed to background radiation and 50, 500, and 5,000 Gray were evaluated for percent germination over three generations. Germination varied from 20 to 85% with decline in numbers germinating with each successive generation. When a statistical two-sample, two-tail, Z-test is used to compare controls with progeny from seeds exposed to 50 Gray, there is no statistical difference at the 95% confidence level.

SBI102: The Vicious Cycle of Inflammation in Human Lung Cancer -Aggravating Itself

One of the leading causes of death in today's society is lung cancer. Cell death and chronic inflammation remains an integral target and interest in our understanding and treatment of cancer. In response to tissue damage in tumor biology, certain immunostimulatory molecules known as damage-associated molecular patterns (DAMP) and cytokine (ex. IL-6) are released, which induce autophagy leading to further aggravation in tumor growth. By studying both the DAMP and cytokines, it may be possible to to block them, and therefore slow the growth of the tumor in lung cancer. In this study, I compared the inflammatory response (DAMP- HMGB1 and cytokine release) under the effect of typical low oxygen environment observed in cancer on lung cancer cells and healthy human lung fibroblasts. My control for this experiment was the behavior of the DAMP and cytokines in a normoxic environment. I took two strains of cells (fibroblasts and cancer cells) and observed the behavior of the DAMP and cytokines for different time periods (increments of 10 minutes), and recorded the changes. Afterwards, I ran both strains of cells through gel electrophoresis and ELISA to examine the proteins in each cell solution that were excreted from the lung cells while in their respective environments. The results for my experiment showed that there is an increased inflammatory response in a hypoxic environment compared to a normoxic environment in both strains of cells, and the cancer cells released more DAMP than the healthy cells. This explains that cancer is fueled by an inflammatory response caused by a cell. Understanding the inflammatory component of lung cancer and how it is driven by low oxygen tension will hopefully allow us to find better therapeutic targets to fight the disease.

SBI103: Docking Studies in the Inhibition of Human Serine Hydroxymethylstransferase

In non-small cell lung cancer, cells reprogram their metabolism towards the production of purines, pyrimidines, and antioxidants, a process catalyzed by an enzyme called human serine hydroxymethylstranferase (SHMT). This is part of the cycle that causes uncontrolled cancer cell division. If small molecules inhibit SHMT, tumor proliferation would be reduced. Using various computational procedures and online databases, and by digitally manipulating the chemical structures of ligands, this project simulated the varying abilities of selected ligands to inhibit SHMT and determined the interactions and energies necessary for binding. The results indicate that small molecules exist that could inhibit lung cancer proliferation.

SBI104: A Genetic Screen for Novel Regulators of Apoptosis

Apoptosis, or programmed cell death, is important for proper development and suppressing tumor growth in adults. In this study, Drosophila melanogaster were screened for novel apoptosis genes involved in the reaper-dependent signaling pathway, a major apoptosis pathway in flies. Four candidate genetic regions, each containing tens of genes, were examined for their ability to suppress a blistered-wing phenotype caused by excessive cell death triggered by reaper overexpression. Removal of either of two overlapping regions suppresses the apoptosis phenotype indicating that a gene within these regions is a novel candidate apoptosis gene. Future analyses will identify and characterize the candidate gene.

SBI105: To Wash or Not to Wash? Effects of Produce Residue on Drosophila melanogaster

This project investigates the effect of produce residue on the common fruit fly, Drosophila melanogaster, which is a model organism for humans. The experiment involves exposing Drosophila melanogaster to vegetable or fruit residue which has been removed by washing. This residue may contain pesticides and microbes. Results will be available at the Covestro Pittsburgh Regional Science & Engineering Fair.

SBI106: Stem Cell Saccharine Effects

Adult murine C2C12 myoblastic stem cells were exposed to varying concentrations of saccharine (an artificial sweetener). These cells differentiate into muscle tissue, and various studies have shown that natural sugars such as glucose and dextrose significantly promote stem cell differentiation. Other research suggests that aspartame, an artificial sweetener, hinders the differentiation and development of C2C12s' development of myotubes (microscopic muscle fibers). The cells, after growing in the presence of saccharine for one week, were photographed, showing the development of myotubes. The cells were also counted with a hemocytometer to produce quantitative results of saccharine toxicity.

SBI107: Pain Reliever Effects on 3T3 Stem Cells

Everyday, millions of Americans take pain relievers such as Tylenol and Advil. As they are over the counter and easy to obtain, many take these drugs in extreme excess to feel some sense of relief. Due to this extreme and casual use, I wanted to test the synergistic effects of such drugs on a common human cell model, 3T3 stem cells. After the cells were grown to a certain density, the variable was applied. Cells were counted after one day of exposure and then again on the second day. An ECM assay was also done to determine the effects of pain relievers on not only the cell proliferation but also the cell's ability to produce an extra cellular matrix. The expected results are that the synergistic effect of the acetaminophen and ibuprofen induced significant cell growth and significantly increased cellular matrix.

SBI108: The Presence of Cell Cycle Proteins and Transcripts in Platelets

Previous studies in the Steinman lab have identified cell cycle regulatory proteins in platelets. Since platelets are anuclear and do not go through the cell cycle, we asked the question of what role these proteins play in platelets. I used Western blotting, RT-PCR, and immunofluorescent staining to characterize expression of cyclin-dependent kinases (CDKs) and their binding partners: CDK inhibitors, and Cyclins. The presence of CDK2, 4, and 6, Cyclin D1, D3, A1, and E, P21, and P27 in platelets were tested through RT-PCR of platelet cDNA. The presence of these proteins in platelets was additionally tested through immunofluorescent staining. Double staining was used to support whether CDKs and binding partners were co-localized. Binding partners with CDKs were also measured by Western blotting immunodepleted extracts. PCR of platelet cDNA has shown transcripts for CDK2, CDK 4, Cyclin D1, Cyclin D3, and P21. Immunofluorescent staining of platelets has shown the presence of CDK2, CDK4, Cyclin A1, Cyclin D1, Cyclin E, P21, and P27, and support of co-localization of CDK2 and Cyclin E, CDK4 and Cyclin A1, and CDK4 and Cyclin D1. The western blot of the immunodepleted extracts of platelets was inconclusive. Platelets have CDK2, CDK4, Cyclin A1, Cyclin D1, Cyclin E, P21, and P27 proteins in them, but only mRNA for CDK2, CDK 4, Cyclin D1, Cyclin D3, and P21. This study's findings could introduce further research studying the cell cycle proteins' and transcripts' functions in platelets, as well as finding kinase targets and the effects of inhibition of these entities.

SBI109: Simulating Pockets on TIGIT

Please visit student's exhibit.

SBI110: C. elegans as a Model for Alzheimer's

The purpose of this research is to lay the foundation of a new model organism, by the name of C.elegans, which can be used to solve the mysteries of Alzheimer's disease. Alzheimer's disease is the sixth leading cause of death in the United States, and there is currently no cure. The brain of a person who has this hideous disease contains plaques, which are formed from abnormal clusters of protein fragments, also known as amyloid – beta. The accumulation of this protein has taken center stage as the cause of Alzheimer's, in recent years. Lately, researchers have actually found a link between the accumulation of the protein in the brain and blood glucose levels, by using mice as a model organism. It appears as though people with type 2 diabetes may also have to worry about developing Alzheimer's, as more and more amyloid – beta builds up in their brains. However, C.elegans may be able to help in the understanding of amyloid – beta plaques and Alzheimer's in general. Transgenic strains of these worms express the full length human amyloid – beta sequence, making them perfect for research. My hypothesis states, that if C.elegans that express Aβ1-42, are grown in media containing large concentrations of glucose, than there will be an increase in Aβ toxicity in the animals, because of a high exposure of glucose. If experiments that were done in mice can be done in C.elegans, than researchers might be able get closer to solving the most inhumane disease of human intellect.

SBI111: Fruit Fly UV Irradiation

Because Drosophila Melanogaster, more commonly known as the fruit fly, shares 75% of the genes that cause disease with humans, are inexpensive and reasonably easy to maintain, and mature quickly, they serve as an excellent biological model. As golden, tan skin has become part of our society's beauty standards, so has the popularity of tanning beds and hours of unprotected sun exposure. Despite studies showing the health risks of such habits, including various skin cancers, millions of people around the world continue to subject themselves to the dangers of UV radiation whether intentionally or not. As the lifespan of humans are incredibly long, it is difficult to completely fathom the long term effects irradiation may have on our DNA. With sufficient UV light exposure, light can cause 2 pyrimidine bases to bind to each other instead of binding to their partner on the opposite strand (thymine and adenine typically bind together as do cytosine and guanine). This chemical glitch is called pyrimidine dimer, and it produces a bulge in the DNA. Cells are unable to read or make proteins to copy itself because of the bulges, so they undergo a process of excision repair to fix the bulge by cutting out the base of pyrimidine dimer and substituting in a replacement base. The problem with this is that the replacement base is chosen randomly and therefore has a 1 in 4 chance of being correct. This introduces mutations in the DNA. What these changes may be is what I aim to discover through an experiment that will expose fruit flies to UV radiation.

SBI112: Determine Genes That Regulate PCD in D.melanogaster

Analysis of possible genes that play a role in apoptosis in Drosophila melanogaster using DNA extraction, PCR and electrophoresis.

SBI113: Bacteria Be-Gone

Given five anti-bacterial creams, it is possible to test the most effective one based on the zone of inhibition created in a petri dish test.

SBI114: Bioluminescence of Dinoflagellates as a Bioassay

Bioluminescence is the production of light via a chemical reaction within a living organism. Bioluminescent dinoflagellates are marine plankton that produce bluish-green light upon mechanical stress. This experiment was intended to determine whether the bioluminescence of P. lunula, a bioluminescent marine dinoflagellate of the genus Pyrocystis, would be significantly affected by the presence of a fertilizer pollutant and whether the bioluminescence of P. lunula would prove to be a successful bioassay for a fertilizer pollutant. RAW soluble Nitrogen, Phosphorus, and Potassium fertilizers were used in this experiment due to their having a composition mainly of one element. The experimenter donned proper PPE, and experimentation began after materials were gathered and the work area was sterilized. The P. lunula stock culture was allowed to sit for one week under a 12-hour light and 12-hour dark cycle to regulate the circadian rhythms. A serial dilution series was conducted through 10^{-7} with a ratio of 10 milliliters of fertilizer solution to 90 milliliters of water. Sixteen conical mixing tubes were filled with 35 milliliters of the respective variable solution. Next, a refractometer was utilized to adjust the salinity of the solutions to a range of within 3 parts per thousand of the level of the control group. The culture of P. lunula was inverted for 15 seconds to ensure homogeneity, and 5 milliliters were pipetted into each conical tube with each sample being taken from the center of the culture flask and with inversion occurring after each sample to maintain a homogeneous culture. After all of the conical tubes were inverted, 16 QwikLite® testing cylinders were set up and 2 milliliters of the corresponding solution was pipetted into a cuvette, and the process was repeated five additional times to fill all cuvettes in each testing cylinder. After the testing cylinders were allowed to sit under the same conditions as the stock culture for one complete 12-light and 12-dark cycle, the QwikLite® 100 Meter was used to measure the bioluminescence of the samples in relative light units as it provides a nonbiased measurement and a controlled stimulus. After analyzing the data and conducting a Welch's t-Test, it was concluded that overall the bioluminescence of P. lunula was significantly decreased in the presence of a fertilizer pollutant. Furthermore, the bioluminescence of P. lunula proved to be a relatively successful bioassay for the presence of a fertilizer pollutant in water as shown by the multiple significant decreases in bioluminescence recorded. The results of this experiment could support further investigation into the use of dinoflagellate bioluminescence as an assay for various other toxicity measurements of water.

SBI115: pH Levels and Roundup

The purpose of this experiment was to discover the effect of pH levels and roundup on Artemia salina. During this experiment, eight different solutions were made, put into cups, and Artemia salina were added to them. The solutions were made with sulfuric acid to make the pH levels either 8.0, 7.0, 6.0, or 5.0, and roundup was added to add another stress factor. The tests were recorded over a period of 48 hours, and results were recorded for how many of the five Artemia salina were living or moving in each cup.

SBI116: The Deterioration of a Tooth in Everday Liquids

The purpose of this experiment is to find out what everyday liquids (coffee, vinegar, water, coke, etc.) we drink or put on food does to our teeth. My hypothesis is if a tooth is put in a more acidic liquid, then it will decay more than if it would in a basic liquid. To test this I will put one human tooth in a cup of coffee, vinegar, water, coke, milk, Pepsi, and vegetable oil each. Then I will take a picture of each tooth every day and record how it has changed from the previous day. I will do this for 31 days. All teeth have been autoclaved to make sure they were sanitized for the experiment. Results will be available at fair.

SBI117: Degron on VZV Replication Proteins

The purpose of this research was to determine if the application of a Dihydrofolate Reductase (DHFR) Degron tag to the essential DNA replication proteins of The Varicella Zoster Virus (VZV) would allow for the conditional growth of VZV to block DNA replication for a better understanding of viral infection. This experiment utilizes "recombineering" techniques (BAC Recombination) to develop mutated viruses containing DHFR degron tags on the essential VZV DNA replication proteins (ORFS 6, 16, 28, 48, 51, and 55). After those viruses are made they are conditionally grown in media containing a degron inhibitor called trimethoprim (TMP), which blocks protein degradation. Assuming those viruses were to grow in the presence of TMP, they will then be grown without TMP to assess function of the DHFR degron tag and see whether or not the proteins are degraded. The results of this experiment are that further development of mutated virus is necessary.

SBI118: The Effect of Deicers on Daphnia Magna

The purpose of my experiment to test which deicer is best for daphnia survival. This is important because runoff from road salt pollutes streams. I will dilute different deicers at 0.20g, 0.25g and 0.30g in 1 liter of water to simulate runoff. I will then put the daphnia in the solution. I will observe the survival rates from each deicer. My hypothesis is, If daphnia are placed into water with different diluted ice melters then the daphnia in the water with the Alfalfa Meal will survive. Final results will be available at the exhibit on fair day.

SBI119: Effects of BMP-2 and Estradiol on 3T3 Stem Cells

The purpose of the experiment was to determine the effects of the bone morphogenetic protein and the estradiol hormone on the proliferation and differentiation of 3T3 fibroblastic stem cells, and to determine if synergy exists between the two variables. The 3T3 cells, which is a mouse-derived stem cell line used to study human fibroblasts, were cultured then passed and incubated multiple times before experimentation began. The cels were transferred from T75 flasks to 18 separate T25 flasks so that 9 interacting concentrations of BMP-2 and E2 could be added twice (one flask for day 1, one flask for day 2 for each concentration). Following the respective incubation time, the cells were photographed for qualitative results and then were quantified using hemocytometers. The data has been quantified, but statistical analyses have yet to be performed to further data interpretation. No conclusions have been made as of January 6, 2017.

SBI120: NaF Mutagenic Effects on Yeast

Sodium Fluoride is an inorganic chemical compound with the formula NaF. A colorless solid, it is a source of the fluoride ion in diverse applications. Sodium fluoride is less expensive and less hygroscopic than the related salt potassium fluoride, and it is included in many public municipal water systems. Fluoride salts are often added to municipal drinking water (as well as certain food products in some countries) for the purposes of maintaining dental health. Thus, many people on a daily basis consume this compound. Sodium fluoride is classed as toxic by both inhalation (of dusts or aerosols) and ingestion. In high enough doses, it has been shown to affect the heart and circulatory system. There have been numerous studies to determine the possible mutagenic effects of sodium fluoride on our bodies. Unfortunately, clear conclusions are yet to be reached. Yeast will be used as the model in this study. The purpose of this experiment is to determine the effects of sodium fluoride on yeast mutagenesis, and to make applicable, real-world connections. The investigation is not yet completed, so data has not been acquired. In-depth data analysis to be performed in the future include graphs to display the results, ANOVAs to determine levels of significance, and Dunnett's Tests to determine where such significance lies in the data set. Real-world, applicable conclusions will be drawn from this data analysis.

SBI121: Characterizing Candidate Epigenetically Modified CpG sites in the AQP1 Promoter Region

Chemotherapy and radiation are two main treatments with side effects of Xerostomia (dry mouth). A more effective method to treat dry mouth as opposed to convetional methods is to demethylate the promoter region of the AQP1 gene. By demethyllating the promoter region in AQP1, the gene would be expressed, allowing for an increased production of Aquaporin 1. By increasing the number of aquaporin proteins in salivary glands, it is possible induce increased secretion of saliva, thereby ameliorating symptoms of dry mouth. Hypothesis: The AQP1 gene will be less successfully demethyllated with the 5-aza than a combination of 5-aza/TSA, because the combination of the methylation agents will be more effective than one agent. In the experiment, the nucleotide sequence of part of the promoter region was sequenced by the lab using the Sanger sequencing method. The three nucleotide sequences determined consisted of "Mock", "5-aza", and "5-aza/TSA". The "Mock" sequence was the unaltered nucleotide sequence. The "5-aza" sequence was demethyllated with only the 5-aza and the "5-aza/TSA" sequence was demethyllated with both the demethylation agents. Of the 40 base pairs obtained, three demethylation sites were characterized by CpG sites. By using the genomic browser Ensmbl, the other possible CpG sites in the entire promoter region were determined. The 5-aza was more effective in demethyllating the nucleotide sequence than the combination of methylation agents. The experiment was successful in the demethylation of the AQP1 gene. However, the hypothesis was not supported as the 5-aza alone was more successful in the demethylation of the AQP1 gene.

SBI122: The Effect of Colored Light on Yeast

Yeast plays a vital role in baking. When making bread, the yeast will not work if it has not been stored properly. I invested how to store yeast and how different colors of light can affect the speed of carbon dioxide formation.

SBI123: Comparison of Symbiotic Root Fungi in Plant Invasions

Please visit student's exhibit.

SBI124: Denaturing Proteins

What happens when a protein denatures? Why might proteins denature at different temperatures? I tested two different types of proteins to find out their point of denaturing. Experimentation revealed many technical factors that had to be finessed, and overall, the research concept was proven.

SBI125: VZV's Effect on Host Proteins

Proteomic studies of the Herpes Simplex Virus 1 (HSV-1) have yielded results which support that a kinase encoded in the virus known as US3 targets the mTORC1 signaling pathway which controls autophagy, proliferation, and translation initiation. Another herpesvirus, known as the Varicella Zoster Virus (VZV) encodes a kinase called ORF66 which is a homolog of US3. This drew interest to understanding ORF66's influence on this pathway. In order to identify ORF66's effect, the phosphorylation of several proteins upstream and downstream of mTOR were examined in infected cultures via Western Blot. These proteins were, namely, Akt (the kinase US3 mimics and activates mTOR), TSC2 (GTPase activating protein; prevents mTOR activation; Akt deactivated), and 4EBP1 (binds to eIF4E to prevent translation; mTOR deactivated). These assays suggested that VZV activates Akt pathway independent of its own protein kinases.

SBI126: Sweet Alyssum-Hyperaccumulation

To discover if Lobularia maritima, of the Brassicaceae family, has potential as a nickel hyperaccumulator, a plant that can accumulate high levels of nickel without dying of toxicity, it was grown from seed in two groups of soil. One group with nickel powder mixed in and one without. The nickel was extracted by magnet and compared with original amount. Due to most plants in the control and experimental groups dying, results were inconclusive. However, because high levels of nickel were left in the soil, I am led to believe that the experimental subject is a non-hyperaccumulator.

SBI127: Homemade Drosophila Traps

Drosophila, commonly known as fruit flies, are an issue in many households because they can spread bacteria and viruses. This experiment proves which homemade trap is the most effective in eliminating them. To do this, I made a trap with a funnel, a mason jar, apple cider vinegar, and dish soap. This was placed in a tank of fruit flies and the number of fruit flies was counted in the trap and tank and a percentage was determined. I then repeated the procedure with rotten banana instead of apple cider vinegar. My testing is still in progress.

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SBI128: Effects of Axe Body Spray on Staph and Yeast Survivorship

Introduction: Axe body spray is a widely used product popular especially among adolescents with unknown effects on microbial life. This experiment will be testing the effects of axe body spray on two different forms of microbial life: Saccharomyces cerevisiae (Yeast) and Staphylococcus epidermidis (Staph). In this experiment, yeast is being tested as representative of eukaryotic skin flora of humans. Staph is usually a component of the normal skin flora of humans. Null hypothesis: Axe body spray will not have a significant effect on yeast and staph. Alternate hypothesis: Axe body spray will have a significant effect on yeast and staph. Procedure: 1. Saccharomyces cerevisiae and were grown overnight in sterile YEPD media. 2. A sample of the overnight culture was added to fresh media in a sterile sidearm flask. 3. The culture was placed in an incubator (30C) until a density of 50 Klett spectrophotometer units was reached. This represents a cell density of approximately 107 cells/mL. 4. The cell culture was diluted in sterile dilution fluid to a concentration of approximately 105 cells/mL. 5. Test tubes were made with concentrations of 0%, 0.1%, 1%, and 10% Axe. (5 replicates for each of the four concentrations – 20 plates). 6. The tubes were incubated at room temperature for 15 minutes. 7. Tubes were vortexed and 0.1 mL aliquots were plated onto YEPD agar. 8. Plates were incubated at 30 degrees Celsius for two days and colonies were counted. Each colony was assumed to have arisen from a single cell. 9. Steps 1-8 were repeated for Staphylococcus epidermidis. Procedure: Agar Infusion. 1. Saccharomyces cerevisiae and Staphylococcus epidermidis were grown overnight in sterile YEPD media. 2. A sample of the overnight culture was added to fresh media in a sterile sidearm flask. 3. The culture was placed in an incubator (30C) until a density of 50 Klett spectrophotometer units was reached. This represents a cell density of approximately 107 cells/mL. 4. The cell culture was diluted in sterile dilution fluid to a concentration of approximately 105 cells/mL. 5. Ten agar plates were treated with a "low concentration" of Axe (20 microliter of Axe, 180 microliters of water). 6. Ten agar plates were treated with a "high concentration" of Axe (200 microliters of Axe). 7. Plates were incubated for 15 minutes. 8. Five "high concentrations" and five "low concentrations" were treated with 100 microliters from the yeast control tube. 9. Five "high concentrations" and five "low concentrations" were treated with 100 microliters from the staph control tube. 10. Plates were incubated at 30 degrees Celsius for two days and colonies were counted. Each colony was assumed to have arisen from a single cell.

SBI129: The role of genes in endoreduplication

CDT1 is a gene that promotes DNA replication in plants and it helps to maintain stability in cells. It is thought to be expanded soybeans and that's is what I am exploring. I am exploring whether the CDT1 gene is expanded through a whole genome duplication and if all genes are expressed and functional. I will be using a BLAST search to identify the gene families in soybeans.

SBI130: The Effects of Household Chemicals on Plants and Their Viability

This project will introduce plant embryos to household chemicals, record their viability, and compare the results to determine how much each individual chemical affects the plants.

SBI131: Slime Mold and the Steiner Tree

This project attempts to test the hypothesis that the slime mold Physarum polycephalum can grow to form the Steiner tree of a network of food sources. An agar plate will be used in conjunction with oat flakes (a preferred food) to test a predetermined Steiner tree. The final length of the growth network will be hand measured and compared the length of the true tree to determine the percent error. If the percent error is roughly low (potentially under 25%), the hypothesis will be supported. At this point, research is ongoing.

SBI132: Repellant Effect on Plant Growth

Full Length Effects of Animal Repellent on Plant Growth. Animal repellents are used both commercially and locally to repel unwanted pests. However, when used in excess, they could have adverse effects on local wildlife. This experiment is directed towards determining the potential effects of Bonide brand Repells-All animal repellent on the growth of corn, watermelon, and bean plant growth. This study may have an impact on the public awareness of the potential dangers of excess animal repellent use.

SBI133: Plant Pathogens and Proteins - What is the Problem?

Rhizoctonia solani is a plant pathogenic fungus living in crops, causing plant diseases. Many Rhizoctonia solani are infected with viruses. A procedure will take place to find out if and how viruses alter the protein expression of this fungus, in order to understand its capability of surviving when infected. Two cultures, one with a virus and one without, will be grown until they emerge. The sample of the emerged will be taken and it is expected that the virus will have altered protein expression and the protein profile will show which band is responsible for the survival of the fungus.

SBI134: Effects of Sodium Fluoride on Memory of Planaria

The purpose of this experiment is to evaluate the effects of sodium fluoride on memory of planaria. Brown planaria will be conditioned using the classical techniques of bright light followed by mild electric shock. After immersion in different concentrations of sodium fluoride solutions, conditioning will be repeated to see if memory deteriorates. This experiment will highlight the potential public health effects due to concentrations of fluoride in the water supply due to human activity.

SBI135: Effects of Palm Oil on yeast cell mutagenesis

Palm oil is found in absolutely everything from food and household products, to make-up and other cosmetics. Today palm oil is also being widely considered as being an alternative to the natural fossil fuels that are rapidly running out, primarily being used as a form of biofuel in the transport industry. As of right now, it is not a known carcinogen and is just on the potential list and this experiment could help to fix this issue. The purpose of this project is to determine the effects of Palm Oil on the mutagenesis rate of yeast cells. Procedure 1. Strain of yeast (-) Lys phenotype grown for 2 days in YEPD media. 2. Sterile yeast pellet washed with SDF to remove any residual nutrients (lysine) 3. Stock re-suspended and stored in com. (-) Lys media for 2 days 4. A 100% stock and a 10% sub-stock of the Glycidol were made by diluting the variable with sterile water. 5. The pellet in SDF was re –suspended. 6. Test tube concentrations were made of .1, 1, and 10% 7. Cells were allowed to sit for 25 mins. 8. 0.1 mL of each tube plated onto 6 complete (-) Lys plates (necessary to show cells that have reverted via mutation to wild-type (+) Lys) 9. Remaining 0.4 mL of each tube was split into two 0.2 mL aliquots and plated onto 2 complete (-) Lys plates 10. Plates were incubated for 5 days at 32 °C 11. Colonies counted and recorded. Each colony assumed to have arisen from a single cell. Data Analysis I will be analyzing the data through an ANOVA statistical analysis test and through the P value I will be able to tell whether the variable should have a significant effect. Dunnette's tests will need to be preformed after in order to see which groups displayed the significant variation when compared to the control. Expected Results I would expect that there would be some colony growth but I am not sure whether it will be significant or not because even the experts are unsure if Palm oil is a carcinogen.

SBI136: Natural vs. Synthetic

I want to know which type of mouthwash, natural or synthetic, will kill more oral bacteria; to reduce the likelihood of developing cavities and mouth diseases. If I swab my mouth, and test three natural and three synthetic mouthwashes, I think that the natural mouthwash will be more antiseptic to bacteria. Natural mouthwashes are sometimes said to be better because there are no chemicals or colored dyes in it, which can alter how effective it is. Results will be available at the competition.

SBI137: Using CRISPR-Cas to Edit RNA in Living Cells: A Novel Approach to Targeting Cancer

CRISPR-Cas, a naturally occurring protein complex in bacteria, can be used to edit DNA in cells and RNA in vitro. This year, I used CRISPR-Cas to target mRNA that codes for MCL-1, an anti-apoptotic protein vital for cancer cell survival. I constructed a plasmid that codes for Cas9 and the desired guide RNA, transfected SK-BR3 tumor cells, and found that cells which received this treatment decreased in number compared to controls. My work shows that CRISPR-Cas can be used to disable mRNA within a cell and demonstrates an advantageous, novel strategy to treat cancer.

SBI138: Revolutionizing the American Lawn: Polycultural Methods

A lawn is a common sight in most American neighborhoods. However, limiting lawn biodiversity to one species, grass, can be detrimental to the environment and inefficient . To research alternatives to a single-species lawn, grass was paired with several plant species and monitored during initial stages of growth. The pairs were planted in cups and grown under constant conditions. Growth was measured by germination rate, size, and changes in biomass. Grass paired with other plants yielded better results compared to the grass by itself. The research demonstrates that lawns can be more efficiently established by incorporating many species of plants.

SBI139: Site-directed Mutagenesis of the Yeast SRS2 C-Terminal Domain to Mimic Phosphorylation

The cellular roles of many proteins change because of structural differences caused by amino acid phosphorylation. The C-terminal domain (CTD) of yeast Srs2 helicase interacts with Rad51 to disrupt initiation of homologous recombination, except in cases of DNA double-strand break (DSB) damage. When DSB damage is found, the cell-regulator, CDK-1 kinase, phosphorylates the Srs2 CTD allowing recombination to occur. To find out if phosphorylation causes structural changes in the Srs2 CTD, we mutate serines and threonines that get phosphorylated to glutamic or aspartic acid because they both are negatively charged like phosphate groups.

SBI140: Finding Different Mutations in PIK3CA Using the TDI Algorithm

PIK3CA is a commonly mutated oncogene whose normal pathway affects important cellular functions. However, the functional impact of these mutations at the gene expression level are unknown. The target genes of PIK3CA mutation were studied computationally and verified using an independent study on PIK3CA. Somatic mutation of PIK3CA affects the expression of 248 genes that are unaffected by amplification. These 248 genes indicate a gain of function of PIK3CA somatic mutation. Significant differences between the targets of common mutations H1047R and E542K were also found, indicating a functional difference in mutations in the helical and kinase domains.

SBI141: Fungal Endophytes and Algae

The Purpose of this experiment was to test the effect that fungal endophytes had on Arthrospira platensis. Fungal endophytes are the bacterium that originally enabled plants to colonize land. Based on this evolution, the conclusion that fungal endophytes reduce drought rates can be drawn. Much research is being done on fungal endophytes because of their potential to revolutionize the agricultural field. My goal in this experiment was to grow the most amount of algae with the least amount of water. By harvesting the endophytes that were found on the roots of milkweed, this goal was answered with data.

SBI142: Crumb-Turfs Effect on Microbial Survival and Reproduction

The goal was to assess the effect of crumb-turf on microbial survivorship. The microbes E. coli and staph were exposed to the crumb-turf in liquid suspension. It is expected that the turf will have a negative impact on the microbial survivorship.

SBI143: Caffeine and the Regeneration Rates of Planaria

The purpose of my experiment is to find if caffeine affects the regeneration rate of planaria and if it affects healing rates of the body. My hypothesis is if planaria are exposed to different levels of caffeine than the ones exposed to no caffeine will regenerate most efficiently. My procedure is sort the planaria into petri dishes with designated amounts of caffeine, then cut each in half horizontally, and monitor, record the length, and activity levels for two weeks. After two weeks, I'll average the lengths of the planaria in like amounts of caffeine. Results will be available upon competition.

SBI144: Sprouting Science

The purpose of this experiment is to evaluate the influence of various mineral and chemical of common beverages on the germination and growth of pea plants. This will be tested by soaking a cotton ball in each liquid, and placing one pea seed in each cotton ball and placing that in bags. The researcher will repeat previous steps until ten plants are made per liquid. The plants are placed in a warm area and observed for twenty-one days. The researcher will measure the germination rate and the average growth rate. Results will be available upon competition.

SBI145: Yogurtalicious

The purpose of my experiment was to graphically and mathematically model the relationship between the amount of time yogurt is cooked for and the amount of lactobacillus cultures in the yogurt to figure out the optimal cooking time in order to help my brother with his crohn's disease. I was able to do this by making the yogurt, then using a serial dilution and plating it on MRS agar plates, and lastly counting the cultures and graphing my results. I found that the optimal cooking time was thirty hours because that is the time point that produces the most lactobacillus cultures.

SBI146: Fresh vs. Frozen: A Study of Insect Growth and Nutrition

Scientists, nutritionists, and animal owners all ponder the question of fresh versus frozen food. This experiment's purpose was finding which food choice benefits stick insects' growth and nutrition. Four habitats were used, 2 nymph enclosures and 2 juvenile/adult enclosures, one of each type was offered frozen leaves while the others were offered fresh leaves. The stick insects in each enclosure were measured and weighed twice weekly, to determine their growth rates. Their food was changed twice weekly and traced on a grid to determine percentage consumed. Preliminary data is inconclusive. Further analysis will be posted at the fair.

SBI147: Well Water Contamination - Fracking

Many claim that fracking water results in cancer and other health problems, so I decided to test if this was true. To do this, I will be observing the effects of fracking water on 3T3 cells, fibroblastic cells from Swiss mice. I will be using three different concentrations: 01%, .001%, and .0001%. I found the low concentration had little to no effect on the cells. However, the high and medium concentrations had a detrimental effect on the cells. Because of this, I believe the fracking, indeed, has an effect on health, just not in very small concentrations I think my research will help determine if fracking water was detrimental health effects.

SBI148: Protein Influence on Microbes

Protein powder is extremely popular as a supplement to working out in the hope of building up muscle cells. With many athletes using protein powder it is important to see if it does what it says it does, and create more cells. The test subjects planned to be used for this experiment are Ecoli and Staph. The bacteria will be subject to different concentrations of protein powder and the resulting colonies will be analyzed.

SBI149: The Effects of Microwave Rays on Bean Plants

This project will microwave beans for a given amount of time, attempt to grow the microwaved beans, and evaluate the effects on their growth.

SBI150: Solution to Invasive Mussels

An Exact Solution to Prevent the Spread of Dreissena polymorpha. Dreissena polymorpha, also known as zebra mussels, are a highly invasive species that have overwhelmed lakes all over the North East. Last year I conducted a similar project which was completed to find a method for terminating the mussels, and then another experiment that tested the successful chemical on marine life. My hypothesis states that the most effective concentration of benzalkonium chloride will be in the range of 30%-50%. Completing this experiment will bring a new ideas and innovations to bringing a stop to the pesky mussels.

SBI151: Melatonin and L. sativa

I plan to expose L. sativa seeds to a melatonin solution before they are planted then apply a salt stressor, and observe melatonin's impact on the seed's tolerance of increased salinity levels. The hypothesis is that a salt stressor will not hinder the growth of the seeds that have been exposed to the melatonin solution. A 50 µM melatonin solution will be created by combining melatonin and ethanol. A 50 µM salt solution will also be created by dissolving salt in water. Seeds will be soaked for 24 hours before being planted. After three weeks, the biomass will be determined.

SBI152: HandSoap Effect on Phage Infectivity

The goal is to test the effects on viral infectivity. Soap will be mixed with T2 Phages and then exposed to a host E. coli B cell. The resulting plaques will allow for an interpertation of infectivity rates. It is excpected that the soap will have a negative effect on infectivity

SBI153: Melons and Melanogaster

My project goal is to find out if their is any correlation between health and organic foods. I am testing fruit flies who share a large portion of DNA with humans and have a short life span. I will subject the fruit flies to a jar of organic or non-organic food for 2 days and record the death toll. This will allow me to see if organic food is better for you than non-organic food as claimed. I am also recording gender ratio to see if their is any correlation between gender genetics and genetics of food digestion.

SBI154: The Effect of The Presence of Martian Soil on Spinacia oleracia Growth

After doing background research into my topic, I hypothesized that the potting soil would have better all around health than the 50% mixture of potting and martian soil which itself would be better than 100% martian soil. To research this 3 sets of grow lights were borrowed and 3 sets of 20 soil mixtures were created. As mentioned before, the soil mixtures were 100% potting soil, 50% potting soil 50% martian soil, and 100% martian soil. 3 seeds were planted in each pot 2 cm down from the topsoil. Every 4 days the plants were watered and cycled among the lights. The results so far indicate a higher germination and growth rate in 100% martian soil, however the biomass and macro nutrients have not tested yet.

SBI155: The Effects of Different Types of Honey on Bacterial Proliferation

Purpose:What honey type is most effective-inhibiting-proliferation? Hypothesis:In order from best to worst inhibition: BlackLocust, Goldenrod, Buckwheat, Wildflower, NoHoney(Control). Procedure: 1.Prepare nutrient broth. 2.Inoculate broth with 1 loop S.epidermidis. 3.Incubate broth for 72 hours at 37oC. 4.Prepare 50% water, 50% honey-solution. 5.Create solution of 25 mL honey-water-solution, 24 mL nutrient broth, & 1 mL prepared S.epidermidis/broth-solution. 6.Repeat steps 5-6 for remaining honeys. 7.Repeat steps 3-6 with 1 loop E.coli. 8.Using Spec20 determine & record amt. transmittance through solutions. 9.Incubate honey/broth-solutions. 10.Determine & record amt.light-transmittance through honey-broth-solutions every 24 hours. 11.Prepare 10-8 serial-dilution of-solutions. 12.Place 1 mL one serial-dilution on petri-dish. 13.Repeat step 13 using 3 more dishes. 14.Repeat step s13 & 14 for remaining serial-dilutions. 15.Incubate remaining dishes. 16.Determine & record # of colonies on dishes. 17.Inoculate 20 dishes with 0.75 mL broth/S.epidermidis-solution. 18.Repeat step 18 with broth/E.coli-solution. 19.Saturate 1 sensitivity-disk in honey-water-solution, placing disk in center of 1 dish. 20.Repeat step 20 for remaining dishes & incubate-72 hours. 21.Determine & record Z one of Inhibition for every dish.

SBI156: Investing Drivers in Invasive Lobular Carcinoma

Invasive Lobular Carcinoma is the second most common subtype of breast cancer, characterized by single-file cell growth in dense layers of extracellular matrix. In my project, I focused on two potential candidate drivers of invasive lobular carcinoma: SAE1 and CTTN. SAE1 is involved in the SUMOylation of proteins, and CTTN regulates the re-arrangement of the actin cytoskeleton. To study SAE1, I inhibited the gene using RNA interference in different cell lines. To study CTTN, I knocked down the gene using RNA interference, followed by a haptotaxis assay. These results will help scientists to develop more effective forms of treatment.

SBI157: Are Fingerprint Patterns Inherited Based on Gender?

The purpose of the investigation this year is to determine if children of one gender's fingerprint patterns are more like their parent of the same gender compared to the parent of the opposite gender. The hypothesis if children and their parents fingerprint patterns are analyzed, the male children will be more like their father and the female children will be more like their mother. The data will be determined by the number of fingerprint patterns one gender in common with the parent of the same gender as opposed to the other parent.

SBI158: The Oligodynamic Effect: Which Heavy Metals Kill Bacteria?

In my experiment I tested different heavy metal ions (Copper, Aluminum, and Silver) on E. Coli bacteria to see if they kill a significant concentration of bacteria. I am using a liquid culture of E. Coli MG1655 with Copper/Aluminum Wire and silver lined test tube. Using a Nano spectrometer machine I tested the absorbance of the bacteria before and after experimentation to see if there was a statistically significant difference. I had predicted that the copper would kill the most bacteria and through experimentation that would be proved.

SBI159: Propylene Glycol Effect on Staphylococcus Epidermidis

The purpose of the project was to find the effect of propylene glycol on staphylococcus epidermidis. The projected result was that the propylene glycol would have a positive effect on the staph. The items mainly used in this experiment were micro pipets, sterile tips, sterile water, staphylococcus epidermidis, and propylene glycol. The plates were counted by quartering the plate and multiplying the count of the quarter by 4.

SBI160: The Edge Effect

The purpose of the experiment is to observe goldenrod plants and compare the level of Arbuscular Mycorrhizal Fungi (AMF) in the roots on an outside of a clump versus the inside. This will be observed by collecting and analyzing roots under a microscope. The amount of AMF colonization on the edge of the clump is expected to be higher than the amount on the interior due to the invasive and competitive nature of goldenrod with plants outside of its clump. Studying and isolating AMF could affect farming and other areas of agriculture due to its positive effect on plants.

SBI161: The Effect of EMF on Aedes aegypti

The Aedes aegypti mosquito is a vector for many dieseases, including malaria and Zina; and factors that affect the growth of these insects are of critical importance to public health. Widespread cellular electromagnetic emissions (EMF) have known effects on other insects, but have not been studied on mosquitoes. This experiment compares the growth and developement of mosquitoes exposed to EMF. Aedes a. eggs were grown in nutrient medium exposed to EMF from a consumer WiFi router and compared to controls not exposed to EMF. Hatch rate, time of growth to pupae, adult emergence, and death were compared.

SBI163: Deer in Headlights

The researcher will be testing how effective different scents are as deer repellant for use around gardens and ornamental shrubs. The researcher believes that if various deer feeders with different scents are placed near each other, then deer will not eat from the feeder with Dial soap because of its scent. This will be tested by spraying five feeders with four scents: orange juice, raw eggs, garlic, and soap and monitoring food consumed and observing a trail camera facing the feeders. The results will be available on competition day.

SBI164: *The Effect of Permanent Maker on Yeast Growth*

Little research exists on the effects of Sharpie ink on skin. Though Sharpies are not recommended for use on skin, many people do write or draw on themselves with it recreationally or for sports. I am testing the effects of sharpie ink on Saccharomyces Cerevisiae cells, yeast similar to skin cells, to investigate possible effects: I am measuring the optical density of S. Cerevisiae grown in YPD media with different concentrations of Sharpie by using colorimeters and comparing that growth with the cell growth of the same type of yeast grown without sharpie in order to find the LD 50.

SBI165: *Coral Stripping on Lobophytum sp*

David Koweek and his team of scientist found that bubbling air through seawater has the possibility to enhance the transfer rate of carbon dioxide between the ocean and air up to 30 times faster natural strengthening reefs throughout the ocean. 10 Lobophytum sp corals will be tested for two weeks without strippin. After two weeks the calcium rate will be calculated and the stripping will be added in. Two weeks later, the calcium rate will again be calculated. A statistical test will be conducted after the experiment is terminated and the results can be found in the final project presentation.

SBI166: *Fruit Juice on Staph. Biofilms*

This project studies the inhibition of biofilms by cranberry and cherry juices, and will compare that inhibition to the juices respective survivorship effects. Biofilms of Staphylococcus epidermidis will be exposed to varying concentrations of the juices, and growth will be quantified through staining and spectrophotometry. A survivorship assay will be performed for both juices. The data will be analyzed using ANOVA and subsequent Dunnett's Tests. The experiment is expected to show significant antimicrobial activity for both juices, and greater anti-biofilm activity for both.

SBI167: *Yellow Perch Growth Rates in Drowned River Mouth Lakes of West Michigan*

The habitat of the Yellow Perch is in the West Lake Michigan area. The importance of the habitat is unknown. The drown river mouth lakes are where the yellow perch are most commonly found. If the yellow perch live in the southern lakes than they will grow faster, bigger, and have higher reproductive rates. Samples were taken from each of the drowned river lakes and were put into a growth rate equation. The perch were seen to have better rates of life due to their habitat in the south but they are going down due to invasive species.

SBI168: *The Grass is Always Greener*

I did this experiment to observe the differences between the growth of grass in an open-system compared to grass grown in a closed-system. I hypothesized that the grass grown in the closed-system would grow quicker and sturdier. To test this, I placed 12 open canisters of soil each into 2 adjacent terrariums. Each row was watered an amount ranging from 0-30ml. One terrarium was sealed, the other kept open and watered respectively again every 12 hours. The grass grown in the open system grew faster and taller than that in the closed (sealed) terrarium. My hypothesis was not supported.

SBI169: *Site-Directed Mutagenesis to Verify Critical Regions of Chd1*

Chromatin is the compact structure to store DNA. Chromatin remodeling proteins affect chromatin to control gene expression. Chd1 is a chromatin remodeling protein which if nonfunctional, can lead to prostate cancer and other disorders. The goal of the project is to test if a conserved residue in the Rtf1 Interacting Domain is crucial for Chd1 function. The amino acid was individually mutated through polymerase chain reaction (PCR). Round one PCR resulted in one usable segment and another being optimized. After optimizing, PCR round two, yeast transformation, and replica printing will be done to discover if the amino acid is crucial.

SBI170: Acids and Alkalis on Bacteria Growth

The researcher of this experiment will use two bacteria cultures to determine if growth will be effected if mixed with molar solutions of acids and bases. The purpose of this experiment can be used to determine what conditions your body should be in when sick. The researcher's hypothesis is if bacteria are mixed with a high molar solution of a base, it will grow faster. The researcher will conduct the experiment by putting the mixture of bacteria and acid or base in an incubator at 37 degrees Celsius for 24 hours. Results will be available on competition day.

SBI171: The Effect of Calcium on Bones

The purpose of the investigation is to determine if adding calcium supplements to bones will strengthen them after a sports injury. After the bones have become pliable from vinegar, the researcher will add different amounts of calcium tablets to water and put the bones into the water for ten days. The hypothesis is if chicken bones are weakened by vinegar, then adding calcium tablets will strengthen them again. During the experiment, the angle of the bend will be examined daily. Results will be available on fair day.

SBI172: Cleaners and D. magna

The purpose of this experiment is to determine if the cleaners, purple power and simple green, have a more lethal effect on daphnia magna when combined; rather than individually. A 48 hour toxicity test was used to determine results. During this time, daphnia magna were exposed to each product individually at a specific concentration. They were also exposed to a combined concentration, where the same concentration was used for each product and exposed to the daphnia. This is assuming, both products become combined in the environment, having the potential to have a synergistic effect on daphnia magna.

SBI173: The Effects of Cocoa on Bacteria

Walking down the candy aisle there are many types of candy. There is sugar, sour, hard, soft, mint, fruity, and last but not least there is chocolate. There are different percentages of chocolate as well, but which percent is the best for health? The purpose of this experiment is to see if dark chocolate helps the probiotics in the gut. If the higher percent of cocoa is used then it will help probiotic growth. Results will be available at the science fair.

SBI174: Which moisturizer works the best?

Companies will talk up a lotion to sell their product, but it is hard to know which brands are really worth the buy. There are different brands, ingredients, and issues the lotion claims to focus on. This experiment will focus on the different types of moisturizers that can be used and it will test which one holds its moisture level to skin better. These moisturizers claim to improve the look of wrinkles and minimize pores. They also in general are supposed to make the skin softer and more even. The gelatin petri dishes will act as a skin stimulant. The height and mass change will be recorded to determine which moisturizer hold its moisture levels the best. The final results will be available at the science fair.

SBI175: The Effect of Tea on Cell Growth

Tea has been thought to be beneficial to health, and many teas contain antioxidants, including catechins, which are a focus of anti-cancer potential studies. In this experiment, 3 types of teas from two brands in different dilutions were used to determine if they would affect the growth of fibroblast cells and cancer cells differently. The results showed that tea inhibited the growth of both the mouse cells (NIH3T3) and the human cancer cells (HeLa), though it affected and killed more NIH3T3 cells. These findings differed from my hypothesis, which stated that HeLa cells would be affected more.

SBI176: Expression and Purification of Recombinant HIV-1 Nef Protein for Drug Binding Studies

This research was conducted in order to effectively clone and express wild type HIV-1 NefConcensus to examine the structure and binding of an inhibitor molecule to the accessory protein found in HIV-1 strains, Nef; NefConcensus is a North American strain. Nef is critical for viral replication, immune evasion and progression of AIDs. Nef takes over cell signaling and trafficking pathways for the benefit of the virus. The NefConcensus has been successfully cloned producing a sufficient quantity of the gene to be transformed into competent cells and successfully yielded an over expressed protein band in an SDS-Page gel. As of February 2017, protein purification is underway and hopes are high given the results of previous experimentation thus far. The protein purification process will be through the use of Ion-Exchange Chromatography. The goal is to apply the results to research involving Drug Discovery. With this information drugs can be developed to inhibit functions of the HIV- virus that will allow it to be discoverable in the human body and quite possibly allow the immune system to attack the cell. Any future research can result in taking a pragmatic approach to patient care for those who have already developed the disease.

SBI177: The effects of hydrozoning

In this experiment, I am testing ten different plants using the system of hydrozoning. As a section of the project of Sustainable Development Organization, hydrozoning is the planting according to their watering needs instead of randomization to conserve water and avoid over or under watering. I am testing the effect of hydrozoning by the outcome of watering plants in sections with different amounts of water, difference in growth of hydrozoned and controlled sections, and the amount of water saved. A preliminary experiment was conducted and the data recorded is being used to conduct a second experiment that is now ongoing.

SBI178: The Effects of Growth factors on 3T3 Cells

Food coloring is used to make foods more attractive and as a result more appealing to customers. Originally foods were colored using natural food dyes. However, artificial food coloring is much cheaper and has a longer shelf life than natural dyes. Artificial food coloring is used in most all food products today. Several types of artificial food dyes have been approved by the FDA. These dyes consist of petroleum, the same product used to produce gasoline, kerosene and diesel oil. In this project I will examine the effect of different concentrations of different artificial food dyes approved by the FDA to observe their effect on microorganisms. The goal of the project is to determine at what quantity artificial food coloring begins to have negative effects.

SBI179: Potential Regenerative Dependence on Autophagy in Planaria

Autophagy is a self-eating survival mechanism. The purpose of this experiment was to determine whether regeneration requires autophagy. It was hypothesized that if planarians were soaked in autophagy inhibiting drugs (chloroquine), then they would be unable to regenerate, because they need energy derived from autophagy to regenerate. The procedure involved soaking planarian in diluted chloroquine to see if it would stop regeneration after injury. Our results did not correspond to our hypothesis, as the planarians continued to regenerate after treatment. Therefore, under our conditions, treatment with chloroquine does not appear to inhibit regeneration.

SBI180: The Effects of shrm on the nervous system in drosophila

Shrm is a protein which regulates apical constriction - a process necessary for the formation of neural tubes. It is known that when there an deregulation of Shrm, disease such as spina bifida occur. Despite this being a disease of the central nervous system, Shrm's role in the CNS has not been thoroughly studied. Through targeted overexpression of Shrm in drosophila CNS, larval brain dissection, staining, and adult behavioral assays, I have been able to find that an overexpression of Shrm seriously mutates brain formation at all stages of development and negatively affects the adult behavior. The different isoforms of Shrm all negatively affect the flies, but to a different extent, pointing out the specific role of each isoform. I am currently perfecting my Phalloidin staining to be able to create a mathematical representation of the changes seen in the fly brains.

SBI181: Analysis of the Effects of Phosphorylation on the Yeast SRS2 helicase C-terminal Region with Bioinformatics Tools

Using the software program PredictProtein, we predict changes in the SRS2 helicase secondary structure caused by phosphorylation at sites targeted by CDK-1 kinase. There are seven Ser and Thr sites known to be targets following DNA damage during S phase. To mimic phosphorylation, we mutate Ser to Glu, and Thr to Aspartate to replace the polar –OH side chains with a negatively charged carboxylate group. We compared wild-type results to results from a single mutation up to all seven mutations in the C-terminal domain of SRS2 helicase, which is known to regulate homologous recombination by Rad 51 recombinase.

SBI300: The Effects of Estrogen on Zebra Fish Reproduction

After reading an article about amounts of estrogen in our rivers and streams that was causing male fish to develop eggs, we wanted to test the effects of estrogen on male zebra fish. We specifically focused on how estrogen would affect the ability of the males to fertilize eggs. We chose three pairs of breeding zebra fish and after several rounds of breeding, recorded each male's fertilization rate by counting the number of fertilized and unfertilized eggs. We then placed the males into a tank with the same amount of estrogen found near an effluent from an urban wastewater facility. After being in the estrogen tank for one week, the males and females were once again placed into breeding tanks and fertilization rates were recorded. After one week, one of our males' fertilization rates decreased by half. The other two remained the same. The males were placed back into the estrogen tank for another week and rates will be collected again. We are still gathering data.

SBI301: The Effects of Water Temperature on Zebrafish Embryos

The IPCC predicts rises in Earth's temperature between 1.4°C and 5.8°C by the end of the century. Knowing that temperature can affect development of an organism, we wanted to see how climate change affects development of an aquatic species. Zebrafish embryos were placed in containers and allowed to develop in 18□C, 28□C, and 38□C. Results showed that embryos in the warmest environment developed at twice the speed, while embryos placed in the coldest environment didn't develop and within two days died. This clearly shows that while some species may suffer, other species may have a certain advantage in increasing temperatures.

SBI302: Effects of LiCl on Zebrafish Embryonic Development

Lithium is being incorporated increasingly in our daily lives in medications, desiccants, and batteries. This raises environmental and developmental concerns. The purpose of this experiment was to determine the effects of Lithium Chloride on zebra fish embryos. We conducted this experiment by placing zebra fish into varying percentages of Lithium Chloride and observing their development. Our initial results brought us to the conclusion that lithium chloride solution causes either a high mortality rate or major birth defects. Additional trials are being conducted to determine if these results remain constant and to view the various birth defects that may occur.

SBI303: Evolutionary Rate Covariation Defines New Protein Cargo for alpha-arrestins

Alpha-arrestins are a family of trafficking adaptors which bind to a ubiquitin ligase in order to regulate the endocytosis and intracellular sorting of membrane proteins, also referred to as 'cargo'. Few alpha-arrestin-cargo pairs are currently known, and to help identify these interactions Evolutionary Rate Covariation (ERC), a computational biology approach that identifies genes with similar rates of evolutionary change, was used. Multiple known alpha-arrestin-cargo pairs were identified as top candidates with ERC, suggesting that this approach can be used to define these interactions.New alpha-arrestin-cargo pairs were also suggested by the ERC dataset and we have worked to confirm these new functional relationships by assessing the localization of green fluorescent protein (GFP) tagged cargos in either wild type cells or cells lacking specific alpha-arrestins. An abnormal localization of GFP-cargo proteins in cells lacking alpha-arrestins is strong support for the idea that alpha-arrestins regulate trafficking of that cargo. Using this approach the O'Donnell lab has confirmed at least 5 new alpha-arrestin-cargo pairs and are poised to expand the alpha-arrestin-cargo repertoire. We have cloned approximately 30 new GFP-tagged cargos for use in fluorescent imaging analyses.

Chemistry (SCH)

SCH100: Mutagenesis of the serotonin transporter to investigate its structure

Serotonin transporters are integral transmembrane proteins responsible for the reuptake of serotonin from the synapse to presynaptic neuron. The issue investigated in this study is the allostery of the protein when it reuptakes serotonin back to the cell. To study this issue, a cysteine was introduced on the loops of the protein. One cysteine was introduced at a time and after expressing the protein, a MTS-benzophenone crosslinker was used to bind to form a disulfide bond to the cysteine mutation. The protein will be stabilized in different states, and the results were compared with each other to determine protein movement. This research will increase our knowledge of the structure of serotonin transporters and can potentially be used to develop better medications for people who have depression and anxiety.

SCH101: The Weed Solution?

The purpose of my experiment is to try and chemically engineer an organic weed killer. I am planning to try and use pine needle extract, and see if it will inhibit/ stop plant growth. This is to determine whether or not it is suitable to tackle weeds. I will test me pine needle extract on different garden seeds versus a control group. I will then analyze my data, and determine if my pine needle extract negatively affects the plants. The results of my experiment will be available on competition day.

SCH102: Docking Study of compounds SERT, DAT, and NET

Docking study and analysis of compounds SERT DAT and NET to find effectiveness and characteristics of their Chemical make up as well as their interaction further analysis will be conducted with a focus of how they interact with the human body and what potential they may hold in the realm of drugs and medication.

SCH103: Effects of filtration

Three filtration systems used: charcoal/gravel/sand design, charcoal/sand design, and zeolite design will filter a solution containing CuSO4(pentahydrate) and a separate, broth-based solution, containing the bacteria Bacillus Megaterium most efficiently. This information will result in a filtration method that can filter out the common aqueous pollutants that plague the people of Syria, killing thousands. The procedures for this experiment include pouring the CuSO4 and the bacterial broth solutions through the three filters. After testing, the zeolite filter removed copper sulfate particulate more efficiently than the other two filters, but the charcoal/sand filter removed more bacterial cells.

SCH104: Acid Catalysts & Ester Prod.

The purpose of my project was to determine the relationship between the type of acid catalyst and the percent yield of the synthesis of isopentyl acetate. The reaction analyzed was acetic acid and isopentyl alcohol, with catalyst of hydrochloric, sulfuric, or phosphoric acid, to produce isopentyl acetate. Only the strong acid, sulfuric acid, produced measureable yield. Hydrochloric acid didn't produce a yield since the catalyst evaporated. Phosphoric acid had no yield since it was a weak acid, therefore it could not lend the hydrogen ion catalyst to the reaction.

SCH105: SEI Effects on Dendritic Growth

While lithium-ion batteries have increased in prominence in the form of electric vehicles and portable electronics, dendritic growth has remained a major issue in the safety of these batteries, causing accidents with the HoverBoard and Samsung Galaxy S7. Formed on the anode of batteries, dendrites are the result of irregular lithium deposition that eventually morphs into microstructures, leading to short-circuiting and potential explosions. One of the major theories among researchers for dendritic growth is the presence of a solid electrolyte interphase (SEI), a selectively permeable region between the electrode and electrolyte that allows ion transport but prevents electron transport. To understand the effects of SEI on dendritic growth, the Monroe and Newman model was developed, and the SEI effects were implemented through inhomogeneous current densities and ion mobility values for various SEI components. Early results have shown that SEI, depending on its components and thickness, will cause different current densities that contribute to dendritic growth. Specifically, an SEI component with greater passivation and resistance reduces the current density onto the electrode, suppressing dendritic growth. However, a growing SEI endangers the cell to potential electrodeposition on SEI components, so dendritic growth within the SEI layer must also be studied. Detailed data and analysis will be presented at the time of the fair.

SCH106: Detecting Allergens

As someone who has allergies, it is difficult to tell if an allergen is present in a food, and finding out if the allergen is present in the food is inconvenient. For this particular project, a simple test kit was created to test for the presence of lactose, an allergen, in all types of food, with 100% accuracy. Multiple trials were completed, each to prove or disprove the presence of lactose in multiple food samples. The results of the trials for each food sample were consistent, and proved or disproved the presence of lactose with accuracy. The test kit for lactose is a simple and quick solution for people with lactose intolerance, and can be used anywhere and anytime, with ease.

SCH107: Catalysis of the Electrolysis of Water

The purpose of this experiment is to test the effects of a known catalyst and two potential catalysts for the electrolysis of water. The formation of Cobalt (II) Phosphate on the anode assists to catalyze the redox reaction and this experiment will be testing Nickel (II) Phosphate and Copper (II) Phosphate for potential catalytic effects. The results will compared to the baseline energy required to split water when uncatalyzed as well as to those of the results of $CoNO_3$. Data is still being collected.

SCH108: How White Are Your Teeth?

For my project, I tested what kinds of drinks most people consume would leave the most damage and stain on your teeth. I used eggs to represent the teeth because I was not able to get a hold of real teeth and in my research I found that the calcium in eggshells is one of the closest substances to human tooth enamel. The beverages I tested for my experiment were black and iced teas, coffee, blue Koolaid, and red wine. I filled each cup with 150 mL of the drink that was assigned to each cup. Next, I hollowed the eggs out and placed them in the cups to soak for eighteen hours. At the end of that time, I removed them, dried them off, and cleaned them with a toothbrush and toothpaste. I compared the tested eggs with what they originally looked like through pictures to obtain a result and draw conclusions. My results served to disprove my hypothesis, but not entirely. The coffee left the most of a stain on the eggs. The red wine that I tested left a minimal stain, but it ate away at the eggshell and started to dissolve it.

SCH109: Trans Metal Complexes and Abs

The purpose of the experiment was to determine if the presence of unpaired d electrons would have an effect on transition metal ions forming colorless complexes or not. Four metal ions (as +2 metal chlorides) were complexed with five different ligands. Each solution was analyzed using a visible light spectrophotometer measuring absorbance. Results show that manganese(II) complexes, which have five unpaired electrons in d orbitals, had very low absorbance if at all. Also, as the number of paired d electrons increased on other metal ions, the complexes became highly colored and demonstrated a pattern in the absorption spectrum.

SCH110: The Effect of Chemical Environment on Ion Release from Silver Nanoparticles

The surface chemistry of nano-particles strongly influences their resulting chemical and physical properties, and therefore also significantly influences the utility of these materials in a wide range of applications, such as antimicrobial applications. A first step in both understanding and using nano-particle surface chemistry is developing and implementing analytical methods to describe the chemical architectures present at the nano-particle surface. Here, we compare the ligand exchange behaviors of silver nano-particles synthesized in the presence of two different surface capping agents: poly(vinylpyrrolidone) (MW = 10 kDa or 40 kDa) or trisodium citrate, and under either ambient or low-oxygen conditions. In addition to a well-characterized particle surface and ligand shell, the dissolution behavior of silver nano-particles in various chemical environments is important for the interpretation of antimicrobial results. We find that the presence of sodium chloride and other solutes causes increased silver ion release compared to water.

SCH111: Does Gesso Affect the RGB Numbers of Red Paint

The purpose of this experiment is to show how Gesso will affect the color of a painting. To begin the experiment, 94 squares were cut and half of them were painted with acrylic gesso primer. Then all the squares were painted with red acrylic paint. Pictures were taken of each square. The pictures were digitally run through a RGB detector to see if there was any affect. The data showed that the gesso significantly affected the blueness and the amount of paint on the canvas. The redness and greenness was not affected.

SCH112: AMD-Analysis of Mine Drainage

This project focuses on my continued efforts toward monitoring the quality of abandoned mine drainage ("AMD") processed by a passive treatment facility located at the site of the old Marchand coal mine near Lowber, Pennsylvania. Last year, I monitored the alkalinity, acidity, sulfate, and iron levels of the facility's inlet. The goal of this year's investigation is to study the correlation between the AMD water qualities, specifically pH and dissolved oxygen, and the iron concentration's decrease from the inlet through the outlet. My results showed that there is in fact an inverse correlation between these two aspects.

SCH113: Atomistic Simulation of Pathways for Mg2+ - Water Dissociation With Rigorous Kinetics

Molecular dynamics simulation is often the only means of obtaining the atomic details of a chemical system. However, many biological systems of interest such as Mg2+-water dissociation are too long to be simulated with standard methods. The purpose of this study is to obtain an accurate estimate of the rate constant of dissociation for Mg2+-water dissociation through a weighted ensemble strategy. The Van der Waals radius of Mg2+ was increased in silico before it was gradually decreased, allowing for a preliminary extrapolation of the rate constant. Results show evidence of a change in dissociation mechanism as compared to larger ions.

SCH114: Charcoal and Wood Calorimetry

Energy can be very expensive, and often not very efficient. My experiment looks to find whether wood or charcoal is more efficient and why one is more efficient. I wanted to find out which one would boil away the larger amount of water per gram while it is in a calorimeter. I figured this out by putting the object being tested in a calorimeter and boiling a container of water above it. I used calorimetry because it is a straight-forward way to measure the energy of something.

SCH115: A Device for Sensing Water Leakage

The purpose of this project was to develop a water sensor that could fit in small crevices and that could detect tiny amounts of water leakage. A super absorbent polymer (sodium polyacrylate) was used for this project. An electrical circuit was built such that the change in the conformation of the sodium polyacrylate after water absorption completed the circuit. The completed circuit alerted the user either through an alarm buzzer or radio frequency signal. Different prototypes were made and tested to provide the most compact and sensitive detection of water.

SCH117: Pool Problems

Many students believe that the school's pool water decreases over time. I measured the quality of school pool water for five days with eight periods a day to test this claim. At the end of every period, I filed a test tube up with the water and tested with a pool testing strip. The results were recorded and showed that the pool stayed right around where it should be with its chemical balance with only minor peaks and dips in the graphs indicating chemical fluctuations. This disproves the claim that the school's pool water quality decreases over time.

SCH118: How does wind affect a candle flame?

How does wind affect the combustion rate of a candle? The purpose of this experiment is to show how adding wind to a candle can increase how much/how fast the candle burned. The procedures used were burn a set of three candles with no air movement, another three a certain distance far enough away from a fan that the candles don't burn out, and do the same with the last set of three just double the distance away from the fan, let all three sets burn for an hour. It was proven the candles burned more with the fan.

SCH119: Determination of Calcium in Various Supplements Using EDTA

My experiment was a complexometric titration to determine the mass of calcium in various supplements. The purpose is because calcium is an extremely important element in the development and preservation of strong bones and teeth. As much as calcium is helpful, it can also harm the body if it is not properly absorbed or is taken in high amounts. For this titration, I made a 0.050 molar Disodium Ethylenediamine Tetraacetate dihydrate (EDTA) solution as my titrate, Eriochrome Black T (EBT) as my indicator and an ammonia buffer at a pH of ten. I titrated by dissolving the 9 different calcium supplements as well as a homemade eggshell supplement in a 3 molar hydrochloric acid solution, added my indicator and buffer, then titrated with the EDTA. As a result, I discovered that the percent error between the experimental mass and the theoretical mass of calcium was extremely low. The highest percent error was only 10% which is merely 50mg off the theoretical calcium. This is helpful because it proves that these calcium supplements can be trusted.

SCH120: Effects of Cinnamic Acid on Tyrosinase Activity

Inhibitors of tyrosinase, which helps create melanin, are widely studied to reduce melanin production (melanogenesis) in undesirable circumstances such as hyperpigmentation, fruit and vegetable browning, et cetera. The inhibitory effects of trans-cinnamic acid, a natural component of cinnamon, were studied via multiple time-based spectrophotometric analysis with varying substrate and inhibitor concentrations. The IC50 was determined to be 3.29mM, and the mode of inhibition to be mixed, although exact Ki's were unable to be determined.

SCH121: Which Brand of Cattle Fly Spray Inhibits Fly Larva Most Effective for the Lowest Price?

Purpose: To determine which brand of cattle fly repellant performs best. Hypothesis: I believe that the AiM-L ball will perform the greatest. 1. Create the testing apparatus made out of see-through pipe. 2. Place 25 maggots in the pipe and let them crawl around the pipe for 18 mins. 3. After the 18 mins are up, write down to measurement of how far the maggots have gone from the repellant. 4. Take the 25 maggots out of the pipe and then replace the maggots with 25 different maggots for the other types of repellents. Conclusion: Result available at the fair.

SCH122: Nitrate Nightmare

The purpose of this experiment was to see if aquarium nitrate removers could eliminate nitrates in pool water. This was done by putting nitrate contaminated water into 6 different buckets after the water had been tested to make sure the nitrates were in it, two ounces of different aquarium nitrate removers were added to each bucket. This process went on for several weeks, however there was no stop in nitrate growth during the period of testing. The conclusion of this experiment is that the aquarium nitrate remover did not eliminate the nitrates in the pool water.

SCH123: Chemical Transformation between PVA and Boric Acid

I want to understand what happens once Elmer's glue and liquid Borax mix to create slime. My hypothesis is that if the boron atoms are able to form chemical bonds with the oxygen atoms of alcohol, then the boron atoms can form chemical bonds with the oxygen of polyvinyl alcohol and create slime. To verify my hypothesis, I will add acid to the slime. I would expect for the slime to turn into a liquid. If this is valid, then if I were to add a base, it should turn back into a semi-solid.

SCH124: Finding Iron by using Titration

My experiment is entitled "How Much Iron?". In this experiment, my goal was to determine if the amount of iron in an iron supplement tablet was the same as the bottle advertised. My hypothesis stated: the amount of iron in one iron supplement will be accurate based on what is advertised. This experiment is important because consumers need to know what they are purchasing, and certain customers, especially anemic ones, need to know precisely how much iron they are consuming. I achieved this by dissolving iron supplement tablets in sulfuric acid and titrating the solution with a potassium permanganate solution. Once the titration was finished for each of the four trials, I recorded how much potassium permanganate was used, and by using dimensional analysis, I calculated how much iron was present. The amount of iron per tablet shown on the bottle of the supplements I used was 65mg, and every one of my results proved that the iron content was higher than that with the furthest off result being 112mg per iron tablet and the closest result being 65.4mg per iron tablet. However, there was a 35.2 percentage of error, which could have been the reason for these inconsistent results. Some possible causes of this high error could have been: going over the equivalence point, losing some material during the filtration process, and the supplements not being properly regulated during production. In conclusion, my hypothesis was not proven.

SCH125: Piezoelectric Properties of Peptides

Spring-like peptides exhibit a strong piezoelectric effect along their longest axis. This effect depends on many aspects such as dipole moment and other unknown factors. In an attempt to maximize the piezoelectric coefficient of a peptide, I will use computation-based modelling to discern those other factors and measure the magnitude of their impacts. This will allow me to tailor stronger peptides, which can be synthesized far more easily than alternative piezoelectric compounds of the same strength. This allows for more practical experiments to be done with powerful and cheap piezoelectric compounds.

SCH126: Does Fruit Juice contain more vitamin C than juice from concentrate

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

SCH127: The Use of 3D Printing in the Manufacturing of Dentures

Additive manufacturing (AM), also known as 3D printing, is becoming very popular, and has now spread to the field of dentistry. Inconel 625, a nickel based super alloy used in AM, will be used in the manufacturing of frames for dentures, making it possible to produce them faster, and cheaper. Because these frames are to be used in patients' mouths , it is important to understand how Inconel 625 can withstand pressure and stress at different points on the frame. To test the strength of the denture frames, we will sinter the Inconel 625 samples at different temperatures and then perform shear puncture tests. Different microscopic tests will then be performed on the samples to evaluate the dents in the metal and determine which sintering temperatures result in the stronger metal that can withstand the most stress.

SCH128: Self-Cleaning Microparticle coatings for use in Medical applications

Please visit student's exhibit.

SCH129: Hand Sanitizer and BpA Absorption from Thermal Paper

Bisphenol A (BpA) is hazardous to human health and is found in widely-used thermal receipts, which cause transdermal absorption for those who handle the paper. Hand sanitizer has been shown to increase absorption of BpA, which is especially pertinent to consumers of fast food, who often eat on-the-go, handling food after touching receipts and using the sanitizer. A qualitative color-change BpA indicator was used to compare levels of BpA found on gloved hands after touching receipts both prior and subsequent to the use of alcohol-based hand sanitizer compared to soap/water, and dry hands. Color changes were standardized using a GC/MS.

SCH130: Rates of Chemiluminescent Reactions

This project tested how the intensities of chemiluminescent reactions are affected by the temperature. A dark box with gloves attached to it was built so the experiment could be performed in a space without light from the environment. One at a time, glow sticks were cracked inside the dark box and held up to a photo sensor connected to a Venir Lab Pro for three minutes. After testing 33 glowsticks (10 between 12-15℃, 10 between 21-23℃, 10 between 89-91℃, and 3 glowsticks that were not activated to serve as a control), the data was compiled and averaged. It was found that reactions that occur at higher temperatures have a higher intensity than reactions that occur at cooler temperatures because the molecules are moving with more speed and energy, which increase the chance of a favorable collision.

SCH131: Does the temperature of water in a saturated solution affect the amount of crystal growth using alum?

The purpose of my experiment was to find out if the water temperature affects the crystal growth using alum. First, I had two cups of 200mL of water in each. Cup A had water at 212 degrees or boiling and cup 1 had water at 125 degrees. Then I kept adding alum until the alum was seen at the bottom of cups, undissolved. This is now a saturated solution. Then I poured the solution into another cup using filter paper to clear out any dust. After 48 hours of the solution sitting, it was time to harvest the seed crystals. I found one in each cup and tied a string around each seed crystal. These were now put into another saturated solution and kept for a week. To my surprise, Cup 1's crystal grew larger than cup A's.

SCH132: The effects of carbon dioxide on the pH of water

The purpose of the experiment was to test the carbon dioxide levels on the pH of water. To test this, homemade cabbage pH strips were used to test the pH of water after being blown with a straw for various amount of time. The more CO2 absorbed into the water, the more acidic the water became. This proves that peoples increasing carbon dioxide levels from using cars, working, and even breathing are negatively impacting the earth's waters. Carbon Dioxide is absorbed into the ocean, and other water bodies, and causing the pH of these waters to become more acidic.

SCH133: Biochar's Ability to Remediate Pharmaceuticals from Drinking Water

Researchers have found significant concentrations of hormonal and alkaloid medications in streams and rivers, causing a visible effect on wildlife. The purpose of this project was to find a reliable method to limit the concentration of Opioids in water. Quinine, a chemical similar in structure to alkaloids was passed through a biochar filter and the resulting filtrate was measured via visible spectroscopy. This system, if functional, could be used to remediate pharmaceuticals in water.

SCH300: Water Changes

Purpose: Find heats effect on salt water's pH and salinity. Procedure: Fill three beakers with # solution composed of # ml H2O and #g NaCl. Leave one beaker at room temperature, heat one beaker to # , and heat the final beaker to #. Measure the salinity and pH of the three beakers before heating and everyday, for three days. This was repeated three times. Data: The pH levels will be analyzed to see if they increase, decrease, or are unaffected by higher temperature. The salinity levels will also be analyzed to see if they increase, decrease, or are unaffected by higher temperature.

SCH301: Heating and Cooling Copper to Alter its Color for a New Art Medium

The purpose of the experiment was to observe color change of copper whilst heating and cooling it. The two procedures used involved heating the copper over fire while monitoring the temperature, and either cooling it by means of air or water. It was discovered that the color change was greater in variation when the copper was cooled using water. Because of these results, we concluded that in order to achieve greater color variation, it is more efficient to use water to cool heated copper.

Computer Science / Math (SCM)

SCM100: Traffic Congestion Simulation

Traffic congestion is a major problem in all environments and costs a significant amount of money in terms of lost productivity and many other losses. Traffic congestions occur due to many different causes and certain factors such as traffic volume, traffic patterns, and accidents cannot be avoided. However, traffic congestion due to humans can be minimized. They include drivers not maintaining the recommended speeds, leaving large gaps, not picking up speed after a congestion point, such as a tunnel, and distractions due to accidents. The objective of this study is to understand those scenarios and identify possible solutions.

SCM101: An RFID-Based Indoor Mapping Tool for the Visually Impaired

Spatial and navigational awareness are critical skills for an efficient and productive lifestyle. Unfortunately, such essential tasks are often difficult, dangerous, or impossible, especially in crowded indoor areas, for the visually impaired. Therefore, the goal of this project is to create a cognitive assistance tool to enhance spatial visualization ability for the visually impaired. To achieve this, a phone-based application will be developed that uses radio frequency identification (RFID) technology, GPS-based location tracking, and native activity monitoring software to help enhance navigational awareness, avoid dangerous situations, as well as improve the lives of visually impaired individuals.

SCM102: Regression Line Derivation

How can you derive a formula for the regression line using known statistical quantities? To find the answer to this question I created a function that represented the distance between the points in a data set and a linear function. Then I used calculus to find the minimum point of this function, this is where the regression line occurs. I then researched statistical concepts to manipulate this formula. What I found is that the slope of the regression line for a data set is related to the correlation coefficient, the standard deviation of y, and the standard deviation of x.

SCM103: Social Net Bullying Mediation

Students in both middle and high schools experience bullying either on a physical or cyber form. Currently, there are no forms of social media that addresses the complications of bullying that occurs within students of a school, anonymously. In order to better address this problem, I will be modifying the current LEAF social network, a specialized social network designed for intimate partner violence developed at the University of Pittsburgh's LERSAIS Department, into an anonymous social network for those impacted by bullying, named LIGHT (Lead, Inspire, Give, Heal, and Teach). LIGHT connects students with teachers, parents, and other supporters to get help in their situation. After modifying features I deemed necessary to change, I will create a recruiting and training presentation to recruit and train 8th, 9th, and 10th grade students at my school. Afterwards, I will ask each student to react to one scenario on the social network, and then fill out a survey to give feedback on how effective the network was. I will use that survey data to find features that should be kept, deleted, or modified once again to best fit the needs of the users.

SCM104: A Deep Learning Approach to the Identification of Transcription Factor-Gene Relationships

Transcription factors (TFs) play fundamental roles in the regulation of gene expression, and understanding which TFs are involved in a disease process sheds light on disease mechanisms. Here, we present a multi-omic deep learning approach to modeling TF-gene relationships. Sparse deep belief networks (DBNs) are trained to reconstruct PanCancer gene expression perturbation signals and capture latent variables that represent potential transcription factors. A TF-gene matrix is created using TF binding site information from ENCODE ChIP-seq experiments. Finally, weights between input and hidden layer units are mapped to potential TFs using hypergeometric testing. Final results will be available on fair day.

SCM105: Optimizing Search Efficiency: AI and the Local Max Strategy

The purpose of my project is to develop a computationally efficient search strategy and apply it to the classic game Battleship, with the intent to achieve success playing against intelligent humans. Once I have programmed the AI, I will determine its efficiency and effectiveness by having humans play against it. This human play data will be collected to continually modify the AI strategy and further increase its success rate until a success rate of over 50% is reached. Additional applications of this strategy include optimal cell tower / WiFi router placement, search and rescue operations, and military operations.

SCM106: Be a Polynomial Pollyanna: A Simplified Approach to Mutiplying Polynomials of a Higher Degree

This project outlines an original method for multiplying polynomials of a higher degree, due to the confusing and error-prone method currently taught in school curriculums. The project will present the method, explain how it is derived, and how it compares to the original method, looking at the new benefits that it offers.

SCM107: A Sound Security App To Prevent Pirating of Confidential Information?

In 2016, 1 in 3 people were at risk of having personal accounts hacked by artificial intelligence systems. This high risk percentage indicates that reCAPTCHA applications have not been efficiently detecting online robotic submissions. In order to solve this problem, I attempted to create a sound-security application with PHP script, MySQL, and an Apache web server to reduce the risk of losing confidential information involved with online security checks. Finalized application results will be available at the science fair.

SCM108: Voice-Based Email for the Blind

Please visit student's exhibit.

SCM109: Unpredictability: An Analysis of the 2016 General Election

Due to discrepancies in the electoral college and popular vote, I asked which voter had the most influence on the 2016 presidential election. Calculating pivotality values, I used a one-tailed z-test to determine which states swung significantly more than others. I found that Utah, Iowa, Michigan, Ohio, Missouri, West Virginia, and Wisconsin were significantly pivotal, but Utah was skewed by third parties. I then performed chi square tests for demographics in 2012 and 2016 and examined changes in influence on the election. The most influential voter was an Iowan white, rural male, 30-44 years old, earning $50-100k, with some college.

SCM110: Aerosoft : Gate to Gate Autonomous Flight

In this project, I developed the first ever end to end autonomous flight solution, named Aerosoft, for commercial cargo aircraft. Aerosoft pilots the aircraft at peak aerodynamic and operating efficiency. Aerosoft uses artificial intelligence to learn how to dynamically and efficiently fly the aircraft on a scheduled cargo service using pre-recorded and pre-processed rehearsal flights. The trained artificial intelligence model is combined with a series of proprietary routing, optimization, and flight management algorithms to seamlessly, efficiently, and autonomously pilot the aircraft from gate to gate using approximately 4-8% less fuel and costing 4-9% less to operate than current systems.

SCM111: An Algebraic Approach to Analyzing Theta Curves

This project studies the Jones Polynomials of mathematical knotoids called theta curves as part of Knot Theory, a subfield of topology. Knots, formally defined as embeddings of a circle in R3 on the interval I:[0,1], are simply continuous loops that have indefinite shapes and sizes due to a knot K's elastic nature in topology. One of the biggest problems in knot theory is categorizing knots in a meaningful way and defining what knots are isomorphic or equal. This means that knot, through a series of continuous deformations Dn, can be rendered identical. Theta curves are a type of knot, called a knotoid, that have an additional n - 2 number of arcs attached. To help classify different theta curves, I analyzed applications of the Jones Polynomial, an algebraic knot invariant, to the curves. I proved two theorems regarding the orientation of theta curves and have two conjectures regarding the Jones Polynomials of two unique types of theta curve, one of which is close to being proven as a theorem.

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SCM112: CNN Training By Set Generation

Artificial neural networks are used for many different computational purposes. These purposes include novel areas such as natural language processing, computer vision, and voice recognition. Convolution neural networks(CNN) have shown great promise in the area of computer vision. I propose an approach to training CNN's by altering random inputs to maximize their probabilities for various classes. These high probability inputs will then be analyzed by a qualitative process and then put back into a supervised dataset labeled as noise. This serves the purpose of preventing the network from thinking with nearly 100 percent certainty that the inputs belong to specific classes. This method for training CNN's will hopefully allow for more accurate models as well as models that have better generative capabilities. This training method will also help to minimize the exploitability of the network in addition to its accuracy overall.

SCM113: The Effects of Encryption, Surveillance, and Infrastructure on Data Interception

Expanding with sophistication, the digital world is becoming more and more secure; however, those trying to breach the delicate system have become more efficient regarding their means of data interception. A meta-analysis will be conducted to dissect the methods of cyber-security individuals can take to ensure the safety of their private information. Cryptographic algorithms, implementations of mal-ware cognizant software, and the security architecture of closed networks will be compared and translated to means that are more accessible to the average pedestrian. This will help ensure the general public safer connections to the internet.

SCM114: AI Based Opto-Lexical Pattern Analysis for Behavior Categorization

This project is designed to test the efficacy of using automatic image captioning and object identification algorithms combined with text analysis algorithms through a use of artificial neural networks to determine and categorize behavioral patterns upon social media. In fact, this algorithm can currently identify and distinguish between behavioral patterns with an unprecedented level of accuracy, leading to the conclusion that the project was a success. In fact, it's notable applications include acting as an early warning system for imminent threats, particularly when 90 percent of all terrorist communications happens through social media.

SCM115: Creating a Computer Algorithm That Predicts the Trajectory of an Object

Purpose: To create a computer algorithm that can predict the trajectory of an object and then compares it to the actual trajectory of the object. Hypothesis: The algorithm will be nearly, if not exactly, the actual trajectory of the object. Procedure: 1. Use Visual Basics Studio Express 2012 for Window Desktop to create an algorithm that can predict the trajectory of an object. 2. Have the algorithm display the results on a graph. 3. Compare the actual results to the predicted results from the algorithm. Conclusion: Final results will be available at the Student's exhibit on Fair Day.

SCM116: Using Bayesian Network Modeling to Locate Breast Cancer Genes

With over 25,000 genes in the human genome, an effective method to link genes to the progression of cancer is needed. The identification of even one novel significant gene in the progression of breast cancer can lead to improvement in breast cancer monitoring and treatment. In this study, we extract and use a large public gene expression data set for breast cancer progression to learn Bayesian networks of gene-gene and gene-stage interactions. We created a set of known genes from a literature review on breast cancer progression to validate associations in our models and discover novel genes.

SCM117: Novel Signature Genes and Their Functions in Metastatic Breast Cancer

About 41,000 people die from breast cancer annually in US. Metastasis is the major cause of death in cancer patients. It is crucial to identify novel signature genes differentially expressed in breast tumors with high metastatic activities and to better understand the biological process in metastasis. I found gene expression data from the GEO Accession Viewer. Then I wrote an algorithm in Python to find differentially expressed genes (DEGs) in tumor samples with high metastatic activities by comparing expression levels of genes between a matched pair of primary and metastatic tumor from same patients. Gene ontology analysis was used to find the biological functions mediated by these DEGs. 36 matched pairs were identified. The genes most commonly upregulated in metastatic tumors were C7 and CCL21 and genes most often downregulated were MMP3 and MFAP5. These DEGs were involved in the immune system. P-values were $< .01$. These novel signal genes may be used as biomarkers to identify primary tumors more likely to metastasize and guide targeted treatment to patients.

SCM118: From Music Assessment to Word Recognition

Automatic recognition of an object is useful to find some information from a large size record. Among those technologies there are recognition of a note in music or a word in a speech. In the previous years of PRSEF I developed a computerized real-time music assessment using time-shift correlation. The speech and music are similar to each other in terms of sound waves. In addition, a note in the music is analogous to a word in the speech. Specifically finding a word in a spoken speech would be the same as finding a note in played music. In this project, according to these similarities, I tested whether a word in a speech could be recognized by a computer using the developed computerized music assessment algorithm. A word recognition by computer was successfully achieved by using the time-shift correlation for two different speakers.

SCM119: "Perfect" Ratio Redefined

Last year I proved that one's body volume and weight are highly correlated. For this years project I found the minimum number of parameters needed to better correlate body volume and weight and also that you can you estimate certain measurements from one's photograph and use it to calculate their approximate weight. I discovered a way to identically capture images and also found removing body parts such as the volume of the head makes the function more accurate because it doesn't necessarily reflect that person's weight. Further results will be presented at the science fair.

SCM120: Uber Economics

This project is a test on the economic law of demand, which states that as the price for a product goes up, the demand goes down. The goal of my project was to determine if uber data could prove the law of demand, and determine the elasticity of the demand curve. I analyzed the and organized the data to only include during mid-day times in sunny weather in New York. My meta analysis proved the law of demand and had an elasticity that was dependent on external variables like time and weather.

SCM121: A Cursive Signature Forgery Analysis App

Purpose: To create a phone app which would be capable of identifying a forged cursive signature. Hypothesis: The app created will be capable of identifying a forged cursive signature with an accuracy of 75%. Procedure: 1. Analyze people's signatures. 2. Create a database of signature characteristics. 3. Make the app. 4. Analyze how well the app works, and asses how to make it better. 5. Adjust and add more detail to algorithms. 6. Repeat Steps 4 & 5. 7. Fix any problems. 8. Test the app once more to make sure it works correctly. Conclusion: Final results available at fair.

SCM122: Air Pollution and Risk of Related Disease Incidence in Pennsylvania

According to the American Lung Association, 38% of the population of the United States live in areas with unhealthy ozone levels. Besides Ozone, there are other particulate materials that exists in the air. Adverse effects of ozone and other particulate materials on human health has been studied extensively (e.g., Koenig et al., 1999). Polluted air can cause respiratory irritation, breathing difficulties, coughing, wheezing, lung cancer, etc. The effects are noted in deterioration of the lung (Pope et al., 2002), cardiovascular system, etc. (Brook et al., 2004). I hypothesized that a higher concentration of Ozone and particulate materials in air increases risk of lung cancer and other cardiopulmonary deaths. I will look at both pollution and mortality rates per specific disease. Pollution data entails particulate matter (PM 2.5) and ozone concentrations, the two most common air pollutants. The specific diseases I will be looking at are lung cancer, influenza, pneumonia, pneumoconiosis, heart disease, chronic lower respiratory disease, leukemia, and asthma; all of which are diseases which are suspected/likely to have a noticeable relationship with air pollution levels. The goal of the study is to link air pollution and disease mortality rates in Pennsylvania over time and see how the association changed over time. I will use the statistical programming package R to conduct all statistical analyses, including mapping disease incidences with pollution levels and a time series graph of air pollution and disease mortality rates. The analysis will be specific to the 67 counties of Pennsylvania. Data for disease mortality rates will come from Pennsylvania Department of Health Enterprise Data Dissemination Informatics Exchange (public source), and data for air pollution comes from Environmental Protection Agency's Air Quality System (AQS) reports. I will also try to determine relationships for specific cohorts (e.g., race, sex, age, etc.), and adjust for variations related to smoking or obesity rates in the county.

SCM123: Using a Taylor Series to Determine the Height and Velocity of a Moving Object

1.How can Taylor Polynomials be used to determine height&velocity of an object? 2.Taylor Polynomials can accurately be used to determine height&velocity of an object. 3.Reference problem@display. • Identify known values in problem. • Use tangent ratio to relate known&unknown values to obtain $\tan(\pi/5)=x/20$.Solve for x to get $x=20\tan(\pi/5)$where x is unknown height. • Construct Taylor Polynomial to 4 terms,using the formula, $f(n)(a)*((x-a)^n)/(n!)$, where $a=\pi/4$. • Plug original value, $\pi/5$, in for x:This is an approximation for $\tan(\pi/5)$. • Multiply by 20 to obtain height. • Repeat steps 2-5 replacing, $\pi/5$, for, $2\pi/9$. • Calculate the average velocity by subtracting first height from second and divide by time. 4.Results will be at fair.

SCM300: Drop Dead

The purpose of this experiment was to find the mathematical equation for which blood spatters. A burette filled with blood was used to drop five drops onto a sheet of paper to determine the size of the resulting spatter. Three trials were conducted at the heights of 10cm, 20cm, 30cm, 40cm, and 140cm. As the height from which the blood dropped was increased, the size of the spatter increased. This equation was calculated from the data: $y = 0.0073133x^4 - 0.0593933x^3 + 0.11906044x^2 + 0.12339533x + 0.88$.

SCM301: President To Be Or Not To Be

The purpose of this experiment was to develop an algorithm that can determine whether someone is a perfect president or not. The procedure includes researching domestic policies of presidents, determining the best president, determining the characteristics of a perfect president, developing the algorithm, surveying people and scoring past candidates, and creating an app for the public to use. No one received a perfect score. It has been concluded that the actual development of the algorithm supports the hypothesis. Also, a mathematical approach could have been used instead of comparing data and adding more characteristics could make this experiment better.

SCM302: Bide : Wait Less at the Doctor's

Patients often spend too much time unnecessarily waiting in the doctor's office waiting room for their appointments. To fix this, we created Bide, an advanced software solution designed to drastically reduce mean patient wait times and increase patient satisfaction and return rate. Bide uses a machine learning algorithm coupled with live progressional data to provide more accurate, dynamic appointment times to each specific patient in the doctor schedule. Through preliminary testing, Bide estimates wait times up to 70% more accurately, allowing patients to arrive just before their appointments will actually occur instead of wasting their time waiting hours beforehand.

Engineering / Robotics (SER)

SER100: Various Techs' Accuracy in Tissue Cross Section Measurement

Tissue, an aggregation of morphologically similar cells that perform specific functions, is understood through its mechanical properties and measurement of cross sectional areas (CSA). Yet, lasers, the currently used measurement method, are large, require constant upkeep, and are expensive. Photogrammetry, a less-expensive potential non-contact measurement method, was tested in this research for its ability to measure CSA. A photography rig, camera, and various CSA measuring softwares were utilized to compare the accuracy of photogrammetry and classic lasers in measuring CSA. Photogrammetry was found to yield more accurate results when measuring objects with crevices and curves, which are typical of tissue.

SER101: Emergency Solar Charger

My idea is to create a small personal device that would be able to charge a smartphone while charging its internal storage simultaneously which would have enough power in it to charge another smartphone completely using solar energy.

SER102: Polar Coordinate 3D Printer

Nearly all Fused Deposition Modeling printers use similar, complex, expensive hardware to manipulate the position of an extruder and bed in the Cartesian system. I proposed using a polar coordinate system to reduce cost and mechanical complexity. I created a successful simulation of the 3D printer's control system and overall movement, and am currently developing the electronic and mechanical systems. Various components have been tested individually or in small groups, but a full assembly has not yet been built. Once complete, I will test the interaction of the mechanical, electronic, and control systems in the prototype and redesign as necessary.

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SER103: Stop Shocks: Antistatic Device

Static electricity is a common problem we encounter when our hair stands up or we get a shock from touching a doorknob in the dry winter. But static electricity can also cause deadly sparks and explosions at places like gas stations. These disasters can easily be avoided by grounding one's self. This project resulted in the creation of a device that attaches to the user's show that connects their foot to the bottom of the shoe, so every step they take they are grounding themselves. This product is easy and convenient but very effective in reducing static buildup.

SER104: Bio-Voltic Cell from Fruits

A problem often overlooked is the problem with batteries. For my experiment, I made a galvanic cell using different fruit electrolytes, and measured their current and voltage, as well as the pH. I measured the voltage and current and the pH by making a series circuit out of them. The average reading for voltage generated was about 5.6445 V and the current measured was 0.97275 mA. Results showed that the more acidic a substance, the better it can conduct electricity. They don't show a huge amount of voltage and current, but it opens the doors to further research.

SER105: Green Stove for Developing Countries

Air pollution continues to be a topic of discussion worldwide. One increasing contributor in developing countries is excessive smoke and fumes from household cooking stoves, which are widely used to cook food. These stoves are necessary for everyday life, yet can be extremely harmful. With pollution, waste and welfare in mind, finding a sustainable solution to address this problem is imperative. The goal of this project is to create a stove that is both environmentally friendly and safe. To accomplish this, two prototypes will be created, one that uses a hydrogen fuel cell to power a stove and reduce emissions, and another that uses waste material to create burnable briquettes. Variables including construction, ventilation and material will be tested to achieve an optimized design. By producing an efficient, green stove, air pollution and thusly the quality of life can be improved in developing nations.

SER106: Reaching Perpetual Motion

The researcher will construct a perpetual motion machine to test if the machine works as it does in theory. The purpose is to prove or disprove whether or not this motion will work better or worse with a lower-density liquid. If this hypothesis is proven right, this will later be tested to see if it could power a machine. The machine will be built and will be tested with eight liquids to see if they will cycle. The researcher will then express the data in graph form for each test. Data will be available on science fair day.

SER107: Which Type of Fingerprinting Powder and Lifting Tape Produces the Best Quality Fingerprints?

Purpose: Determine which type of powder and tape produces the best quality fingerprint. Hypothesis: The magnetic powder & packing tape will produce the best quality fingerprint. Procedure: 1.Obtain ink fingerprints (Control) from 10 subjects. 2.After test subject cleans their hands, have them evenly apply 1 mL lotion on hand. 3.Using a uniform amount of pressure, have the test subject place ring, middle & pointer fingers on test surface. 4.Apply apowder to each fingerprint on test surface. 5.Using a tape being tested, lift print from test surface. 6.Clean the surface & the subject's hand with soap&water. 7.Repeat steps 4-9 using remaining powders & tapes. 8.Analyzequality of print lifted to ink print obtained in step2. Conclusion: Final results available at fair.

SER108: Geopolymer Concrete: The New Standard?

This experiment will take accepted standards in concrete engineering and revolutionize them, so that they are more effective and safe for the environment. This investigation will determine if Geopolymer concrete yields better results than standard concrete which utilizes OPC. If viable, this product will use all recycled material as part of its binder.

SER109: A Method of Converting an Accident Byproduct into Clean, Useful Energy

The purpose of this research project is to establish a theoretical basis of harvesting the naturally generated hydrogen gas byproduct of nuclear reactors into hydrogen energy. There are numerous benefits from this; It would further eliminate hydrogen gas in reactors, decrease the chances of disasters such as the hydrogen explosions at Fukushima, and could provide power during emergency conditions for lights and controls. The energy source would be cheaper and readily available, for manufacturing hydrogen gas is a time-consuming and expensive. The results of this experiment will be presented at the fair.

SER110: Will the Size, Number and Placement of Tubercles Improve the Performance of a Vertical Axis Wind Turbine?

Purpose: to determine the optimum size and placement of tubercles on a VAWT. Hypothesis: the smallest tubercle on the outside of the blade will be the best performing. Procedure: 1. Draw 3D models of control VAWT and separate tubercles with widths of 2.54cm, 5.08cm, and 8.89cm. 3D print. 2. Construct testing apparatus and measure performance in electricity produced. 3. Using the best performing tubercle width, test VAWTs comparing the tubercles on the outside and inside of the blade. 4. Repeat step 2. 5. Construct a full size VAWT using a plastic barrel with optimum tubercles. Results: Available competition day.

SER111: Interactive game for motor movement rehabilitaion

My project is an interactive game for the use of motor movement rehabilitation. This game will work in conjunction with interactive hardware and motion sensors to analyze rehabilitation data. I will use Blender, a three dimensional modeling software to engineer and design a functional game. As I design my video game I will learn the programming language Python, in order to further advance my games effectiveness. Also I will engineer hardware that will work with my game to enhance its effects as a tool for rehabilitation.

SER112: Hull and Boats

The purpose of my experiment was to determine which of three ship hulls would be able to hold the heaviest load before sinking. I hypothesized that the ship with the largest volume to mass ratio will be able to hold the most weight before sinking. I based my hypothesis on the formula D=m/v, Fb=(Rho)Vg and P= Po+ (Rho)gh. In order to test my hypothesis I created different hulls with different hull designs and varied the materials used to create each hull. Then I placed the designs in water. I continued to add weight to each design until the hull designs began to take on water. Then I recorded how much weight each design held and compared the result of each. My results will be available on fair day.

SER113: Does Magnetic Fluid Particle Size Affect Heating By Magnetic Induction?

Purpose: Determine if MagneticFluid particle size affects heating by magnetic induction. Hypothesis: As the size of the MagneticFluid particle decreases, the rate of heating will increase. Procedure: 1.Place 10mL of MagneticFluid containing 10 nanometer sized particles in a test tube. 2.Place test tube inside an induction coil. 4.Turn on induction coil and determine the temperature every 15seconds for 5minutes. 5.Allow MagneticFluid to return to original room temperature and repeat steps 2-4 29 times. 6.Repeat steps 2-5 with MagneticFluids containing 0 (control) and 1000 nanometer sized particles. 7.Repeat steps 2-6 using different strength magnetic fields on the induction coil. Conclusion: Final results available at fair.

SER114: Structural Integrity of Bridges Compared to Their Weight-Bearing Capacity

This project is testing how much weight a bridge can hold in comparison to its design. I will construct multiple types of bridges then add weight to test their strength, thereby determining their practicality.

SER115: Gone With the Wind - Wind Turbine Blade Design

Wind turbines are a good alternative energy source. My experiment tests which wind turbine blades generate the most power(watts). I built a wind turbine out of PVC and connected it to a DC motor and multimeter to calculate power of four different blade designs; a rectangular blade, a very wide blade, a shorter, less wide blade, and finally a skinnier, shorter blade. I measured the power in three trials then got the average of the three. At the beginning I hypothesized that the wider blade would generate more power, but the smallest blade generated the most power.

SER116: Zone Signature Algorithim of RFID as a Real Time Localization System

Radio frequency identification (RFID) is a device that harnesses radio waves that can interpret received signal strength (RSS) data for real localization capability. It employs a system of readers, tags, and an information system. In this study, we used a zone signature algorithm that reduces the infinitesimal variables involving propagation issues. RSS data was measured and placed into individual blocks in a grid system. After obtaining the data, accuracy was based on the percentage of correct tag placement prediction over total attempts made to predict zones.

SER117: Wind Power and Automobiles

Problem: While gasoline and fuel are the most effective ways for energy to power an automobile, we have a limited supply of these precious fossil fuels and we have ways of producing energy naturally that is unlimited. Hypothesis: Could you use wind power to produce electrical energy for an automobile? After some careful thought and consideration, I knew I had my hypothesis. If you were to put a wind turbine on an automobile, then you will be able to produce a sufficient amount of energy to use for the automobile. Also the greater the wind speed, the more electricity you will produce. Procedure: The experiment will take place as follows. First ,the Thames and Kosmos wind power kit will be put together. To put this kit together, the kit directions found in the experiment manual that came with the kit and will be followed exactly found on page six through nine in the manual. After the wind turbine is fully set up, it will be secured to the floor with duct tape to avoid loss of energy from the shaft by shaking. Once the base of the wind turbine is secured, it will be time to start the testing. The testing will start by using a fan that has three constant speeds. The fan will be place exactly one meter away from the wind turbine. The wind speed from the fan will be measured with an anemometer to be more precise. The fan will be run at each speed for two minutes and a multimeter will be used to test the voltage at each speed. This process will be repeated three times to be precise. After all tests are finished, the voltages will be compared to each other. Next, the data will be used to find out if it would be possible to have wind turbines on vehicles. If the answer is yes, would there be a sufficient enough amount of energy to be a useful invention? To test if it would be a useful addition to an automobile I will look at the energy produced and how much energy an electric car battery uses and get the answer. This will be if it were to be set to scale. The thing that will the control is the wind speed. Final results will be available on fair day.

SER118: Is it Possible to Produce Medical Equipment for Less?

The engineering goal of this project is to determine whether it is possible to construct medical grade equipment for a lesser unit retail price, while still being equivalent in function, to be able to provide to the consumers for less. This is done by first using a CAD program. Then using those designs, going to local producers to get quotes for some of the parts. Once all the parts were ready, everything was assembled. When comparing the unit price of the retail and self-made product, the self-made product was able to be produced for less than the retail value.

SER119: The Future of Energy

The purpose of this experimentation is to determine whether cow manure, kitchen scraps, or a mixture produces more methane in an anaerobic digester and if one produces a worse smell than the other. In anaerobic digestion, biogas is produced by organisms breaking down organic material in an oxygen depleted environment. Biogas contains 55%-65% methane. ¼ of cow manure in the digester will be turned into methane. Previous studies suggest that kitchen scraps are the best source of methane. So mixing cow manure and kitchen scraps should produce the greatest amount of methane.

SER120: One Arm Robot

The goal was to build and test a robotic arm constructed mainly of wood and powered by a pneumatic system. The hypothesis states that if the robotic arm is built using pneumatic power, then the arm will pick up 15 ounces. The hypothesis is not supported, but the arm is still impressive on how well it operates while picking up an 8 ounce object. The procedure started with drawing and planning how the arm would be built. Then it moved to building the base, then attaching the swivel and tower pole. The next step was building and pinning the arm onto the tower pole. Then the claws were assembled and affixed to the end of the arm. Next the syringes and tubing were set up and attached in their appropriate places. It then proceeded to building the control panel and placing the syringes into the control panel. After that the arm was tested and the display board was completed. The arm moves left and right, and up and down. The claws on the end of the arm go open and closed. Each set of syringes has a bypass hole that must be held during operation. The bypass hole allows for smooth action and a larger operating range.

SER121: CV for Unbiased Data Collection

The objective of this project was to design a program to use a dissecting microscope with camera to automatically score fly eyes based on roughness. This roughness is caused by a protein called shroom which is used to control the shape of tissues in the body. This scoring is used to study what protein assist shroom in functioning, as this protein can cause neural tubes to be mal formed in mice and possibly also in humans. This would be helpful as it is unbiased from fly to fly and would reduce the time needed to score fly eyes. For my final solution, I trained a neural network to intensify the fly eye scores, which had a 98% accuracy at the end of training. Further testing is necessary to confirm the results and that will eliminate the possibility that it is just remembering images.

SER122: No-Touch Handicap Door Activators

My grandmother is very old and suffers from COPD. Part of the problem with having COPD is that she has to carry an oxygen tank with her, this oxygen tank often prevents her from also being able to open doors, or even push a handicap automatic door button, while carrying her oxygen tank. This problem that I noticed with my grandmother is what prompted me to create my project. For my project, No-Touch Handicap Door Activator, I tested and created an easy add on device to add on to handicap automated door buttons. This add on device has a sensor that is programmed to open the switch for the automated door whenever a FOB or tag gets close to the sensor. This add on device is effective and much cheaper than installing a whole new automatic motion sensor activated door; also the add on device was found with testing to work best when the FOB is within 5 cm of the sensor.

SER123: 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 shots fired. Based on the data I will conclude which pattern works to distract or disorient the shooter most effectively.

SER300: Extracting Electricity from Play

Inclusive economic growth is the utmost effective means of reducing poverty, but this growth is impossible without energy. Our solution to this is a tetherball pole that can harness mechanical energy. As the tetherball swings, it rotates a motor that can generate electricity. An outlet on the pole exists in order for the users to easily charge a device, making electricity easily accessible to energy-poor communities. Using a multimeter, we've collected data to analyze the exact energy output generated by each spin of the tetherball. By reversing a basic motor, we have found a viable source of energy through play.

SER301: An Analytic Metric for Calculating Joint Space

Joint space is all of the places that a robot arm can access. Current distance metrics only approximate joint space, because they assume that all joints are equal. In reality, joints are unequal, because they require different amounts of energy to actuate and affect the position of the robot hand differently. To accurately calculate joint space, the distance should be measured using a non-uniform metric. Our project addresses this problem by weighting these robotic joints, which reflects the differences in performance. To accomplish this, we will experimentally discover these weights, and then analytically determine their relationship.

SER302: Tensility Without Tensile Tests

The purpose of our research is to compare the complex characteristics of carbon fiber to those of other metals or building materials in order to prove why carbon fibers should phase out other metals. We believe that carbon fibers are more advantageous for use in infrastructure. To compare the strength, we conducted flexure tests on various materials (carbon fiber, iron, etc.), rather than tensile tests which are dangerous and difficult to perform; we found that carbon fibers were indeed the strongest. We found that compared to other materials, carbon fibers are less corrosive and easier to maintain than other materials.

SER303: SticKey - Communication Made Easy

Individuals with fine motor impairments often find themselves with limited means of communication and interaction in a society that is dependent on technology; the SticKey is the solution. The goal of our assistive typing device is to provide a means of communication, therapy, and self-confidence to its users through a low-tech and affordable unit. The SticKey consists of two joystick units one a color selector and the other a letter and character selector. By operating the two joysticks the user can type letters, characters, and switch to mouse mode. The creation of the SticKey closely followed the engineering process. The final designed enclosures were printed in our school's engineering lab on 3-D printers. In identifying the need for the SticKey we found that 48.9 million people with disabilities live in the Unites States and 34.2 million people have functional limitations. Throughout our extensive research and interviewing of professionals, we found a significant void in the assistive technology market for a device like ours. The SticKey seeks to make an impact on the lives of individuals in school, at work at, home, and in rehabilitation centers. The SticKey eliminates the gap between being disabled and feeling disabled by putting communication back into the daily life of the user.

SER304: What Wood You Do?

People who heat their home with wood need a more efficient and safer way to transport it to the wood burner. By using inventor software, a prototype and engineering goal was designed and created that acts as a sled and carrier. It transports the wood and prevents strain or injury to the individual. After use of the Holzschlitten (wood sled) it was confirmed that the prototype was effective. For future designs or improvements, additional features could be added such as a stand to set the prototype on, clamps to hold the handles together and a plastic bottom.

SER305: Water Sampling with Drones

Water quality issues have been seen all around the world in the current day and age, as seen in local areas such as Flint, Michigan, but also internationally in countries such as India and China. The cause for water crises can be traced back to poor water sampling and analyzation. Current day water sampling is ineffective as it involves taking water from the side of a water body, rather than the middle. Without collecting accurate samples away from the shore at an efficient time, water sampling is essentially useless in protecting water bodies from over contamination. Therefore, the goal of this project is to use a drone to collect water samples from the middle of a body of water. In order to enhance water sampling, a device will be built and attached to the drone to collect water at different depths, a GPS will be placed on the drone in order to record for efficiency, and water will be safely collected and brought back for better analysis.

Earth / Space / Environment (SES)

SES100: Analysis of Leaf Pore Adaptation in Fragaria

This project evaluated the variability of stomatal length, stomatal density, and stomatal location among different species and cross species of Fragaria (strawberry). his project used three different growing conditions to determine the influence of environment on stomatal characteristics. Microscopic leaf images were taken from which stomata measurements (in micrometers) were made. It is my hypothesis that stomatal length will increase under wet growing conditions and that stomatal density will be smaller when atmospheric carbon dioxide levels are high. Data collection and analysis is still being conducted. Complete findings and conclusions will be available at the science fair

SES101: Implications of Vibrations on Plants

Deforestation all across the country is caused because we need room for farming. There must be a way to reduce the area of a farm by implanting a technique. That technique I believe is direct vibration. In this experiment a hand sander will be utilized to vibrate a set of plants to see how well these plants grow when they are placed closer together compared to a set of plants that are planted the same distance away but without vibration.

SES102: Homemade Battery

The researcher will experiment three compostable fruits and see which provides the most voltage. The three fruits the researcher will be using are a lemon, orange and an apple. They will be using a voltmeter to test which one releases the most energy. Then the researcher will measure which fruit has the most voltage by testing with one trial for each fruit for ten days and find the average of their voltage. The researcher predicts the lemon will have the most voltage because it is the most citrus out of the three

SES104: Effects of Atm on Ch4 Emissions

The intent of this investigation is to measure the rate of escaping methane from abandoned gas wells and its relationship with changing atmospheric pressure. Data was collected on the flow rate of methane escaping an abandoned gas well using a digital flow meter. The data so far consists of flow rate measurements, dates when measurements were taken, and atmospheric pressures. A distinct relationship between the flow rate of methane escaping abandoned gas wells and the atmospheric pressure has not been found. Ongoing data analysis may reveal a connection between atmospheric pressure and flow rate.

SES105: Visualizing Cyanobacteria from Shark Bay Australia

The rationale for my study is to examine how stromatolites (solid structure created by single-celled microbes) are effected by photosynthesis in certain areas of the microbes, because these stromatolites produce a lot of chlorophyll F specifically Shark Bay. The question that we are trying to figure out is where and why do stromatolites produce a large amount of chlorophyll F specifically in Shark Bay Australia? The procedure is that we will look at microbes from these stromatolites under the microscope using the method called photomicroscopy in order to find where chlorophyll f is being produced at the most.

SES106: Faux Snow? Oh no...

The category of this experiment is Environmental Science. The purpose was to determine the effect of artificial snow on the aquatic environment. To conduct this experiment, two large containers with lake water (one with Snomax added) were tested for changes in pH and nitrogen (nitrate and nitrite) levels. The pH was 5 and nitrate and nitrite levels were 0 in both containers. There was no difference in pH or nitrogen levels between the lake water with Snomax and the lake water without Snomax.

SES107: Temp. Effects on CH4 Emissions

The intent of this experiment is to measure the rate of methane escaping deserted gas wells and to detect its relationship with temperature. As ambient temperature increases, methane gas emissions were expected to also increase, which could eventually have an impact on global temperatures. Data collected included gas flow rate, utilizing a digital flow meter, dates, and local ambient temperature. Although the collected data has yet to show a noticeable correlation between the flow rate of methane escaping the well and temperature, further study will be conducted in order to form a more definitive conclusion.

SES108: The Airduino

The purpose of my experiment is to make a cheap, small, and portable device that can easily measure air quality. To do this I used a microcomputer with many sensors attached to it, which measure different types of information about the air. I then programmed the microcomputer to log the data recorded by the sensors. Experimentation is still continuing.

SES109: The Effect of Toxic Pollutants on Bioluminescent Dinoflagellates

The project being conducted tests the use of bioluminescent dinoflagellates (BLDF) as indicators of three toxic pollutants; motor oil, fertilizer, and sunscreen/perfume. The BLDF will be introduced into solutions of the pollutants. The number of BLDF present will be counted two weeks after being placed in the water and two weeks prior. If the number decreases, BLDF could then be used to detect pollutants in water. This would provide a means for finding safe water for human consumption. At this time experimentation has not yet been concluded. It is predicted BLDF can be used as an indicator of pollutants.

SES110: Regulate Mineral Intake by Testing Hardness of Tap Water

The purpose of this experiment is to test the amount of minerals in water to help fix mineral intake of a person's diet. In my experiment I will test five different types of tap water by evaporating them in a solo cup and measuring the mass of the cup to decide how many minerals were left behind. This project can help better administer proper dosage of multivitamins without going over the daily dosage allowance. The less mass, the softer the water. My results will be available on competition day.

SES111: Factors that Influence Light Pollution: a Systematic Review and Meta-Analysis

The skyglow is one of the most dramatic anthropogenic modifications to the Earth's biosphere.Though there are plenty of research focusing on the damage created by the pollution, little was known about its cause.This project would analyze the causes of skyglow other than artificial lights. A meta-analysis would be performed on the relationship between skyglow and environmental factors or city development factors. Conclusions are drawn from trends and patterns from the study of the data. The ongoing steps of the experiment include classifying data with visual representation and possibly building a mathematical function to describe the connection.

SES112: Oil vs Shrimp

n oceans, common occurrences of oil is found. The most intoxicating oil to marine life is crude oil. Since the oil is affecting marine life, mostly fish, giving them cancer, tumors, deformities, and sometimes causes suffocation from oil, I wanted to see if smaller ocean organisms are also being affected. I used three different oil levels to simulate an oil spill. A very small microorganism in the ocean is a brine shrimp. I added a thin layer of brine shrimp eggs over 355 mL of salt water in each of the 40 cups, having 10 cups per group. Once the eggs were added I put the different increments of crude oil into the salt water, making sure I had 10 cups with no crude oil to use as a control group. I mixed them with a toothpick, to separate the eggs sticking together, and the oil with the salt water. I let the eggs hatch and grow for a week feeding them every two days with crushed yeast. After they had hatched and grown for a week, I looked at three brine shrimp from each cup under a microscope and compared the brine shrimp from the cups to a normal brine shrimp also counting an estimate of how many were alive and dead in each cup.

SES113: Warm and Cold Air

Unpredicted severe weather can cause serious damage in countries where their systems for predicting storms are very basic. This is a big problem even in the U.S when a severe storm unexpectedly wreaks havoc on an unexpected town. I wanted to find a way to enhance the predictability of storms so I decided to test what happens when a cold air mass meets a warm air mass. This could help forecasters to know what most likely will happen when this common occurrence occurs. For my experiment, I will put a piece of cardboard in between an aquarium and pour cold and warm water on either side of the tank. Then I will drop blue food dye in the cold water and red food dye in the warm water. I will take pictures and record what happens when the cardboard is removed. The water is simulating the warm and cold air masses. Final results will be shown at the fair.

SES114: Shower Filtration for Residents of Flint

Lead contamination is an ongoing epidemic in the United States. While the most infamous and recent example of lead-poisoned water can be found in Flint, Michigan, lead contamination is a nationwide problem: a USA Today investigation found excessive levels of lead in 2000 different water systems across all 50 states. The cost to buy and install lead filters often isn't accessible to those most impacted by water crises, and in order to help combat this problem we have modeled and 3D-printed a cheap, easily-installed filter-attachment that allows lead-contaminated water to leave the sink and/or shower lead free.

SES115: Radishes and Radiation

Microwave ovens blast food with high levels of energy. This results in heating up certain fats and other ingredients in food. The energy simply passes through other substances without damage. If you microwave radish seeds before growing them will it affect the growth of the plant? If you put radish seeds in the microwave before growing them, then the radishes that are exposed to the radiation will germinate slower. Final results will be available on Fair Day.

SES116: Nitrates in Water Systems

Nitrates are a common water pollutant that can are linked with algae blooms. The purpose of my project is to use scientific instruments to identify nonpoint sources of pollution in a water source; to show the general public the impact of what non-point nitrate pollution can cause to the environment and local communities. I gathered materials, went to location, and analyzed data. All variables that will be testing: atmospheric temperature, water temperature, pH,conductivity, and parts per million of nitrate. The environment around testing location will be analyzed. Data will be available at presentation.

SES117: Coastal Preparedness for Hurricanes

The purpose of this experiment is to gauge eastern coastal cities for their hurricane preparedness. My hypothesis is that if coastal cities are gauged for preparedness then Miami, FL will be the most prepared due to having the most emergency responders. This project can help us to better prepare our coastal cities for hurricanes. I will set up data comparisons on all of the cities and analyze who is the most prepared. My data will be available on test day.

SES118: Can Heat Make Electricity

The purpose for this experiment is to determine if a heat box with a tesla turbine can be more efficient than a photovoltaic solar panel. Solar panels are made up of solar cells, which convert sunlight directly into electricity. Connected to the solar panel is a multi-meter to measure the amperage. I will do the same to the Tesla turbine in the heat box. In doing this, I can measure the energy produced. If the heat box with Tesla turbine produces more energy, my hypothesis will be correct. All results will be available at fair day.

SES119: Do Filtered Coffee Grounds Stimulate Plants?

For this project, the researcher will place filtered coffee grounds into soil planted with lettuce. The researcher thinks if you put a certain amount of filtered coffee grounds in the plant soil, then this will stimulate the growth of the plant because coffee contains high amounts of nitrogen, a necessity for plant life.The purpose of the experiment is to see if using the filtered coffee grounds, that we would normally throw away, can encourage better growth in plants.

SES120: UV Effects on Oil Booms

This research study investigates how well oil booms hold up to exposure to ultraviolet radiation, to improve the longevity and durability of oil booms in the case of an oceanic spill. My hypothesis is that Spunbond fabrics will work better than any other fabrics, which will allow for greater longevity in the case of an environmental emergency. I will complete my experiment by testing different fabrics in a UV weather chamber. Whichever material does not degrade or degrades at a slower rate is the best material to use. My final results will be available on fair dates.

SES121: Can Aquatic Plants be Used to Remove Ammonia From Fish Impoundments?

Purpose: To find a passive, inexpensive way to reduce ammonia levels produce from fish in fish impoundments. Hypothesis: The concentration of ammonia present in the water will decrease with the presents of aquatic plants. Procedure: 1. Create ammonia and water solution in testing containers. 2. Place plants being tested in the designated testing containers and have one with no plants (control). 3. Take a sample of water from each container. 4. Test the sample from the previous step for concentration of ammonia. 5. Repeat step 3-4 every 2 hours for the next 8 hours. Conclusion: Final results available at fair.

SES122: Earthworm Earthworkers

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.

SES123: How natural buffers can help our streams

The researcher will test five natural buffers to neutralize pH. This can help neutralize the pH of our streams that are affected by acid mine drainage to improve living conditions for aquatic life. The hypothesis is, if five natural buffers are added to vinegar, then calcium carbonate will neutralize it the best because it's meant to neutralize stomach acid, since vinegar is very acidic like stomach acid, it should make the very close to seven.

SES124: Common Herbicides and Artemia

The purpose of my project is to determine if common herbicides affect the hatching rate of artemia. First 25 brine shrimp eggs were placed in 100 Petri dishes. Then a 1% sodium chloride solution, round up solution, atrazine solution, and A mixed solution was made. 25 of the Petri dishes were filled with each solution. Plates were allowed to sit for 48 hours to hatch. After 48 hours the number of hatched brine shrimp were counted with a pipet. Data will be averaged. In conclusion brine shrimp were hatched in different solutions for 48 hours and counted.

SES125: Amount of Fish Affects on Plant Growth

I will be researching and testing how the amount of nitrate levels in the tank affects the plant growth. I will do this by using goldfish and basil plants. To do this, I set up two different fish tanks with two basil plants in each tank. Both tanks contained different amounts of goldfish so the nitrate level was changed in each tank. Not enough data was collected to make a conclusion. This project will be continued with a grow light to see if it changes my results.

SES126: Coal Ash on Daphnia

The purpose of this experiment is to test the effects of coal combustion byproduct (CCB) on Daphnia m.. To conduct this experiment I measured concentrations of coal into different groups and added water. Then I added the Daphnia m. and let the cups sit. After 24-hours I recorded deaths in the daphnia. My results showed that even at my highest concentration of 5% CCB to spring water, the daphnia had survived no different than the control samples. The data that I collected does not support my original hypothesis that even the slightest concentration of coal ash would kill the Daphnia.

SES127: Naled and Zebra Fish Embryos

The purpose of this experiment was to determine if Trichlorfon, an ingredient in Naled, an insecticide used for killing Zika-carrying mosquitos, alters normal growth patterns in zebra fish embryos. To find a concentration of Trichlorfon that was below the lethal concentration, multiple tests were performed during many preliminary experimentations with a variety of similar organisms. The treatment was then applied to the embryos and they were observed for a total of seven days. Please visit my project display for results.

SES128: Bug Spray Microbial Effects

Bug was added to staph and E-coli in different concentrations. Both liquid pulse and augur infusion exposures were done. The microbes were plated and incubated for 48 hours. Then results were counted. A significant effect on the survivor ship of the microbes were found at increasing concentrations of the bug spray. Results were graphed and stats were done.

SES129: Why you should reconsider using styrofoam

In America many materials could be diverted from landfills by being recycled. However, most Styrofoam products are not recyclable in the same way as various plastics. My experiment attempted to implement a better strategy to eliminate Styrofoam waste and educate people on how much trash they produce everyday and how it's harmful to the environment. Bacteria in mealworm's guts decompose Styrofoam naturally. Different amounts of mealworms were put in Styrofoam containers and the amount of Styrofoam consumed and CO_2 gas emitted was measured. After five trials, it was concluded that mealworms would not be a viable method for decomposing Styrofoam.

SES130: Mapping the Downstream Effects of Shale Drilling

The drilling of Marcellus Shale has evoked recent controversy, as the acidic chemicals used could potentially harm the environment. This study will focus on the drilling-heavy area of Sewickley Creek, a Y-shaped creek with a well on either branch. Water pH will be taken upstream, at the drilling location, and multiple locations downstream with the goal of finding a noticeable change in proximity to the well. If this change is found, the study will then seek to map the "danger zone" in which pH is abnormal and less than ideal.

SES131: The Power Plant's Effect on the Acidity of Snow.

The purpose of this experiment is to determine if the power plant affects the acidity of the snow less on the side the wind predominantly comes from more than the side it blows towards. During this experiment i have collected snow from different point around the power plant and tested the P.H. of these samples to determine if the snow on the side the wind blows from has a lower P.H. than the snow on the side the wind blows to. I expect the results to be that the P.H. is higher towards the direction that wind blows towards.

SES132: Using Flocculation to Clean Water

Drinking water comes from surface waters containing soil particles making the water murky. They are small and light, so it takes a long time until they settle in the water. This is a problem, since bacteria can stick to the particles, making the water unsafe to drink. To become clean, the water has to undergo treatment steps before it is safe to drink. The first step is getting rid of the total suspended solids with a process called flocculation. Flocculants, substances that help clump particles together so they can be filtered, are used to turn water from turbid to clear.

SES133: Grass metal pollutant Analysis

This experiment was to test the effects of metal pollutants on the environment. Four types of metal pollutants, Copper, Magnesium, Zinc, and Lead were being tested to see if they would affect the growth of grass. The grass seeds were planted and each was watered with the water that contained one of those metals. There was a control group that was just watered with de-ionized water. The grass was observed for physical and chemical changes. Once the grass was digested with acid it would be tested on an Atomic Absorption Spectrometer to see if the grass contained any of the metal pollutants.

SES134: Am I Swimming in Battery Acid or Bleach

This experiment was set out to see if the location of a natural body of water has an effect on its pH level. The experiment took place throughout Garrett County, Maryland and tested nine different bodies of water, which each fell into one of the following runoff types; farm area runoff, road area runoff, or natural area runoff. Garrett County is very rural with at times very in climate weather, along with many flourishing forests. Where there is farming there are chemical fertilizers, where there is a road there is sediment and road salt, and where there is a forest there is natural filtration which each could have an effect on the acidity of the natural waters. It is hypothesized as follows; if a body of water is found near a farm or crop field where possible fertilizers are used then the water will have a more acidic pH ranging from 6-4, if a body of water is found near a highly traveled road then the water will have a more basic pH ranging from 9-7, and if a body of water is found in a place surrounded by natural forest and habitat then the pH of the water will be more neutral pH ranging from 8-6. Procedure: On google earth find the body of water selected, look at the area surrounding land and features to determine the type of run-off it may be associated with. Create chart of which body of water goes with what type of run-off. Gather pH test strips, plastic baggie, scientific journal, and a pencil. Drive to the the selected testing locations one at a time throughout Garrett County. When you arrive at the testing location find two places surrounding the body of water to test the pH. Move to the first site selected; remove a test strip from the box and dip in water for 3 seconds then remove the strip from the water, wait 15 seconds then compare the strip colors to the diagram on the box to determine the pH. Record the pH of the water on a chart in the journal, make additional notes about observations of the land and water around the site. Move to the second site and repeat steps 6-7 with the new site you are located at. Repeat steps 3-8 for each of the water testing sites until all sites have been tested. Analyze the data recorded and compare the pH of the water tested and see if the surrounding area has had an affect on the water. Compare data to hypotheses and record findings. The concluded results of the experiment will be available at the presented exhibit on March 31, 2017 (Fair Day).

SES135: Caffeine's Effects on Zebrafish Embryos

In this project, caffeine in varying concentrations was given to zebrafish embryos, which were then observed for 96 hours. Growth, development, and heart rates were statistically analyzed. The null hypothesis was that the caffeine will not have any significant effects on zebrafish embryo growth, development, and heart rate.

SES136: Green Renewable Battery

Global Warming is a huge environmental issue faced today and is caused by greenhouse gases. About 82% of the total emitted greenhouse gases is carbon dioxide. My purpose was to collect this carbon dioxide (eliminating it from the air) and use it to produce electricity. I hypothesized that by increasing CO_2 gas pressure, I can dissolve more carbonic acid solution and thus increase electrolyte conductivity to improve the current of my galvanic cell that I had developed last year. The final results of the current will be available at exhibit on Fair Day.

SES138: Is solar power a cost effective solution for landscape lighting?

The purpose of this project is to determine if a 117 volt landscape lighting system could be converted to a 12 volt solar powered system and still be cost effective. I hypothesized the conversions from a 117 volt landscape lighting system to an environmentally friendly solar-power system would be cost effective in only one solar-based panel is used and the size of the battery is downsized. The 20 watt incandescent light bulbs will be replaced with 2 watt LED bulbs. A single solar panel will be used instead of multiple panels. Experiments will be performed to determine if the system could operate on a smaller battery. The cost of the solar conversion will be compared to the amount of electrical savings per year to establish if the conversion is cost effective. The final results of this research will be available at the student's exhibit on fair day.

SES139: Effects of Ibuprofen on Aquatic Plants

People take Ibuprofen everyday. It is disposed of through the kidneys and enters the water system. It isn't treated in waste treatment facilities so small amounts of Ibuprofen are in water. Hypothesis stated the more Ibuprofen in water, the less an elodea plant will grow. This was tested by concentrating different amounts of Ibuprofen in water and filling aquariums with multiple elodea plants. Plants grew and measured for height every other day. Current data shows the aquarium with the highest ibuprofen concentration is limiting plant growth, but full results will be available on fair day.

SES140: Pin(e)s and Needles

Some coniferous plants produce chemicals that inhibit the process of cell division. These plants could act as an organic alternative for herbicides can help the environment and increase the demand on natural products for consumers. Will these plants exert an inhibitory effect of the germination of radish seeds? If radish seeds are grown using a mixture of pine, spruce and fir then, the seeds growing with spruce will have the lowest germination rate and the control group will have the highest. A Leachate will be made from each conifer and will be used to grow radishes; the amount germinated will be recorded. Results will be available on Fair Day.

SES141: What soil do earthworms grow in best?

The purpose of this project is to discover what gardeners should use in their gardens to keep the earthworms healthy and productive in making the soil ideal for plant growth. The hypothesis states that the worms would grow better in cow manure due to the abundance of organic matter in the manure. I placed twelve worms in four wood and plexiglass containers with different types of soil mixtures in each container; natural soil, cow manure mixture, organic matter mixture, and coffee grounds mixture. I weighed each set of worms every week for three weeks. After the experiment, the worms in the cow manure grew better than the worms in the other types of soil.

SES142: Water Filter Effectiveness

The purpose of this investigation is to determine what water filter is the most effective for spring water. The researcher's hypothesis is the Brita water filter will work the most effective for spring water. The researcher will test the untouched spring water using the testing kit. There are three water filters the researcher will be using; Brita Water Filter, GoldTone Water Filter, Water Water Filter. After testing the water the the researcher will test each filter. Data will be collected and analyzed to establish the most effective filter for spring water. Data will be available on the day of competition.

SES143: Evaluating the Accuracy of the Small Angle Formula

With NASA's current plans to institute extraterrestrial bases, astronomical research to determine suitable locations is important. The Small Angle Formula (SAF) uses a celestial body's angular size and distance from earth to estimate diameter. My experiment will determine the formula's accuracy using styrofoam balls of different sizes. I will place each ball 1.500 meters from myself and find its angle with respect to the surface. Using the SAF, I will calculate each diameter and find its percent error. I predict that increasing angular sizes will result in increasingly inaccurate computations. Final results will be available at my exhibit.

SES144: Isolation of phages to treat bacterial infection in farm fish

Bacteriophages were discovered in 1915 by Frederick W. Twort, who had discovered the properties of phages in curing diseases. At this time, not much was known about phages and how to isolate or use them as cures. As time wound on, many scientists started to recognize the healing effects of the Ganges River, in India. Surprisingly, these "cell eaters" were found in masses in the river. Soon, there was a viable connection found between bacteriophages and bacterial cell destruction. If possible, life saving phages can be isolated from certain abundant sources such as water. If a bacteriophage can be isolated from a water sample, then widespread treatment can be very effective, and cheap. There would be no more need for chemical antibiotics, and treatment for any bacterial infection would be safe, cheap, and reliable.

SES145: Effect of Lunar Cycle on Methane Emission

Over the past 150 years, many gas wells in Pennsylvania have been drilled, abandoned, and sealed incorrectly. It's unclear how severely these old wells contribute to methane emissions, and my experiment dealt with estimating average leakage. If it was known how the well emissions correlate to the lunar cycle, it would give inspectors a more reliable way to measure the emissions of a well. Over three months, regular measurements were taken of the flow rate and methane concentration of the leakage from one well. The data didn't show a significant correlation, and I'm planning more experiments on the subject.

SES300: Fish Tank Sustainability

The team observed a fish tank of tilapia. It was then determined what would be needed to measure. Next, each student found a sensor to measure the pH, temperature, salinity, and chlorinity of the tank. Afterwards, the team met with Carl Lotz, a professional consultant, to discuss the team's project ideas and possibility of identifying and purchasing sensors and other equipment for the project. Mr. Lotz is providing us with a system to coordinate the data. With this we are going to coordinate with a school in California who is using a similar fish tank to provide a self sustaining food system an orphanage in Guatemala.

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SES301: The Effects of Acid Mine Drainage on the Development of Zebrafish Embryos

Acid mine drainage is a problem in areas surrounding abandoned mines. The objective of our research was to observe and record possible effects that acid mine drainage could have on an aquatic ecosystem. In our study, water was sourced from a stream, Millers Run, with known acid drainage from a local mine. It was then put into dilutions of petri dishes of 100%, 66%, 33% and a control with 0%. Zebra fish embryos were added and were monitored for approximately seven days using a stereomicroscope and compound microscope. While there was only a slightly higher mortality rate in the higher concentrations of mine drainage, the biggest difference was the physical abnormalities noted in the higher concentrations and absent in the lower concentrations. Interestingly, the iron oxide in the mine water was attracted to the chorions of the embryos. This could be one reason for a higher mortality rate in the higher concentrations. Due to the higher than expected mortality rate overall, the experiment will continue with trial 2 and a new set of embryos in the dilutions of acid mine drainage.

SES302: The Green House

The project is in the environmental category. The purpose of the experiment was to determine the roofing material with the best insulative property. Four houses were made and were each topped with a different roofing material. The temperature changes from inside to out were recorded every few minutes. Average temperatures were found. The results were inconclusive as to which roofing material had the best insulative property.

SES303: The Effect of Different Types of Soil on the pH of Water

"The Effect of Different Types of Soil on the pH of Water" is the title for a science fair project that falls under the category Environmental Science and has the purpose of discovering the effect of different soil types on the pH of water. Soil was collected from four locations and placed in containers. pH of each soil was tested and then water was put over the soil. It was left to mix for one hour, one day, and two days. The pH levels of Deep Creek averaged 7.17, NHS averaged 7.31, Yough averaged 7.53, and the mine averaged 7.54.

Medicine / Health / Microbiology (SMH)

SMH100: Antibacterial Activity of Aqueous and Methanol Extracts of the Clubmoss Lycopodium obscurum

In Native American medicine, the clubmoss Lycopodium obscurum was infused in water and used as an eyewash. In this experiment, aqueous and methanol extracts of L. obscurum were screened for antibacterial activity against Escherichia coli using the agar diffusion test. It is hypothesized that the extracts of L. obscurum will exhibit a measurable inhibition of growth on E. coli at 37°C. Measurements of zones of inhibition were taken after 18, 42, and 66 hours. Data will be analyzed using an ANOVA test. Results will be available on the day of the fair.

SMH101: The Spice Test

The purpose of my experiment is to determine whether turmeric and curcumin improve memory. I will feed Drosophila melanogaster (fruit flies) with turmeric and regular medium, curcumin and regular medium, or just regular medium for the control. I will form memories in the fruit flies using classical conditioning. I will test the memory of the Drosophila to evaluate the effects, if any, from the turmeric and curcumin. I will then analyze my data. The results of my experiment will be available on competition day.

SMH102: Dissolution Rates of Pill Casings in Stomach Acid

Please visit student's exhibit.

SMH103: RTI Analogs on ECM/Fibroblasts

Full-length The Individual and Synergistic Effects of Reverse-Transcriptase Inhibitor Analogs on Extracellular Matrix Formation and Fibroblast Cell Proliferation. Reverse-transcriptase inhibitors are medications given to people diagnosed with HIV. There are many different RTIs, which makes prescription a vital aspect of diagnosis. In third-world nations, transmission of HIV is more likely due to lessened access to medications. A common means of transmission is the prevalence of open wounds. In such nations, one would think that it would be advantageous to prescribe such a patient with an RTI that is efficient in the both the reverse-transcription of viral DNA and wound healing. This study tests with RTI analog is most effective at fibroblast cell (3T3) proliferation and ECM formation. This experiment has vital applications in the field of tissue engineering, particularly the prescription of third-world patients diagnosed with HIV.

SMH104: Can you zap that zit? Home remedies put to the test

60 million americans suffer from acne. Most people feel frustrated or controlled by their acne. This project could benefit both people and scientists alike. I am testing the organic method of treating acne on E. coli by using home remedies. The purpose of this to see which home remedy works best without harmful medication. I will be growing 3 agar plates of bacteria to test toothpaste, lemons, and tea tree oil. My hypothesis is if I test toothpaste on the bacteria, then it will kill bacteria best because it is made for killing bacteria. Results will be available by competition.

SMH105: Effect of Essential Oils on S. epidermis

The purpose of my project was to determine which of the most proven essential oils; Eucalyptus globulus, Rosmarinus officinalis, Pelargonium graveolens, Cinnamomum verum, Lavandula angustifolia, Cymbopogon flexuosus, has the most bactericidal effects when tested on Staphylococcus Epidermidis. In order to avoid bias, each container was covered with a blank label and numbered one through six. The bacteria was swabbed onto a blank Petri dish of agar. Diffusion discs were saturated in essential oil and placed into quadrants of each Petri dish. The bacteria is grown for 48 hours and zones of inhibition are measured in millimeters. After observation and data was taken into consideration conclusions are drawn.

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SMH106: Do GMO Starches Negatively Affect the Growth Rate of Physarum polycephalum?

Purpose: Determine the effect of GMOs on Physarum polycephalum's growth. Hypothesis: GMOs will negatively affect the growth of Physarum polycephalum. Procedure: 1.Prepare GMO and non-GMO starch solutions being tested. 2.Place an oat flake soaked in the GMO or non-GMO starch being tested on a petri dish containing the Physarum polycephalum. 3.Wrap the petri dish prepared in step 2 in aluminum foil and place it in a sealed container placed in a dark closet. 4.Measure the growth of the Physarum polycephalum after incubating 24, 48, 72 and 96 hours. 5.Repeat steps1-4 with the other GMO or non-GMO starches. Conclusion: Final results available at fair.

SMH107: Effects of IGF-1 and FGF-2 Growth Factors on 3T3 Cells

The project is being done to look at different levels of growth in C2c12 cells upon using different growth factors. C2C12 cells are myoblasts, meaning that they create muscle, but some people have a condition called atrophy which results in the degeneration of these cells. i'm testing to see how growth factors can counter the mechanisms of atrophy. So the cells will be cultured, trypsinized, passaged, then grown with the growth factor, and hopefully there will be excessive growth.

SMH108: Evaluation of Novel Antimicrobial Peptides in Killing Drug Resistant Bacteria

Bacterial infections caused by strains of bacteria like P. aeruginosa and K. pneumoniae can lead to the spread of biofilm, especially when bacteria are inhaled. Biofilm, an aggregated clump of bacteria, is dangerous because it becomes increasingly difficult to remove as more bacteria become part of it. When biofilms form on human tissue, the AMP Colistin is often used as a recourse to halt biofilm spread, sometimes unsuccessfully. Although research is not complete yet, initial results suggest that lower concentrations of peptides from the a4 series could be more efficient in killing the same amount of bacteria at lower concentrations.

SMH109: The Accuracy of a Fitbit

I have chosen to test the accuracy of a FitBit Flex. My hypothesis what that the FitBit was not going to show evidence that is was recording properly. Everyday I would have a volunteer walk five laps around the upper hallways in the school, once with the hand counter and once with the FitBit. The data was recording at the end of each of the ten laps. After looking at my data and finding the averages, the two methods were only off by 1 step. I believe future tests would be needed to validate my hypothesis.

SMH110: Which Brand of Deodorant Spray Is Most Effective In Inhibiting Bacterial Proliferatrion?

Purpose:Determine which deodorant is most effective in inhibiting bacteria. Hypothesis:The ability of the deodorants to inhibit bacteria will occur in the following order: 1.Herbal Choice(Best). 2.Naturally Fresh. 3.Crystal Body. 4.Thai Crystal(Worst). 5.Saline Solution(Control). Procedure: 1.Prepare a nutrient-broth/S.epidermidis solution containing one deodorant. 2.Determine the %transmittance using a spec20 at0,24,48,and72hours. 3.After72hours prepare a10-7serial-dilution and inoculate 8 nutrient agar plates. 4.Repeat step3for the other deodorants and incubate for72hours and determine the number of colonies present on each plate. 6.Dip a sensitivity-disk into one of the deodorants and place it on 8 petri-dish inoculated with S.epidermidis. 7.After72hours determine the average zone-of-inhibition. Conclusion:Available at fair.

SMH111: Could viral be the new antibacterial?

Please visit student's exhibit.

SMH112: Round-up's Effect on Gut Microbiome

Previous work suggests that one dose of Roundup significantly inhibits growth of beneficial more than detrimental human gut bacteria. The effects of repeated Roundup exposure are unknown. Over 6 days, beneficial and detrimental human gut bacteria were repeatedly exposed to Roundup doses at concentrations found on food (10ppb, 100ppb,1000ppb) and growth was measured. Beneficial growth decreased 55%. Detrimental growth, while initially decreasing, recovered to 95% of unexposed growth. Regardless of dose, repeated exposure was significantly more harmful to beneficial than detrimental bacteria ($p < 0.00005$). Repeated Roundup exposure may cause gut dysbiosis, which is associated with serious diseases.

SMH113: How fast do antacids work?

Have you ever had a painful, burning sensation in your chest that does not seem to stop? You might need to take an antacid. An antacid is used to neutralize acidic environments inside the stomach and are used to help treat things like acid reflux and heartburn. Acid reflux happens when the esophageal sphincter, the thing that closes the esophagus after eating, is not strong enough to close. As a result, the stomach acid moves into your esophagus, leading to a burning feeling in your chest. Heartburn, although has nothing to do with your heart, is a burning or tightening in the chest and is often mistaken as a heart attack. Antacids come in a variety of different brands that are different prices. This experiment will determine whether or not generic brands of antacids work as well as name brand antacids. It is hypothesized that the generic antacids will work just as well as the name brand antacids. The results will be presented at the science fair.

SMH114: SLS & Fluoride on Teeth

Some studies say that sodium lauryl sulfate, or SLS, when added to toothpaste, decreases the amount of fluoride deposited on teeth, decreasing the effectiveness of the toothpaste. I tested this by brushing eggshells with toothpaste samples: once with 0g SLS, once with 0.1g, once with 0.5g. I rinsed the toothpaste off with distilled water, and found the fluoride content of each solution using fluoride test papers. I found the area of reaction was largest with 0g SLS, smaller with 0.1g, and practically invisible with 0.5g, so I conclude that SLS in toothpaste decreases the amount of fluoride deposited on teeth.

SMH115: Preventing Alzheimer's

Elevated levels of fructose lead to early onset Alzheimer's however, DHA can reverse those effects. Drosophila melanogaster was used to demonstrate the best method for Alzheimer's prevention by means of a locomotor assay to determine their crawling capability. In three groups, reduced fructose, DHA, and a control (high fructose), the eggs were hatched within the experimental mediums and developed for an additional 3 days. Due to the DHA group dying, the results were inconclusive. However, the control and reduced fructose groups had a significant difference leading me to believe that a reduction of fructose your diet would also be significant.

SMH116: Bacterial Reaction to Copper

This research tests the effect that copper (II) sulfate (or cupric sulfate, CuSO4) mixed into LB Agar plates has on the growth of the bacterium E. coli on such plates. Solid copper has known antimicrobial properties and has the capability to kill bacteria on contact as well as causing the deterioration of DNA - the process causing this is somewhat unclear, but likely involves the uptake of copper ions (Grass). Copper (II) sulfate may have similar properties, and it has been used in the past as a pesticide (USDA). This research found that at 6.25millimolar concentration of copper sulfate in LB/Agar there appeared to be limited growth and that at concentrations above 12.5 no growth occurred. While any specific test was insufficient to prove that there was a significant effect, considering all results with an ANOVA test resulted in a finding that copper sulfate did have a significant effect.

SMH117: Does the Diameter of an Endotracheal Tube on a Respirator Affect the Amount of Medication Delivered to a Patient?

Purpose: Determine if diameter of an endotracheal tube affects the amount of medicine a patient receives. Hypothesis: As diameter of the endotracheal tube increases, the amount of medicine a patient receives will increase. Procedure: 1.Determine mass filter before attaching it to endotracheal tube. 2.Place 3 mL NSS and 1 mL food coloring into nebulizer to simulate standard dose medicine patient receives. 3.Attach 7.0 mm diameter endotracheal tube to ventilator and run for 15 min. 5.Remove the filter and determine its mass. 6.Using a color scanner determine optical density of liquid on filter. 7.Repeat steps 1-6 twenty-nine times. 8.Repeat steps 1-7 using other diameter endotracheal tubes. Conclusion: Final results available at fair.

SMH118: Does Bleach Break Down Bacteria

The researcher will study the best method to lower contamination risk within the milk supply by finding the best method to clean washcloths used in the milking process. Utilizing different bleach and detergent solutions, bacterial colonies will be analyzed dependent on their response. If washcloths are cleaned with bleach and detergent, then the bacteria will be reduced the most in count. Investigation will be done by preparing agar plates and transferring bacteria onto them before and after cleaning. The researcher will grow and record the colonies and finalize the data. Results will be available on fair day.

SMH119: Which Natural Herb Inhibits Bacterial Proliferation Best?

Purpose:Which herb inhibits bacterial proliferation Hypothesis:Bacterial inhibition greatest-least;usena, creosote root, sarsaparilla root, yarrow. Procedure: 1.Inoculate 50mL nutrient broth with E.coli and 50mL with S.epidermidis;incubate for 48hrs. 3.Prepare herb solutions with 10g of herbs,10mL water. 4.Add 1mL solution to 49mL nutrient broth. 5.Inoculate solution with E.coli solution;incubate at 37ºC. 6.Prepare 10-7 dilution;inoculate 4nutrient agar petri dishes with 1mL. 7.Incubate for 72hrs. 8.Count E.coli. 9.Repeat steps 4-8 for herb solutions. 10.Repeat steps 3-9 for S.epidermidis solution. 11.Dip sensitivity disk into herb solutions. 12.Place in center of 4petri dishes inoculated with E.coli. 14.Repeat steps 11-13 for different herb&using S.eperdermidis. Conclusion:Results at fair

SMH121: Solubility of Pain Medicines

Ibuprofen takes between ten and fifteen minutes to dissolve completely, slower than desired for most. The goal of this experiment is to create a capsule for oral delivery that dissolves faster than brand name pain medicines. To create this capsule, collagen was used as opposed to gelatin. Collagen is composed of organic plant material, making the substance more water-soluble than gelatin. To test this, simulated stomach was created, using hydrochloric acid and human enzymes. The simulated fluid will match the pH and temperature of a human stomach. Results are ongoing and will be ready for day of science fair.

SMH122: Fusion Genes as Drivers of Breast-Brain Metastasis

Fusion genes were shown to be potential mediators of cancer progression, specifically metastasis, in a preliminary study. It is hypothesized that fusion genes that retain domains regulating protein kinases will promote metastasis due to the role of kinases in regulating growth. To test this, RNA was sequenced for 30 patient matched pairs of breast to brain metastases. Using this RNA-seq data, gene expression was calculated and fusions were called. The gene partners for each fusion were then annotated and used along with the gene expression data in a script that identified differentially expressed fusion genes with functional domains regulating protein kinases for ongoing investigation.

SMH123: Which Metal Nanoparticles Inhibit Bacterial Proliferation the Best?

Purpose:Determine which metal nanoparticle has greater effects on proliferation of S. epidermidis. Hypothesis:The ZnO will inhibit proliferation better. Procedure: 1:Prepare 550mL Nutrient Broth. 2:Inoculate 50mL broth/w2 loops of S. epidermidis, incubate 72hrs. 3:Place 1mL into 11 tubes containing 49mL of nutrient broth, 11 with water. 4:Add 0.5,1 mL of nanoparticles to 22 tubes. 5:Incubate solutions 72hrs. 6:Prepare dilutions 10-7. 7:Plate 1mLon Agar Plates. 8:Incubate plates 72hrs. 9:Count bacteria colonies. 10:Place 1mL of solution from step 2 onto 10 plates. 12:Place sensitivity discs into water from 3-4, place on petri dishes. 13:Incubate plates 72hrs. 14:Measure zone of inhibition. Conclusion:Results at fair.

SMH124: Developement of an In vitro model to investigate the role of Klotho in Skeletal Muscle Regeneration

Regenerative capacity of skeletal muscle decreases with age, as does longevity protein Klotho. We sought to develop an in vitro model recapitulating an in vivo observation that Klotho prevailed in mouse muscle following injury. A myoblast monolayer was "wounded," the healing process and Klotho levels were observed to evaluate model viability. Model was used to test effects of Klotho supplementation and silencing on regeneration. Cells were exposed to high- and low-serum media to associate Klotho with cell proliferation or differentiation. In vitro results suggest that Klotho supplementation facilitates muscle regeneration, knockdown inhibits it; Klotho promotes cell proliferation and healing.

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Regenerative capacity of skeletal muscle decreases with age, as does longevity protein Klotho. We sought to develop an in vitro model recapitulating an in vivo observation that Klotho prevailed in mouse muscle following injury. A myoblast monolayer was "wounded," the healing process and Klotho levels were observed to evaluate model viability. Model was used to test effects of Klotho supplementation and silencing on regeneration. Cells were exposed to high- and low-serum media to associate Klotho with cell proliferation or differentiation. In vitro results suggest that Klotho supplementation facilitates muscle regeneration, knockdown inhibits it; Klotho promotes cell proliferation and healing.

SMH125: Contact Conditions and Solutions

Contact lenses have become more and more popular as the years go on, due to it being the simplest way of correcting someone's vision without them having to wear glasses. According to the Center for Disease Control (CDC) there are around 125 million people that wear contacts in the world. The purpose of this experiment is to inform those who use contact lenses on the bacteria that may be present, and how various solutions can alter that. This experiment should also help indicate which solution is better to use based on the effectiveness, price, or both. Silicone hydrogel, colored, and daily disposable lenses will be tested by applying bacteria grown in a pertri dish onto the contact and placing it into each solution, later on detecting the amount of bacteria that solution had removed. Overall this experiment will help determine that if the lenses are placed into a solution that contains a pH of 7 or higher, then more bacteria will be removed from the contact. It is important to understand what types of bacteria could be living on your contacts and what the best way to get rid of those would be. The final results of this experiment are still being measured and will be available at the Science Fair.

SMH126: Anti Cancer Effects of Broccoli

This study was conducted to test the hypothesis that broccoli extract will slow down the growth of cancer cells by killing the cells faster than the rate at which they will multiply. Normal and cancer cells were treated with different concentrations of broccoli extract to test the cell viability and proliferation. My hypothesis was supported by this experiment. The inclusion of broccoli extract resulted in apoptosis because pre-apoptotic gene expression in the cells increased. Statistical analysis verified the results that broccoli extract had slowed down the growth of cancer cells by killing them faster than the rate at which they multiply.

SMH127: Shedding Light on Microbial Bioload Reduction

The purpose of this investigation is to determine if heat and sanitization alone is as effective in reducing microbial bioload as heat and chemical sanitization. I hypothesize that water will be as effective as chemical sanitization in reducing microbial bioload. Procedure: 1. Ten test points determined. 2. Soil ten test points. 3. Set a baseline. 4. Heat/sanitization dishwasher run. 5. ATP swab surface of ten test points after cycle; insert samples into Luminometer. 6. Repeat process on next cycle with detergent. 7. Continue 50 pod and 50 non-pod test protocols. 8. Record results. 9. Analyze data. 10. Draw conclusions.

SMH128: Echocardiographic Predictors for Recurrence of Atrial Fibrillation

Background: Whether echocardiographic abnormalities predict failure of maintenance of normal rhythm in the context of a rhythm control strategy for Atrial Fibrillation (AF) is controversial. Objective: This study was done to evaluate the relationship between three echocardiographic abnormalities and AF recurrence in patients treated with a rhythm control strategy. Methods: A total of 2522 consecutive AF patients prescribed anti-arrhythmic medications for rhythm control of AF from 2009-2013 and who also had echocardiographic data were included in this study. Cox proportional- hazards models were used to assess relationships between echocardiographic parameters and AF recurrence. Results: Mean age was 69 ± 12 years with 58% men and 95% white. 58% had paroxysmal AF and 42% had permanent AF. Left ventricular ejection fraction (EF) was >50% in 79%, mild-moderately reduced (35- 49%) in 11.1%, and severely reduced (<35%) in 7.9%. Mean left atrial (LA) size was 4.25 ± 0.78 cm, and 53.2% had moderate or greater mitral regurgitation (MR). During a mean follow-up of 29 months, increased LA size (> 5cm) was significantly associated with increased risk of AF recurrence (Figure); the effect of LA Size (HR=1.45, p=0.01) remained consistent after adjustment. Neither LVEF nor MR was significantly associated with AF recurrence (Figure). Among patients with EF <35%, LA size>5.0 cm, or severe MR, greater than 65% of patients in each of those groups maintained sinus rhythm for at least six months. Conclusions: Increased LA size was significantly associated with higher risk of AF recurrence, but reduced EF and presence of MR were not. A rhythm control strategy should not be ruled out in AF patients with reduced EF or moderate-severe MR.

SMH129: Manipulating Immune Checkpoints with Anti-Vascular Drugs

Introduction: The expression of immune checkpoint co-inhibitory molecules in the tumor microenvironment prevents protective anti-tumor immunity. Mitigation of hypoxia in the TME through vascular normalization could reduce their expression. Hypothesis: Expression of immune checkpoint molecules will be reduced in tumor cells treated with the vascular normalizing drugs rocilinostat (HDAC6 inhibitor) or ganetespib (HSP90 inhibitor). Methods: Murine renal cell carcinoma cells were cultured in six-well plates and treated with 10-fold dilutions of rocilinostat or ganetespib beginning at 125 or 100 micromolar, respectively. The cells were harvested after 24 or 48 hours, and stained for PD-L1, PD-L2, HVEM, and CD80. Expression differences of the checkpoint molecules were assessed with flow cytometry and qRT-PCR. Results: Expression of immune checkpoint molecules remained unaffected by low concentrations of inhibitors, but significantly increased at higher concentrations, thus not supporting the hypothesis. Notably, stimulatory CD80 expression increased at low concentrations, which suggests rocilinostat and ganetespib are immunostimulatory at lower concentrations, but immunosuppressive at higher concentrations.

SMH130: Effects on Immunoresolvins on Mast Cells

Mast cells serve an important role in the human body as defenders, holding the potential to release chemical alarms like histamine as well as multiple pro-inflammatory mediators including the cytokines, interleukins (IL) - 6 and -13. These cells play a central role in allergic disease and anaphylaxis, and related disease is considered to be a consequence of improper activation of the immune response. Both IL-6 and IL-33 are related to the pro-inflammatory response, and IL-33 has shown to induce the release of both mentioned cytokines. Accordingly, immunoresolvins are molecules that have the ability to resolve an acute inflammatory response, and lipoxin A4 has shown to have both potent anti-inflammatory and pro-resolving actions. As such, we predicted lipoxin A4 would block the release of interleukins -13 and -6 on interleukin -33 activated mast cells. Murine bone marrow mast cells were activated with different concentrations of IL-33 in the presence of lipoxin A4 for 24 hours. Then, an ELISA analysis showed that IL-13 release was significantly lower in lipoxin treated cells than in control cells, while there were no discernable effects on IL-6 release. Conclusively, Lipoxin A4 was shown to block IL-13 release, while there was no effect on IL-16 release.

SMH131: DNA Methylation Status of Mitochondria Post TBI

This project will focus on investigating whether there is a correlation between DNA methylation and different outcomes attained after traumatic brain injury (TBI). The methylation of NDUFAF2, a nuclear gene that catalyzes the transfer of electrons from nicotinamide adenine dinucleotide hydrate (NADH) to ubiquinone (coenzyme Q) as the first step of the mitochondrial respiratory chain, will be experimented upon. The hypothesis states that increased DNA methylation within the gene will associate with a more positive outcome after a TBI, because DNA methylation helps regulate healthy cell function. In order to test this hypothesis, DNA samples from patients with positive and very adverse outcomes will be analyzed for the degree of methylation utilizing specific enzyme digestion, PCR and other molecular genetics laboratory techniques. A statistical analysis of the data will help test the hypothesis.

SMH132: Improved Cancer Vaccines through Cytosine Research

One of every four deaths in the United States today, is from cancer. This year, around 564,800 Americans are expected to die from cancer. Vaccines are designed to stimulate the immune system to react to this cancer. However, these vaccines have limited success due to the resulting less mature dendritic cells, which specifically (in this case) fails to produce a cytokine, interleukin 12 (IL-12). If a method to efficiently produce this IL-12 is standardized, the chance of a vaccine succeeding is significantly increased. The method I am researching, involved the integration of cytokine interleukin 4, and interleukin 10.

SMH133: Countering Free Radicals with Antioxidants

Antioxidants are used to enrich diets; however, most individuals do not know what purpose they serve in the body. Antioxidants counter free radicals which are unstable molecules that try to bind to molecules in the body. Free radicals cause heart disease and types of cancer. Antioxidants have the power to counter these free radicals; therefore, it is important to know which antioxidants are the best at countering. To test this, a substance containing free radicals will be mixed with antioxidants, hypothetically creating a stable environment for plants to germinate in. This knowledge can be used to guide the public's diet.

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SMH135: The Antibacterial Properties of Different Dried Fruits

Purpose: To determine which fruit has best antibacterial properties &what amount inhibits bacteria growth. Hypothesis: Ability to inhibit bacteria will be (least to greatest): control,dried apricots,dried cherries,raisins,prunes. Experimental Procedure: Step1 Grind the fruits. Step2 Make 850mL of nutrient broth & distribute between 17 tubes. Step3 Inoculate tubes w/ E.coli. Step4 Place different amounts of fruit in tubes. Step5 Determine the absorbance &transmittance for tubes with spec 20. Step6 Repeat step 6 after 24, 48, & 72 hours. Step7 Perform a 10^-8 serial dilution & put 1 mL of solution onto a petri dish. Step8 Count colonies on plates. Conclusion: Final results available at fair.

SMH136: Not used

SMH137: Are There Natural Organic Oils and Extracts That Are More Effective at Inhibiting Bacterial Proliferation Than Penicillin?

Purpose: Determine which natural oil/extract is most effective at inhibiting bacterial proliferation compared to penicillin. Hypothesis: Ability of oils/extracts to inhibit bacterial proliferation will occur in this order: • Olive leaf extract. • Tea tree oil. • Oregano oil. • Grapefruit seed extract. • Penicillin. Procedure: 1.Prepare nutrient broth.Inoculate with S. epidermidis.Incubate.Repeat using E. coli. 2.Inoculate petri dish with 1mL solution.Dip antibiotic disk in oil/extract.Place in center. 3.Incubate.Determine/record inhibition. 4.Repeat using E. coli solution,penicillin ,oils/extracts. 5.Prepare solution using nutrient broth,S. epidermidis,oil/extract. 6.Incubate.Perform 10-7 dilution. 7.Inoculate with 1mL solution.Incubate at 37ºC for 72hrs. 8.Determine/record colonies. 9.Repeat for E. coli and oils/extracts. Conclusion: Results available at fair.

SMH138: Secondary Function of Him-5

For meiosis to occur, a double strand break (DSB) has to occur to ensure a successful crossover and proper segregation of chromosomes. One gene that helps to facilitate these DSBs is Him-5. Preliminary data suggests that Him-5 may have additional roles in crossover formation post-break formation. To test this possible secondary function, I will make double mutants with genes required for crossover resolution with fundamental Mendelian genetics. I will analyze the pertinent oocytes using microscopy and interpret the results with velocity.

SMH139: Cleaning Schools with Non-Toxic Solutions

In my project, Cleaning Schools With Non-Toxic Solutions, I tested the effectiveness of standard cleaners versus non-toxic cleaners. In my research I found that some soaps contain harmful chemicals to humans and the environment. I swabbed bathroom toilet handles and I chose this area because I felt it would contain the most bacteria. I cleaned the handles with Lysol, a non-toxic cleaner, and a 10% bleach solution (3 handles, each cleaned with different product).I swabbed the handles again and applied the specimen to the petri dish. In my results each of the cleaning products killed more than 98% percent of the bacteria. In conclusion, the non-toxic cleaner was just as effective as the standard and bleach solutions, which shows that it can be a safer alternative to toxic cleaners.

SMH140: Can a Silver Ion Solution Inhibit Bacterial Proliferation?

Purpose:If silver-ion solutions can inhibit bacteria. Hypothesis:Concentration of silver-ions increases the ability to inhibit bacteria. Procedure: 1:Place silver-wire test-sample in apparatus. 2:After30minutes remove50mL sampled-water from apparatus & create nutrient-broth solution--inoculate solution with one loop E.coli. 3:Using spec20 determine % transmittance of bacteria present at 24, 48, and 72 hours. 4:After incubating for 24hours prepare 10-7serial dilution E.coli/nutrient-broth solution prepared in step2. 5:Inoculate4sterile nutrient agar petri-dishes containing 1mL of serial dilution prepared in step4 & incubate Petri-dishes for 72 hours at 37˚C. 6:After incubating for 72 hours determine & record number of E.coli colonies present on each petri dish. 7:Repeat steps 1-6 after incubating for48 and 72hours. 8:After apparatus containing silver-wire test-sample runs for 60, 90,and 120 minutes repeat steps1-7. 9:Repeat steps1-8 using S.epidermidis. Conclusion:At fair.

SMH141: Comparing porcine hepatic xenotransplantation to allotransplantation: a meta-analysis of collected data

Twenty-two people die each day waiting for an organ transplant. Xenotransplantation could solve this problem and save thousands of lives. The purpose of this project is to see which is more successful: allotransplantation (same species) or xenotransplantation (different species), specifically with livers. A database of past hepatic transplants was analyzed; graphs were created to compare two separate successful experiments. The implications of the result could be that xenotransplantation is far from becoming as successful as allotransplatation, or that it has growing potential to become mainstream. Final results will be available on fair day.

SMH142: Specific Mutation Pinpointing in CHD1

My project explores the interaction of amino acid Y1454C with the Chd1 protein. Y1454C is an amino acid that is most commonly found in prostate cancer cells; Chd1 is a protein that is found in all human beings. So, my project is exploring introducing Y1454C to Chd1 to see if the Chd1 gene will mutate or not and the mutation that occurs from this. This project, once complete may have a vast implication: a discovery into a potential cause of producing Chd1 may help us (society) further understand how cancer works. A Chd1 mutation is especially important, since it is in all humans. Further research could understand in the amino acid mutation could be a heredity affect. As of right now, I have optimized the forward primer used in PCR with Y1454C, but I am continuing research into optimizing the reverse primer used with Y1454C. This is great research thus far, as my attempts to optimize PCR can be described as dismal at best; however, this project is ongoing and further developments will continue through lab research. I am currently working om optimization and preparing for yeast cell transformation.

SMH143: Analysis of Antimicrobial 3D-Printer Filament

My project is based on testing the effectiveness of new, antimicrobial Purement PLA filament in 3-D printed objects. 3-D printing has gained popularity and is being used more commonly in children's toys, classrooms, and homes. I will compare this new filament technology- that is supposed to prevent microorganism growth on its surfaces- to that of a non-antimicrobial filament, via microorganism growth results. For testing, I will use a non-pathogenic strain of E. coli and nutrient media to expose 3-D printed parts, dilute the parts in a buffer, sample the buffer, and swab it onto a nutrient agar plate, comparing growth.

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SMH144: Effect of Cytokines on Glucocorticoid Receptor Function

25 million people have a diagnosis of asthma in the US of which 10% are severe asthmatics. Severe asthmatics' symptoms do not improve with conventional treatment. My hypothesis stated if one or more cytokines that are produced in excess in the airways of severe asthmatics inhibit the function of the Glucocorticoid Receptor (GR) which impairs its ability to suppress inflammation and improve symptoms in severe asthma. Vector DNA were introduced to the monocytic cells in order to express luciferase gene, which was made from the GR. The effect of Dexamethasone, as it is a ligand. Combined with the cofactors, the luminescence of the luciferase protein could be directly correlated with the activity of the GR.

SMH145: What's so bad about blue light?

I wanted to do this experiment because it has become a popular topic within the past few years and I wanted to see for myself if blue light had a negative impact on sleep. My hypothesis is that blue light will negatively affect sleep. Procedure: Night one and two: Go straight to bed at 10 o'clock, try to keep track of how long it takes to fall asleep. Record approximately how long it takes to fall asleep, what time you wake up, and if you struggled to get out of bed the following morning. Night three and four: 15 minutes of usage before bed, go to bed at 10 o'clock. Record approximately how long it takes to fall asleep, what time you wake up, and if you struggled to get out of bed the following morning. Night five ad six: 30 minutes of usage before bed, go to bed at 10 o'clock. Record approximately how long it takes to fall asleep, what time you wake up, and if you struggled to get out of bed the following morning. Night seven and eight: 45 minutes of usage before bed, go to bed at 10 o'clock. Record approximately how long it takes to fall asleep, what time you wake up, and if you struggled to get out of bed the following morning. Wait one week for your sleep patterns to go back to normal and repeat all steps a second and third time for a second trial and better data. The final results will be available at the student's exhibit on Fair Day.

SMH146: Which lactose medication works best?

For many people, consuming milk, ice cream, and other dairy products is extremely painful or uncomfortable because of a lack of lactase, an enzyme that breaks down lactose. Because of this situation, many medications have been made, tested, and sold to the public in order for them to be able to enjoy these foods and drinks. But which ones work the fastest? The purpose of this experiment is to see which kind of milk has the most lactose, and which brand of lactase enzyme medicine is the most effective. This should matter to people who are lactose intolerant or have friends/family who are lactose intolerant, so that they can see what medications work best, and which milks to stay completely clear of if you HAVE to drink milk. The hypothesis, if skim milk is used with Lactaid, then it will take the least time to break down the lactose in the milk because there will be less lactose to break down. This will be tested by using different kinds of milk with different brands of lactase enzyme medication, and timing how long it takes for glucose to be present in the mixture. The final results will be available at the science fair.

SMH147: Does Cast Padding Infused With Nano Silver Particles Inhibit Bacterial Proliferation on the Skin?

Purpose: Determine if cast containing Ag particles inhibits bacterial growth. Hypothesis: Cast containing Ag will inhibit bacterial proliferation better than cast without Ag. Procedure: 1:Infuse Ag into 2 pieces of cast padding. 2:Apply casts to arms. 3:Sterilize sampling template & place on section of arm selected for testing. 4:Roll cotton swab over sampling area. 5:Create McFarland standard. 6:Inoculate nutrient agar plate with 1 mL of McFarland standard. 7:Repeat steps 3 – 6 using 3 more nutrient agar plates. 8:Incubate & determine # of colonies. 9:Place 1 mL of McFarland standard into nutrient broth. 10:Perfrom Spec20's. 11:Repeat steps 3 – 10 for remaining 3 test areas. 12:Repeat steps 3 – 11 after 24, 48, 72, and 96 hours. Conclusion: Available at fair.

SMH300: 3D Printed Auto-injector

After major changes in the pharmaceutical industry centered on auto-injectors like the the controversial EpiPen price increase, there was an evident need for a more affordable design. After interviews with members of the auto-injector community, it was concluded that a rechargeable and environmentally friendly product was also an issue of importance. Using the guidelines of these interviews along with assistance from a mechanical engineer, an iterative prototype system was used to develop a functioning model that satisfied the initial goals of the project. The final product will be a two-part alternative to the current expensive auto-injectors offered in the market.

SMH301: The Effects of Vitamin Suppliments on FAS

Fetal Alcohol Syndrome (FAS) is a rising problem in the United States with 6.3% of all births being affected. Our experiment used zebrafish embryos to determine the effects of Vitamin A, Folic Acid, and Magnesium on the effects of FAS. All embryos were placed in a 2.5% ethanol solution for 24 hours. They were then removed, washed and placed into different solutions with one of the vitamins. One group was placed in regular tank water. Their development was monitored and data was collected for two weeks. While each of the groups of embryos with vitamin supplementation had overall lower mortality rate than our control in ethanol alone, their physical abnormalities were more prominent. A second trial is underway with smaller amounts of each vitamin supplement.

SMH302: The Effect of Nicotine on Zebrafish Embryos

Nicotine has been proven to cause lung cancer and early death in adults. We wanted to see how nicotine would affect the development of a human fetus using Zebrafish embryos as a test subject. In this project, we placed embryos in varying concentrations of nicotine and followed their development over a span of seven days. Our results were mixed among the concentrations, but overall their development was severely delayed with the higher nicotine solutions showing developmental abnormalities and embryos eventually died. This could imply that there are negative effects on a human fetus if the mother smokes cigarettes.

SMH303: Designing Assistive Devices for Patients with Parkinson's

The purpose of this project is to create a cost-effective alternative to common handheld, stabilizing tools meant for parkinson's patients. In order to do this, research on already-existing products was completed, followed by research of possible components of a new model. Then, sketching commenced on said model before moving on to three dimensional CAD modeling in Fusion 360. Post modeling, all parts necessary for prototyping were printed out using a 3D printer and then assembled for testing using springs. Following assembly, parkinsonian tremor was simulated using a reciprocating saw and 3D modeled attachment

SMH304: Oral Rehydration Therapy Design

The ORTube is a 3D printed tool that assists in the administration of Oral Rehydration Therapy (ORT), a simple and cost effective solution that facilitates the rehydration of patients suffering from diarrheal diseases such as cholera. Because the ORT recipe requires very precise solute concentrations to ensure efficacy and safety, data will be collected on the concentrations of salt and sugar in the solution prepared with the ORTube, and a hypothesis test with a low significance level will be performed to ensure that the observed concentrations of salt and sugar match those of the ORT recipe.

SMH305: Effects of Nicotine on the Development of Zebrafish Embryos

It is a known fact that nicotine from cigarettes demonstrates adverse effects on a developing human fetus. The objective of this experiment was to observe the effects of varying concentrations of nicotine on developing zebrafish embryos. Embryos were placed in solutions with varying nicotine concentrations ranging from 0mg/ml to 0.1mg/ml. At the end of trial one, delayed development and abnormalities were seen in the more dilute concentrations of nicotine. The concentrations of 0.1mg/mL and 0.05mg/mL experienced 100% mortality. We then adjusted our concentrations of nicotine and ran a second trial, which we are continuing to monitor.

SMH306a: Exploring Key Factors of Differentiation of Chemoresponse in Breast Cancer Cell Lines

An intrinsic subtype of breast cancer is a biologically distinct category of breast cancer. Each subtype has common biological characteristics; especially cell lines have clonally the same phenotype. Data from our previous experiment has shown that cell lines of the same intrinsic subtype have different chemosensitivity for the same target drug (unpublished data). We try to find mechanisms of targeted chemotherapy resistance to explore differentially expressed and mutated genes between response and nonresponse cell line groups. Mainly stimulated intracellular signal pathway is essential for target treatment response. Our data shows that some specific subtypes do not have any effective target drug. The low frequency of response related mutations makes it difficult to identify effective drugs for cancer treatment. Precise subclassification of breast cancer using gene expression and mutation profiling can improve the response rate for target treatment.

SMH306b: Exploring Key Factors of Differentiation of Chemoresponse in Breast Cancer Cell Lines

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Physics (SPH)

SPH100: Constructing A Thermal Screen

My project will revolve around the process of supercooling. I have been researching supercooling and exactly how it can be performed. I have specifically been studying the supercooling of a compound containing sodium acetate and water. This compound is often used in things such as reusable hand warmers. I have been developing theoretical ways in which both the supercooling of sodium acetate and the supercooling of water could be applied in unconventional ways such as in window screens. I also did some research on ways that the heat released during the supercooling of sodium acetate could be maximized.

SPH101: Effect of Electric Current on Different Metals

My experiment will involve two main components. Testing the effects of running an electric current around iron cores, each with a different composition. I'll test each one and compare their magnetic strengths. The second part would be testing the effect of an electric current around a permanent magnet. I will measure the strength of the magnet before running an electric current around it and during. Ultimately, the goal is to see what makes the best electromagnet.

SPH102: Do different road surfaces and grades affect stopping ability?

By completing this research, it will make more people aware what surfaces are safest to be traveling on in ideal weather conditions. I recently just got my permit and was curious about the best safe driving techniques so I mentioned the idea to my father and we began our research. My goal is to educate new drivers on the importance of the vehicles ability to brake on different road conditions and how not all surfaces should be treated equally when driving. The grade of the surface being traveled on will affect the braking distance. The steeper the downhill grade the harder it is to stop a car with brakes because of gravity. On the other hand, if a vehicle is traveling uphill it is easier to stop. The friction between your car tires and the surface you are traveling on determines your maximum acceleration, more importantly your minimum stopping distances. If the surfaces you are driving on are wet, the friction decreases between your car tires and the surface being traveled on. Consequently, the wet gravel surface, wet asphalt surface, and wet concrete surface are going to have less friction than a dry gravel surface, a dry asphalt surface, and a dry concrete surface. Coefficient of friction is determined by using a drag sled, A drag sled is a weighted tire that will not roll, only skid when it is pulled on the road surface. The sled is pulled by a rope connected to the sled and a set of scales. As the sled is pulled, the weight of pull to get the sled moving on the surface is recorded, then the math formula of friction = force divided by weight (F=f/W). Or in other words the pounds it took to pull the sled is divided by the weight of the sled. A 50 lb sled that took 40 lbs of force to pull would show that the surface to tire friction rate was .08. The lower the number, the slicker the surface is to stop on. Grade of the road surface is determined by placing a 4 ft level on the road surface then lifting one end until the level shows true level. Then you measure the distance from the high end of the level back down to the road surface. This is called Rise and Run. To calculate the grade, you simply divide the rise by the run. An example would be if the 48-inch level was 4 inches high on one end you would simply divide 4 inches by 48 inches and your grade would be .08%. You then test each surface multiple times to get an accurate answer.

SPH103: Traffic light Efficiency

The purpose of this experiment is to determine if traffic lights with LED light bulbs and the necessary heater or incandescent light bulbs are more or less energy efficient in winter weather. It is hypothesized that the incandescent light bulbs will be more energy efficient than the LED light bulbs and necessary heater because of the combined energy of the LED light bulb and heater. After all materials are gathered, experimentation begins. Plug in light fixture with extension cord attached to external power supply, and insert incandescent light bulb. After cooling lens to freezing (0 degrees Celsius), attach to fixture and place approximately 60 grams of snow top. Plug in fixture and time for 2 minutes, unplug for 2 minutes, and repeat until snow has melted. After snow has melted, measure the amps and volts with amp meter and lens temperature with laser temperature sensor. Repeat exact procedure with LED light bulb, inserting heater before bulb and attaching to separate extension cord to external power supply (heater remains on for entire duration of each trial). Repeat procedures three time total for each bulb. After experimentation, take all data and analyze the results.

SPH104: Light bulbs and temperature

The purpose of this experiment is to test if the illuminance of a light bulb is affected by how cold the temperature is. To conduct this experiment I tested four different light bulbs being Incandescent, CFL, LED and Halogen bulbs for their illuminance (lux). The light bulbs were first tested before they were put in the fridge and after an hour they were tested again to compare the change in illuminance. The control was for the bulbs to be tested at room temperature. My hypothesis wasn't supported since the CFL illuminance dropped the least.

SPH105: Comparing Light Intensity to the Rate of Change of Magnetic Flux

For my science project, I will be exploring Faraday's Law, using alternating current, inducing current into a secondary coil. The experiment will prove Faraday's Law by finding the relationship between the voltage in the primary (main AC-carrying coil) and the voltage of the secondary coil (the coil that will carry an induced current). By finding this relationship and comparing it to the mathematical expression of Faraday's Law, it can be confirmed. For accurately finding the relationship, the AC's frequency, peak current, the secondary coil's cross-sectional area, and the primary coil's turn density will need to be found.

SPH106: Battery Life Optimization

One large problem for this generation so immersed in technology, is battery life. Phone users are constantly seeking a charger and outlet. This is also a problem for the companies designing these products. They are trying to fit more battery life into a smaller footprint. In my experiments, I explore ways for a phone to charge without being plugged in. Energy sources explored include body heat and the kinetic energy of walking. This energy recovery should hopefully prolong battery life.

SPH107: Sending Signals Underwater

Please visit student's exhibit.

SPH108: Muzzle Velocity

The purpose of my investigation is to determine whether different bullet weights and powder amounts affect muzzle velocity. Muzzle velocity is the velocity, or speed, with which a bullet or shell leaves the muzzle of the gun. Muzzle velocity is affected by the projectile's mass, the barrel's length, and the propellant's quantity (Unknown). The muzzle of a firearm is the end of the barrel from which a projectile will exit (Chastain). I chose to conduct this experiment because I am a hunter. I am interested in learning all aspects of the firearms and bullets that I use. I hope to gain knowledge about the best type of bullet to use for different hunting environments such as open fields and wooded areas. I will be using one rifle with two different grains of bullets, and shooting several times. My hypothesis is that I believe different bullet weights and powder amounts will affect muzzle velocity. I think the lighter the bullet and the more powder grain there is to project the bullet, the bullet will travel at a faster speed. A bench rest was set up 12 feet from the chronograph. I loaded my rifle with a 140 grain bullet with 41 grains of powder. I set my rifle in the bench rest for stability and then pulled the trigger. The bullet passed over the chronograph. I observed and recorded my time. I repeated these steps two additional times with the same type of bullet for a total of three trials. I then continued my test following the same process with each of the other bullet types. The data I have collected does not support my hypothesis. I was not correct in hypothesizing that the lighter the bullet, the faster it will travel. In addition, a higher powder grain for each bullet of the same mass did not increase the muzzle velocity. The bullets with the higher powder charge traveled at slower velocities than bullets with a lower powder charge. The average velocity of the 140 grain bullet with a 41 grain powder charge is 2,488 fps (feet per second). The average velocity for the 120 grain bullet with a 41 grain powder charge is 2,682 fps. This data shows the heavier bullet traveled at a faster speed. The average velocity of the 140 grain bullet with a 43 grain powder charge is 2,633 fps. The average velocity for the 120 grain bullet with a 43 grain powder charge is 2,774 fps. This data also shows the heavier bullet traveled at a faster speed. The average velocity of the 140 grain bullet with a 45 grain powder charge is 2,777 fps. The average velocity for the 120 grain bullet with a 45 grain powder charge is 2,876 fps. This data, once again, shows the heavier bullet traveled at a faster speed. When comparing powder charges to see if the higher powder charge increases a bullet's velocity, my test data proves it did not. The average speed for a bullet with a mass of 140 grains and a 41 grain powder charge was 2,488 fps. The average speed for bullet with a mass of 140 grains and a 43 grain powder charge was 2,633 fps. The average speed for a bullet with a mass of 140 grains and a 45 grain powder charge was 2,777 fps. My test data proves that a higher powder charge did not increase velocity. The average speed for a bullet with a mass of 120 grains and a 41 grain powder charge was 2,682 fps. The average speed for bullet with a mass of 120 grains and a 43 grain powder charge was 2,774 fps. The average speed for a bullet with a mass of 120 grains and a 45 grain powder charge was 2,876 fps. Once again, my test data proves that a higher powder charge did not increase velocity.

SPH109: Golf ball performance

The reason I did this project was to help golfers find the best ball to use. How I did my project was by making a machine to hit the balls and then record data. I used a shotgun stand to hold the skeet shoot to swing the club. After that I measure the height I need for the club not to hit the ground. Then I measure the distance of the ball and made my charts. I am still analyzing my data and do not know if my hypothesis is correct.

SPH110: Is Gravity Stronger Than We Think?

As other sciences continue to find new discoveries, astronomy and physics seem to be at a still point. The purpose of my experiment was to find newfound scientific facts that could progress the astronomy and physics world. The discovery of this could shape this science for many years to come and solve many of the universe's mysteries. After dropping the marbles and accounting for friction and earth's gravity, I gathered my data and analyzed it. My results show that my hypothesis on objects affecting other objects' gravitational pulls was incorrect. There is no correlation between the two.

SPH111: What Influence Does the Magnus Effect Have on a Rotating Cube?

Purpose:To determine what influence the Magnus Effect has on a rotating cube. Hypothesis:The Magnus Effect will have a greater effect on a rotating cube than on a rotating cylinder. Procedure: 1. Obtain materials. 2. Build testing apparatus. 3. Place a balsawood cylinder in the testing apparatus. 4. Without rotating the cylinder in the testing apparatus, drop it and determine/record the distance the cylinder travelled forward from the plumb point (control). 5. Repeat steps3-4 for29 more test drops. 6. Repeat steps3-5 for the remaining rotational speeds being tested. 7. Repeat steps3-6 with the cube. Conclusion:Final results available at fair.

SPH112: The Efficiency of Varying Solar Cells
The world is mostly powered by nonrenewable energy sources, and they are running out. In order to prevent the next few generations from running out of power, there needs to be more effort in researching and using renewable energy sources. In particular, solar energy is a field that is largely unexplored, and has great potential to provide more power for the world. It is considered to be one of the cleanest and most reliable forms of renewable energy. Solar cells convert the sun's energy into electricity through the process of photons of light from the sun exciting electrons in the solar cell, causing electron movement, which conducts electricity. For this experiment, 3 different types of the most popular solar cells on the market today, monocrystalline, polycrystalline and thin film solar cells are compared for efficiency and for temperature resistance. Since each of these solar cells have a different chemical composition, each one's efficiency to produce electricity, along with the resistance to efficiency levels dropping at higher temperatures. First, I measured the voltage and current of each cell at a constant temperature and under a constant light source. Then. I calculated the wattage output of cell. With this data, I used the efficiency formula to find the efficiency of which each solar cell produced electricity. Next, I tested for each solar's efficiency again, but at a high temperature. Higher temperatures will cause for a drop in efficiency for every single solar cell, because at a high temperature, the electrons in solar cells will rest at a higher energy level. Therefore, it takes less energy to excite these electrons, and as a result less energy is produced. However, due to the difference in composition of each cell, the level of resistance will be different. The results for my experiment showed that monocrystalline solar cells were the most efficient, and thin film solar cells had the highest resistance to a drop in efficiency at high temperatures. This explains that in areas of warmer climates, such as places near the equator, it is better to use thin film solar cells in terms of efficiency level, because as the less temperature resistant solar cells' efficiency level drops, thin film solar cell efficiency level will become the highest. In contrast, in cooler areas, where monocrystalline solar cells' efficiency are not as effected by temperature, it will be the best to this type of solar cell, in terms of efficiency ratings. Understanding how solar cells work and which ones to use depending on geographical location will hopefully allow for more research on what and how solar energy can be used for, along with encouraging more people to convert to using solar energy to power their houses.

SPH113: Jumping Techniques for a Better Vertical Jump
The researcher will be testing to find what kind of jumping techniques middle school students use to increase their maximum vertical jump to increase sport performance. There are five variations of jumps that the researcher will be testing; natural jump, jump arm swing, three step volleyball approach jump, run and jump, and step and jump. Data will be collected and analyzed to establish the technique with the highest mean per jump across the experimental groups. Data will be available on the day of the science competition.

SPH114: Oscillators
While physical calculations often neglect the effects of non-conservative forces for mathematical simplicity, their effects can easily be observed in the simple pendulum, whose oscillations decay over time in the presence of air. This experiment investigated the effects of the mass, shape, and dimensions of the bob on the motion of a simple pendulum, with the hypothesis that the amplitude of the oscillations would decay exponentially and the rate of decay would be inversely proportional to the mass, greater for a sphere than a cylinder, and directly proportional to the cross-sectional area. Data will be analyzed by the competition day.

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SPH115: How Does Surface Area Affect Rolling Resistance of Rolling Objects (Tires)?

How does surface area affect rolling resistance of objects? This project belongs in the physics and engineering category. To achieve this goal, the time had to be taken to figure out how long it takes a matchbox car to get down a 5 foot long ramp with different grits of sandpaper in each channel. The channels consisted of 0 grit, 50 grit, 80 grit, and 120 grit sandpaper. The car traveled fastest at 0 grit and slowest at 50 grit. Surface area affects rolling resistance extremely.

SPH116: What is scientifically the best hunting arrow, heavy or light? Which side are you on?

The purpose of this experiment was to find out what is the best hunting arrow, heavy or light and what arrow penetrates the most. Misjudging yardage was also observed in this experiment. The hypothesis is that the lighter, flatter trajectory arrow will not drop as much as the heavier more kinetic arrow. Therefore, you will not miss at longer yardages as much with the light arrow and not drop in penetration with the heavier arrow as much as the lighter arrow. Procedures: Select the best selling light arrow and heavy arrow. Test the velocity of each with a chronograph shot out of the same bow. Collect data from hunters that come into the sport shop with the cooperation of the shop owner. Collect what every hunter's average shot distance was. Test each of the hunters as to their ability to judge yardage for what the median of every person's shot distance was. Test the benefits of the flatter trajectory of the lighter arrow offers, so if yardage is misjudged how much would it benefit you to have a flatter trajectory. Test the grouping ability of each arrow by having them shot by a PSE certified bow mechanic and world champion to see if one is more forgiving and groups better than the other. Then determine the kinetic energy of each arrow and how it affects penetration by shooting each test arrow into a test medium and recording the data. The final results will be available on the day of the science fair.

SPH117: Effects Of Speed Vs Mass On A Batted Ball

The purpose of this experiment was to determine if bat speed mattered more than the mass of a bat when hitting a baseball. To figure this out we used two bats, (One bigger than the other) and hit baseballs and recorded how many cleared a designated marker. The procedure showed that the lighter bat had more balls hit over the marker than the heavier bat did. This was due to the relationship between acceleration and mass in the equation of force. Speed will have a bigger effect in force than mass will, so a lighter bat is better than heavier.

SPH300: Analysis of Heat Treated Filament for Artificial Muscles

The invention of carbon nano-tube muscles has furthered science in the artificial muscle department; however, researchers have discovered monofilaments function similarly once coiled and heat trained, but the process is complex. Our goal is to demonstrate contraction consistency when coiled fishing line muscles are heat treated. Heat treating the artificial muscles with boiling water was most effective allowing for the muscles to elongate. We will then test these coiled fishing line muscles by applying heat and measuring the amount it contracts. This will provide sufficient data pertaining to the consistency and strength of the artificial muscles.