



# **65th PITTSBURGH REGIONAL SCIENCE & ENGINEERING FAIR**

## **SENIOR DIVISION ABSTRACTS**



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**Note:** Due to processing time constraints, some abstracts were omitted and others were limited to the purpose of the research. Omissions should not be considered as a negative reflection on the student or their project.







## SENIOR DIVISION – BEHAVIORIAL AND SOCIAL SCIENCE

Project Number: SBS018

Grade: 10

Title: The Ability of a Corvus Albus

Abstract: Crows, including Corvus albuses (Pied Crows) have been noted by scientist to hold high intelligences levels. A pied crow was taught to paint a picture with its beak. This was achieved through positive reinforcement and behavioral shaping. With these two elements, the bird was trained to pick up the brush and place it into a bowl, then remove it and stroke the canvas. This process was actively repeated. In the end, the bird was able to “paint a picture”. Future research could be done to see if crows were the only species of bird that could perform this behavior.

Project Number: SBS019

Grade: 11

Title: Teenagers and Clothing

Abstract: To determine how teenage girls in grade 9 were more influenced in choosing clothing than 12 graders. The reearcher predicted that teenage girls in grade 9 would be the most influenced when choosing attire. The researcher created a survey tht included 7 questions, focusing on 7 influences. The researcher found the results to be very similar. So, an accurate conclusion could not be made, however conclusions were made according to the sum of responses for each group.

Project Number: SBS020

Grade: 11

Title: The Effects of Brain Dominance

Abstract:

Project Number: SBS021

Grade: 9

Title: Sleepy Behaviors

Abstract: It is a fact that two thirds of the time children's behaviors are negative. I believe it is important for people to know what makes children act negatively so that the cause might be eliminated. If the cause is environmental, it may be eliminated; but if the cause is genetic, another course of action would be in order. I tested gender (genetic) and sleep (environment) to see if they affect children's behaviors. I made up a negative and positive behavior rubric to evaluate the behaviors of 5 boys and 5 girls for 7 days. Sleep does affect the behavior of both genders.

Project Number: SBS022

Grade: 12

Title: Thinking Under Pressure

Abstract: This project is a continuation of last year, and will examine the effects of argon, air, and helium (all of which have 21 percent oxygen) on the human body under pressure. Three tests were given at depths of 30, 20, and 10 meters. Gasses were compared and the tests had shown that argon can be used from 20 to 10 meters. Argon absorbs very slowly into the body, requiring less time to decompress. This gas can now be used on future dives.

Project Number: SBS023

Grade: 11

Title: Can Video Games increase Intelligence?

Abstract:

**SENIOR DIVISION – BEHAVIORIAL AND SOCIAL SCIENCE**

Project Number: SBS024

Grade: 11

Title: Affect of L-Tyrosine on Memory

Abstract:

## SENIOR DIVISION – BIOLOGY

Project Number: SBI001

Grade: 12

Title: R-Cognin Mediates Aggregation via Free Cell Surface Sulfhydryls

Abstract: Retina Cognin (R-Cognin) is a tissue specific, 50-KDa protein that mediates the aggregation of retinal cells in chick embryos. R-Cognin is related to protein disulfide isomerase (PDI) and is thought to regulate signaling between retinal cells via thioreductase activity. R-Cognin's cell surface receptor has yet to be identified. To elucidate the structure of R-Cognin's receptor and to define R-Cognin's binding mechanism, the disulfide exchange inhibitor 5-5'-dithio-bis(2-nitrobenzoic acid)(DTNB) was used. It was determined here that the addition of DTNB to trypsinized cells blocked R-Cognin binding, demonstrating that R-Cognin requires free sulfhydryls on the cell surface to bind effectively. Through multiple assays, it was also determined that DTNB binds irreversibly to the cell surface and is able to block aggregation in an in vitro system.

Project Number: SBI002

Grade: 10

Title: Breed or Not to Breed

Abstract: Breeding cows is one of the most important tasks on any dairy farm. The current practice for determining if a cow is ready to be bred is through visual observations. Unfortunately, the visual signs to determine if a cow is in estrus can be easily missed because some cows do not show any outward signs. Progesterone testing of the milk can be one way to determine if a cow is in estrus and is ready to be bred. This testing can save money for the dairy farmer by eliminating unnecessary insemination fees.

Project Number: SBI003

Grade: 11

Title: Fetal Hepatocytes / Bioreactors

Abstract: This project examines the use of fetal hepatocytes versus adult hepatocytes in liver bioreactors for superior efficacy. Increased efficacy of bioreactors would offer alternatives to liver transplantation, as there is a dire shortage of organs for transplantation. The bioreactor culture, using cells from embryonic mouse livers, was terminated after 21 days. The bioreactor tissue was paraffin embedded, sectioned, and analyzed by H&E and immunohistochemical staining. It was found that fetal hepatocytes gave rise to a functional, metabolizing tissue. Advantages over using adult hepatocytes included increased resistance to apoptosis, biliary cells, and a mixed population of cell types.

Project Number: SBI004

Grade: 9

Title: The Effects of Various Puppy Foods on Mealworm Growth

Abstract: The purpose of my experiment was to determine the growth effectiveness of several brands of puppy food. In order to test this, I put fifty mealworms in containers with three different brands of ground up puppy food and weighed them every week for eight weeks. I also made a negative control, where the mealworms had only a water source in the container, and a positive control, where the container was filled with cornmeal instead of puppy food. The mealworms gained almost equal amounts of weight in each puppy food. Future experimentation would include testing the puppy foods on larger organisms.

Project Number: SBI005

Grade: 10

Title: The Impact of Soil on Plant Growth

Abstract: Growing plants is something that everyone in the world is doing towards the spring time. This project is designed to help gardeners figure out if the soil they have in their backyard is





## SENIOR DIVISION – BIOLOGY

Project Number: SBI017

Grade: 11

Title: To Grow or Not to Grow?

Abstract: California has had droughts in the past, the only source of water was the ocean. All the crops died from the lack of water. This work intended to learn if plants would grow if they were given small amounts of salt water using a drip irrigation system. Three drip irrigation systems were set up. They were all the same using different levels of sea salt. It was determined that the plants will grow, but would die early. Literature suggests that the salt is very harmful to plants and causes plants to have stunted growth.

Project Number: SBI018

Grade: 11

Title: Ethylene Effects on Bananas

Abstract: I wanted to determine if apples could be used in place of ethylene to ripen bananas. I hypothesized that the bananas in with an apple would ripen more quickly than the bananas in a container without an apple. In one container I placed 2 unaged bananas and an apple. I massed 5.0 grams of Sodium Hydroxide chips and placed them in the container. In the other container I placed 2 more unaged bananas and massed 5.0 grams of Sodium Hydroxide chips. I concluded that apples can be used in place of ethylene to trigger the ripening process of bananas.

Project Number: SBI019

Grade: 10

Title: Analysis of Wild vs. Farmed Salmon Protein

Abstract: The purpose of this experiment was to determine if the protein content of wild and farmed salmon differed in both amount and kind. Four samples of both wild and farmed salmon were prepared for the gel electrophoresis chamber. They were run through the chamber for one hour at 150 volts with a control which was the protein marker. They were then compared to the protein marker to determine the different sizes of the proteins. There were no conclusive results from this experiment. Future experimentation would include testing different species of wild and farmed fish.

Project Number: SBI020

Grade: 10

Title: The Affect of Vitamin C on C.elegans

Abstract: Different amount of vitamin c has different influences to C.elegans. There different amount of vitamin c were picked and put into there different plates which had C.elegans in there. The observation was to count the number changing in each plate. The lower levels of vitamin c are advantageous to the growth of c.elegans. Opposite, overdoses of vitamin c are harmful to them.

Project Number: SBI021

Grade: 9

Title: Effect of environmental factors on the development of Zebra fish (Danio rerio)

Abstract: Zebra fishes are an important part of the food web, Zebra fish eat smaller living organisms than themselves and in the wild, and bigger fish, small amphibians, mammals, or birds eat them. Recently pollution caused by industrial wastes changes the environment, causing results that threaten nature. For example, acid rain, oil pollution, etc. Environment changes may directly alter the living condition of plants, animals and even Human being. These alterations may cause illness, death or genetic disease. In this experiment, I observed how pH value changes affect the survival of Zebra fish embryos and infants.

## SENIOR DIVISION – BIOLOGY

Project Number: SBI022

Grade: 12

Title: The Ant Colony: An Emerging System

Abstract: For my project, my aim was to isolate specific rules which govern the ant colony as a living system. In the past decades humans have discovered that ants are not controlled or manipulated by their queen, but by a series of complex guidelines that are genetically hardwired into their behavior. The application of thousands of these rules at any given minute dictates a precise and efficient pattern for the colony as a whole, despite the fact that single ants may move and act in a random manner. I used controlled environments to demonstrate how the system reaches efficiency.

Project Number: SBI023

Grade: 9

Title: 40 Days and 40 Nights

Abstract: In the project, I tested to see if certain arthritis medicines would improve the conditions of pine branches. I used aspirin and glucosamine/chondroitin as the arthritis medicines. I thought that the glucosamine/chondroitin would improve pine branch conditions best. The aspirin did the best in improving pine branch conditions.

Project Number: SBI024

Grade: 12

Title: Effects of Heat on the Wolf Spider

Abstract: In this project, the researcher studied the behavior of wolf spiders under abnormal temperatures. First, the spiders were studied under normal room temperature. Then, the spiders were introduced to an increased temperature, 38 °C. After that, the spider's movement was recorded and counted. After recording and counting the movement, the information was then placed on a table for comparison.

Project Number: SBI025

Grade: 9

Title: Peppers and Oxygen Absorption

Abstract: Scientists stated that the capsaicin in chili peppers destroys cancerous cells through deprivation of oxygen. I therefore hypothesized that peppers could prevent the oxygen-absorbing chemical pyrogallol from taking in oxygen. By allowing pyrogallol to absorb oxygen in a flask, then by measuring how much water filled the emptied space that once contained oxygen, the percentage of oxygen removed from the air could be found. I discovered that peppers did not prevent the solution from absorbing oxygen; more research showed that capsaicin does not block oxygen absorption, but rather begins the pathway to apoptosis in transformed cells.

Project Number: SBI026

Grade: 9

Title: The Effects of Fetal & Bovine Serum in Different Cell Lines

Abstract: The survival of cancer cells is dependent upon the blood supply. This experiment concentrated specifically on blood serum, which is the liquid part of blood with growth factors. Fetal Bovine serum and Adult Bovine serum were tested to show the effects on three different cancer cell lines. I also used different concentrations of the serum. I found that the higher the concentration the better the growth.

## SENIOR DIVISION – BIOLOGY

Project Number: SBI027

Grade: 9

Title: Using Lime to Protect Pine Trees

Abstract: The purpose of this experiment was to determine if the addition of lime to the soil will help protect pine trees from acid rain. 5 groups of pine trees were used in this project. They were watered each week with acid rain. Also, each group received lime: 14g, 28g, 42g and no lime. The growth and the health of the trees were observed and recorded for 2 months. It was found that the trees that received lime grew better and were healthier. The controls that had no lime were unhealthy and not growing well. The plants with more lime developed poorly. The hypothesis was supported by the results. The trees with 14g of lime did the best.

Project Number: SBI028

Grade: 11

Title: Biochemical Memory in Planaria

Abstract: It has been suggested that there are non-neuronal mechanisms of memory in organisms. To explore this concept, Planaria were chosen because of their ability to learn and regenerate. After being trained against their established bias in a two-prong maze, their memory retention was tested after induced fission and regeneration, comparing the neuron-containing anterior region with the posterior region. Memory transfer was also tested by feeding untrained subjects trained ones. Results showed no significant difference of memory retention in the neuronal regions, proving the existence of biochemical memory, and a significantly faster learning rate after the consumption of previously trained planaria.

Project Number: SBI029

Grade: 9

Title: Body Type Hype

Abstract: My project, entitled "Body Type Hype" takes a close look at a person's body type. I investigated to see if it determined what sports a person was good at. In experimenting, I tested a person's overall fitness in five simple tests. After looking at my results, I found out that body type plays a major role in how well a person is capable of excelling in sports.

Project Number: SBI030

Grade: 9

Title: The Effect of UV Light on the Behavior of Drosophila

Abstract: I investigated how ultraviolet light effects the behavior of Drosophila and compared that to behavior under white light. I did this by placing the Drosophila into a test tube with a motion sensor and connecting it to a chart recorder so when a Drosophila passed it would record a movement. I found that the Drosophila had the same behavioral patterns in UV light as white light. This is because their photoreceptors allow them to detect the UV light.

Project Number: SBI031

Grade: 11

Title: Are Insecticides Safe?

Abstract: This experiment tested whether methoxychlor reduces gene expression in Sertoli cells by conducting PCR. The results show that gene expression was reduced.

## SENIOR DIVISION – BIOLOGY

Project Number: SBI032

Grade: 11

Title: Hormone Induced Parthenocarpy

Abstract: The purpose of my experiment is to see if I could induce parthenocarpy in *Brassica rapa* by the use of hormones. Parthenocarpy is the process of growing plants without seeds. The hormones I used were Indole-3-Acetic acid, Naphthaleanacetic acid, and Indolebutyric acid. There were four trays in which I planted the seeds, one for each hormone and one for control. When the flowers sprouted and opened I removed the stamens to prevent self-pollination. When the tips of the fruits began to show they were treated with the hormones. My experiment is on-going therefore results can not be reported yet.

Project Number: SBI033

Grade: 12

Title: Pharmaceuticals and Extra-Cellular Matrix

Abstract:

Project Number: SBI034

Grade: 11

Title: Are Wolf Spiders Nocturnal?

Abstract: The purpose of this experiment is to determine rather or not Wolf Spiders are nocturnal. To conduct this experiment the researcher search books and the internet for a highly nocturnal spider that does not die in the winter. To be nocturnal means to be more active during the night than the day. The spiders were placed into a controlled environment in which they were observed and ranked by their amount of activity. The researcher found that the Wolf Spiders were more active at night than day. These findings contradicted the researcher's hypothesis by proving that Wolf Spiders are nocturnal.

Project Number: SBI035

Grade: 11

Title: The Effects of Ethylene via Cigarettes on the Development of Pea Seedlings

Abstract: The purpose of my research was to study the effect of ethylene gas on the growth patterns of pea seedlings. I hypothesized that the plants exposed to ethylene gas will have thicker, shorter stems than the control plants. Ten pea seedlings were planted in each of two separate beakers. One of the beakers was exposed to a lit cigarette. The other was used as a control. I exposed the first set to ethylene every two-three days. I recorded the data twice per week. The plants that were exposed to ethylene had thicker, shorter stems than the control plants.

Project Number: SBI036

Grade: 9

Title: Ibuprofen vs. Aspirin

Abstract: I compared the inhibition rate of the COX enzyme of aspirin and ibuprofen. I simulated the reaction that takes place within the body when either NSAID (Non-Steroidal Anti-Inflammatory Drugs) is taken. Though conclusions could not be drawn from my results a general understanding of the inhibition rates of both drugs was understood.













## SENIOR DIVISION – CHEMISTRY

Project Number: SCH023

Grade: 12

Title: Chemical Solutions' Effect on Electrical Conductivity

Abstract: The title of this project is "Chemical Solutions Effect On Electric Conductivity". In this experiment the researcher is measuring the amount of current in four metal wires. The current will be used to calculate the resistance and then the resistance will be used to calculate the resistivity and finally received the electric conductivity. The metal wires that were tested are aluminum, black annealed, copper, and nickel chromium. The metals will be soaked in different chemical solutions for twenty-four hours. These metals will be examined everyday to see if any change has taken place.

Project Number: SCH024

Grade: 10

Title: Comparison of Household Bleaches

Abstract: The purpose of this experiment is to find which bleaches are truly ultra and which are regular. There were three procedures to complete this experiment is to find which bleaches are truly ultra and which are regular. There were three procedures to complete this experiment. The first was the preparation of a 0.3M sodium thiosulfate. The next was to standarize a 0.3M sodium thiosulfate solution. The final procedure is the titration of the bleach. To obtain data find the average amount of titrant used in milliliters. Find the average molar concentration of each bleach. I conclude that the strongest bleach was Shur Fine and the weakest bleach was Our Family.

Project Number: SCH025

Grade: 11

Title: Antioxidants & Cell Death

Abstract: The purpose of this experiment is to assess protective effects of common antioxidants, against oxidative cell death Induce oxidative stress to insulin-producing beta cell line using hydrogen peroxide. Add solutions of variables (Vitamins A,C,E, green tea) to cells, along w/ H2O2. As a control, allow cells to grow normally in media Measure cell death using MTT assay/spectrophotometer. Hydrogen peroxide was a proper inducer of cell death. Vitamins A and E seemed to have negative effects upon the cell, possibly due to fat soluble properties. Vitamin C and Green tea, however, seemed to have significantly protective effects.

Project Number: SCH026

Grade: 12

Title: Oxygen Concentration vs. Reaction Rate with Sulfite

Abstract: Construct an electrochemical oxygen sensor and use to test oxygen-sulfite reaction rate.

Project Number: SCH027

Grade: 12

Title: It's Crystal Clear

Abstract: This project was intended to produce synthetic tanzanite (a gemstone). "Since 1991, rumors have circulated that Russian scientists were manufacturing synthetic Tanzanite. Though it has yet to be documented and is definitely not commercially available, the buyer must still beware" (GIA). In this project, attempts to crystallize tanzanite were made by using its chemical formula and percent composition. The chemical components were blended and reacted to produce the mineral. Crystallization took about three days. These attempts proved to be worthwhile by producing both clear and yellow crystals after several trials. The yellow was the result of adding ferric nitrate as an impurity.





## SENIOR DIVISION – COMPUTER SCIENCE/MATH

Project Number: SCM007

Grade: 11

Title: Coding/Analysis of Steganography

Abstract: Text steganography is a method of cryptography that hides enciphered messages inside larger, inconspicuous messages, allowing two parties to communicate without revealing their concealed intents. This project investigates a program that utilizes steganography to encipher messages in ciphertext, meaning that the message is hidden in another larger text. The project tests security by creating a counter-program that detects and deciphers ciphertext, and evaluating the efficiency of that deciphering program. Results determine that if a third party is given the ciphertext, the hidden message can be cracked. However, because the third party must first determine which messages are ciphertext, text steganography remains practically secure.

Project Number: SCM008

Grade: 12

Title: Hierarchies in a Relational DB

Abstract: There are many models available to represent hierarchical data in relational databases. This project intended to find which hierarchy model was the fastest for different tasks. Seven models were assembled, including one original model, along with a list of tasks that each should complete. For each model, code was written to execute each task. Then, a benchmarking tool was created to time how the models compared when combining tasks. The Adjacency List with Sibling Numbers model was the fastest overall, followed closely by the Modified Nested Sets model. Future work could include adding more tasks, or comparing against object-oriented databases.













## SENIOR DIVISION – ENGINEERING/ROBOTICS

Project Number: SER001 Grade: 12

Title: Does the Shape of the Pile Affect Its Vertical Load?

Abstract: This experiment determined the force of friction that held different shaped piles in sand. It was predicted that the shape would significantly affect the amount of friction applied to the pile, and the vertical load of the pile. All piles were made with the same lateral surface area. The calculated force of friction was found to be significantly different between the different shaped piles, six trials performed for each pile. (ANOVA :  $F = 3.91, F(0.05) = 3.68, p < .04$ ). The greatest force of friction was applied to the triangular pile and the least force of friction was applied to the circular pile.

Project Number: SER002 Grade: 9

Title: London Bridge's Falling Down

Abstract: Bridges are an essential part of life. This project was intended to show if arch bridges hold more weight than beam bridges. 10 of each bridge were built for testing. Weight was put on the bridges until it snapped. It was determined that, on average, arch bridges hold more weight than beam bridges. A future project is planned to see if arch bridges hold more weight than suspension bridges.

Project Number: SER003 Grade: 12

Title: Prediction of Clamp-Pressure

Abstract:

Project Number: SER004 Grade: 12

Title: Torque and Model Airplane Flight

Abstract:

Project Number: SER005 Grade: 12

Title: What a Twisted Web They Weave

Abstract: This project "What a Twisted Web They Weave" was performed in order to test if a man-made spider web could be made stronger by adding agents to a web. The results were predicted to be that all of the agents applied would improve the web in various ways. The hypothesis was tested by constructing webs of thread, adding various substances to each web, then by placing steel plates on top of the completed web. The results showed that the web with double strings was the strongest of all the agents added, but all agents did improve the strength of the web.

Project Number: SER006 Grade: 10

Title: HARP: Helicopter-based Autonomous Robotic Pilot

Abstract: The goal of my project is to build an autonomous robot capable of taking-off, hovering and landing a model helicopter. The robot will use a variety of sensors including a GPS, a compass and an accelerometer to maintain a stable hover for 30 seconds and then land. The robot will be based on Parallax's Basic Stamp 2p40 microcontroller which uses the PBasic programming language. The helicopter will be a size 60 gas helicopter with an aluminum frame and 5 servos that control altitude and the three axes of movement.





## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH001 Grade: 12

Title: Genomic Changes on Chromosome 13 in Chonocarcinoma

Abstract:

Project Number: SMH002 Grade: 12

Title: Osteogenesis Imperfecta

Abstract: This project is researching why Osteogenesis Imperfecta mice with the same Type-1 collagen mutation differ with regard to the strength of their bones. Through biomechanical testing, measurement of bone dimensions, ashing, body mass measurements, microsatellite genotyping and linkage mapping, both phenotypes and genotypes of the mice were studied. Failure load was then regressed on genotype for each tested locus. For those loci in which the P-value was less than 0.01, other phenotypes were also regressed on genotype. Significance levels of  $P < 3.4 \times 10^{-3}$  as suggestive of linkage and  $P < 10^{-4}$  as significant were used. Significant results in regards to failure load were found for loci D4Mit124 and D8Mit13.

Project Number: SMH003 Grade: 12

Title: RNAi Mediated Disruption of hnRNP F and Downstream Effects on Ig Synthesis

Abstract: Various cis- and trans-acting modifiers affect Immunoglobulin mRNA cleavage. One such trans-acting modifier, hnRNP F has been shown to weaken the favorability of the proximal polyA site which codes for secreted Ig seen in plasma cells. If hnRNP F is downregulated in B-cells using RNAi technology, a switch to Ig secretion should be evident, rather than the typical membranous Ig seen in memory cells. This manipulation of the Immune Response system calls for a more active and responsive network, arming the body for a heightened anaphylactic effect.

Project Number: SMH004 Grade: 9

Title: Effect of SPF's in Consumer Products

Abstract:

Project Number: SMH005 Grade: 12

Title: Family Ties

Abstract: The DNA in cheek cells will be isolated by using three different methods. The results from these methods will be tested to determine which one gives the purest DNA in the greatest quantity. The best method will be used to isolate a families' DNA for comparison. The results are pending.

Project Number: SMH006 Grade: 11

Title: Classroom Hygiene, An In Situ Study

Abstract: Good handwashing is essential in the containment of disease among large social groups. Unfortunately, many individuals do not wash frequently enough. This experiment compares a month long regimented handwashing using soap and water with an alcohol based cleanser in two first grade classes plus an unregimented control. Weekly hand cultures were done on all students and bacteria colonies were observed over three days. Certain epidemiological parameters were also collected. Results show that those students using the





## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH016

Grade: 9

Title: Dirty Pop

Abstract: The purpose of this project was to determine if more bacteria are found on soda cans from vending machines, in the home refrigerator or at room temperature. Using three cans for each test, plus a control, the tops were swabbed with sterile swabs. Then blood agar plates were inoculated and left to incubated 48 hours at 37 degrees Celsius. Colonies were counted. More bacteria colonies were grown from the samples taken from the cans at room temperature. The hypothesis was supported and more bacteria are found on the soda cans that were kept at room temperature.

Project Number: SMH017

Grade: 12

Title: Antibacterial Dentifrice

Abstract: The purpose of this investigation was to determine which type of toothpaste retarded bacterial growth the best. Agar plates were inoculated with non-pathogenic bacteria. A sterile disk which was soaked with a toothpaste solution was put in the center of the plate. The area of inhibition was measured on each plate. Results were observed and recorded. It was found that the expensive toothpaste retards the growth of bacteria the best. The hypothesis was supported by the results and the most expensive toothpaste did the best in controlling bacteria growth.

Project Number: SMH018

Grade: 11

Title: Using Yeast to Measure Ultra Violet Radiation

Abstract: Increasing levels of ultraviolet radiation are becoming a problem in many areas of the world. However, the machine used to measure the level of radiation costs around \$40,000! I performed my experiment to see if yeast could be used as an alternate source for measuring the radiation levels. A single strain of light-sensitive yeast produces endless colonies for testing, and only costs about \$10. By taking four separate plates coated with yeast colonies and exposing each to a different level of radiation, I was able to determine that yeast can be used to measure the differing radiation levels in sunlight..

Project Number: SMH019

Grade: 12

Title: Ampicillin Resistance in Ecoli

Abstract: I compared the ampicillin resistance in transformed E.coli and agriculturally caused resistant E.coli from beef. I obtained ampicillin resistant E.coli from beef using Luria-Bertani broth as a control and LB broth with ampicillin as the experimental. I exposed the bacteria to an ampicillin free environment for 24 hours. I then inoculated plates with a 1 millionth dilution. This procedure was repeated for several 24 hour time periods. The procedure was repeated using transformed E.coli MM294 as a control. The agriculturally caused resistant E.coli lost its resistance after time in an environment without selective pressures.

Project Number: SMH020

Grade: 11

Title: Microbes in Your Meat

Abstract: The objective of this study is to isolate and identify Gram negative bacteria from commercial meat products and to determine the susceptibility of these strains to several common antibiotics. Cultures will be obtained from retail beef, poultry, and pork products. The frequency of recovery of pathogenic bacteria will be determined for each type of meat. Information regarding whether the meat products were raised "naturally" without exposure to antibiotics will be recorded



## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH027

Grade: 12

Title: Toothbrush Investigation

Abstract: The research used an old toothbrush to gather the bacteria. After gathering the bacteria was cultured in broth. The research plated the bacteria of the old toothbrush without the mouthwash. Then she diluted the Listerine, Act, Scope, and Peroxide into f different dilutions (100%, 75%, 50%, 25%, and 0%). The research added the bacteria to the mouthwash dilutions then plated it. Next she put the plates in the incubater over night. The next day she recorded her data. The mouthwash did in fact did help decrease the amount of bacteria on the toothbrush.

Project Number: SMH028

Grade: 11

Title: How Temperature Effects E. coil

Abstract: My project investigates the effect temperature has on the growth of bacteria when exposed to antibiotics. My procedure was to first grow E. Coli in selected temperatures, then record the growth differences for the separate temperatures. After the first trial of my experiment I grew more plates of E. Coli with antibiotic disks placed in the center. After growing and incubating plates both with and without antibiotics, I compare the growth rates between the two groups. I found that temperature has a great effect on the growth of E. coli, but the antibiotics didn't have much of an effect.

Project Number: SMH029

Grade: 10

Title: Inhibition of Liver Cancer Cells by a Vitamin-K Compound

Abstract: The purpose of this experiment was to test if liver cancer cells were inhibited in correlation to the amount Vitamin-K applied. A variety of materials were used for this experiment. Human liver cultured cancer cells were then obtained. The liver cancer cells were then treated with different amounts of Compound 5 (Vitamin-K). After the experiment was done, results were taken. The results were then used to produce a conclusion.

Project Number: SMH030

Grade: 11

Title: Assay of Immobilized BMP-2

Abstract: The purpose of the experiment was the evaluation of a growth factor (BMP-2)immobilized on a polymer surface (nitrocellulose) to promote differentiation and proliferation in a pluripotent stem cell line (C2C12 cells). Cells were cultured in C-DMEM medium and placed in the wells of 12-well plates, which had been coated with the polymer. Varying concentrations of BMP-2 were added to the growth medium in the wells. Cell proliferation was assayed with a live/dead qualitative assay, while cell differentiation was assayed with an alkaline phosphatase assay.Greater proliferation was detected with the addition of BMP-2, while there was no significant statistical variation in terms of differentiation between experimental groups.

Project Number: SMH031

Grade: 11

Title: Do PA ticks contain human pathogens?

Abstract: The purpose of this project was to contribute data about percentages of Pennsylvania ticks that were carriers of various human pathogens, and to learn new lab techniques that I was previously unaware of. The procedure included extracting DNA from 10 ticks and amplifying it using the polymerase chain reaction. That DNA was then analyzed with agarose gel electrophoresis. Percentages of positive and co-infested ticks could then be determined. For



## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH037

Grade: 12

Title: Exercise vs. Asthma

Abstract: The purpose of this investigation is to measure the amount of air passing through the lungs of asthmatics and non asthmatics before and after exercising. The researcher typed a permission slip to be signed by 20 asthmatics and 20 non-asthmatics. First the student blew through the peak flow meter to see how much air will pass through the lungs at a resting rate. Each measurement was recorded on a labeled chart. The student performed 100 jumping jacks to change the breathing pattern. Then each student blew into the peak flow meter to give active measurement. The researcher recorded the measurements on the charts and analyzed the results.

Project Number: SMH038

Grade: 9

Title: Do Spider Plants Inhibit Bacte

Abstract:

Project Number: SMH039

Grade: 10

Title: Effects of Sunscreen on UV Light

Abstract:

Project Number: SMH040

Grade: 11

Title: Effects of Temp on Phage Growth

Abstract: Bacteriophages are viruses that infect only bacteria. No 2 phages have been found to be the same. This experiment tests 14 phages' resilience to change in temperature. By exposing the phages to different temperatures then spotting them onto an Agar plate with bacteria it is possible to see how well each phage grows at a certain temperature. This experiment shows which temperature each phage prefers.

Project Number: SMH041

Grade: 12

Title: Nature's Toothbrush?

Abstract: Interested in whether or not apples act as a natural toothbrush, I used Snyder test agar to determine if Streptococcus mutans were present before and after eating an apple. While some students reduced their chances of susceptibility, others had no effect making the results of the experiment inconclusive.

Project Number: SMH042

Grade: 11

Title: Do Herbs Inhibit Bacteria?

Abstract: I wanted to determine which herb would inhibit the most bacterial growth.

I made 10 tryptic soy agar plates. I rehydrated the cultures of bacteria. I inoculated the plates. I placed a thin layer of peppermint, aloe, chamomile, and garlic on the 1 cm. indent in each quarter of a plate. Saline solution was my control. I incubated the plates. All herbs had no zone of inhibition except fresh garlic (20mm.) and garlic powder (1mm.). Fresh garlic did inhibit the





## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

hypertension. Hyperuricemic and control rat aortas were used to prove that high superoxide levels in hyperuricemic samples led to hypertension. Hypertension was evidenced by rat blood pressures. Superoxide proved to be one of the many factors of hypertension. This conclusion can be used in further cardiovascular research.

Project Number: SMH053

Grade: 9

Title: The Effect of Antibiotic Misuse on the Development of Drug Resistant

Abstract: Drug resistant bacteria have been a troublesome medical phenomenon ever since the invention of antibiotics. This work intended to discover the link between the dosage of antibiotics used to treat E. coli infections and development of drug resistant bacteria. Bacteria were grown in four petri dishes, each containing various dosages of the antibiotic, Ampicillin. A colony was chosen from each generation and transferred to the next, until there are sixteen generations of bacteria. Finally, samples were taken from four generations and grown to represent the population. The results demonstrate that drug resistance developed when using an overly small dosage.

Project Number: SMH054

Grade: 12

Title: Effects of Caffeine

Abstract: For my project, I will be conducting experiments on rats to determine if caffeine and dependence upon it provides any positive (or negative) effects on intelligence. I will run both of them (i.e.: Tyco and Krycek) through a maze three times and average the times for each individually. Then I will introduce pure caffeine into Tyco's diet through his water. After a few days of this I will run them both through again, in the same manner. My hypothesis is that Tyco's time will have significantly improved while Krycek provides my control in the experiment so that I will have something to compare Tyco's improvement against.

Project Number: SMH055

Grade: 12

Title: Movement Disorders

Abstract: This project involves researching the possible linkage between streptococcus infection and the development of Tourette's Syndrome, Obsessive Compulsive Disorder, and Attention Deficit Hyperactivity Disorder. There are several major areas of research to support my hypothesis: how sufferers seem to have a higher level of the D8/17 antigen, and the recent procedures of plasmapheresis and intravenous immunoglobulin. For this project, a wide variety of scientific journals and immunology books were examined in order to compound extensive evidence to support my hypothesis.

Project Number: SMH056

Grade: 10

Title: The Effects of Sulforaphane on Human Female A549 (Lung Cancer) Cells vs. Human Male A549 (Lung Cancer) Cells

Abstract:



## SENIOR DIVISION – PHYSICS

Project Number: SPH007

Grade: 9

Title: Comparative Properties of Bismuth and Graphite in Magnetic Levitation

Abstract: Friction is a large problem and magnetic levitation can help with this problem. Both bismuth and graphite have characteristics that can help levitate a small magnet. To see which one worked better I tested them by making a stand with a rod that had magnets on it dangling over two small bismuth plates that were separated by small pieces of wood. I raised and lowered the magnets so I could center out the magnet it worked but the magnet was not levitating very high off the bottom plate. Then I repeated the process with the graphite. The bismuth turned out to be the better of the two.

Project Number: SPH008

Grade: 11

Title: Effects of UV Light on Power Lines

Abstract: I recreated a power line by using a high voltage generator. Using different wires I tested the current levels with and without UV light. I found that the onset voltage for a jump in current is lower with UV light.

Project Number: SPH009

Grade: 10

Title: Geometric Shapes Applied to Bridges

Abstract: I feel that throughout mankind's existence, we've found some shapes hold better than others. Just like the circle is superior for a wheel, I think triangles would be best for holding weight. I plan to prove that the use of triangles on bridges is better at holding weight than any other geometric shape.

Project Number: SPH010

Grade: 9

Title: .... And the Strongest Seal Is?

Abstract: The title of my science fair project is And The Strongest Seal Is... . In my project, I had four different types of ziplock baggies: Ziplock brand bags, Zipper Seal (Dollar Stores brand), Target brand bags, and Glad Ware brand bags. The purpose of my research is to discover the strongest ziplock baggie. To find that out I had to do three tests on each brand. For each test the brands were tested three times and the results were then averaged to come up with the winner. After testing my hypothesis that Glad Ware would be the strongest, it turned out the strongest bag was the cheapest.

Project Number: SPH011

Grade: 10

Title: Determination of Tensile Strength of Electroplated Metals

Abstract: The purpose of this experiment is to determine strength of various electroplated metals. This will be determined by performing tensile strength tests on metals with a plated outer surface. By performing these tests I will be able to determine if electroplating metals increases or decreases their overall tensile strength. I hypothesized that the electroplated metals would be stronger than the non-electroplated metals and this hypothesis was supported by the experimentation.

## SENIOR DIVISION – PHYSICS

Project Number: SPH012

Grade: 12

Title: Rise or Shine?

Abstract: Levitation is an important tool for the future. This experiment was intended to find out if seasonal temperature change would effect levitation. A levitation apparatus was constructed. It consisted mainly of magnets and an element called bismuth. This apparatus was put in hot and cold environments to represent different weather conditions to see if it would prevent the levitation. It was determined that the different temperatures had no bearing. This did not agree with the hypothesis. Future work is planned to determine if humidity and pressure had any effect also.

Project Number: SPH013

Grade: 12

Title: Refractive Meteorological Correlations

Abstract: The purpose of this project is to determine if sky color can be utilized to predict weather patterns and temperature. This project will help to prove or disprove the old sailor's myth: "Red sky at night, sailor's delight, Red sky at morn', sailor take warning".

Project Number: SPH014

Grade: 9

Title: Testing submarine shapes for the hull of it

Abstract: I plan to test the drag of several different hull shapes. I will do this by constructing four different hulls with a lathe. All of the shapes will have the same volume. Then I will mount the hull inside a water tunnel,(Much like an airplane in a wind tunnel) and the one with the lowest drag force will be the best.

Project Number: SPH015

Grade: 9

Title: The Efficiency of Maglev vs. Rolling Friction

Abstract: My project studies Maglev and the effect slope has on the speed of the train. In my project, I compare modes of transportation that use rolling friction vs. transportation that utilizes the energy of magnetic force for propulsion. The purpose was to find out how much more efficient Maglev is. To find the energy difference, I calculated and compared kinetic energy totals. I found that Maglev is 8.3 times more efficient than rolling friction.

Project Number: SPH016

Grade: 9

Title: The Strength of Wood

Abstract: I tested Red Oak in three Different enviromental conditions. The conditions were heat, cold, and dampness. I tested the strength of it by placing increasingly larger incriments of stress by way of a Torque Wrench. I tested 80 samples of Red Oak, 20 per group. I exposed then for one hour and then found the strongest one.

Project Number: SPH017

Grade: 9

Title: The Strength of Wood

Abstract:

## SENIOR DIVISION – PHYSICS

Project Number: SPH018

Grade: 11

Title: Rocket Power

Abstract: Every aircraft design matters on one key question, where to put the wings? This project tests three variable top wing placements. Forward, Middle, and Rear. The plane design was propelled by an Estes D-12 model rocket engine. The planes were launched off a wooden ramp designed for the planes. The forward most design was hypothesis to perform the best.

Project Number: SPH019

Grade: 11

Title: Viscosity of Motor Oils

Abstract: The purpose of this experiment was to determine if time and temperature effected the Vitamin C content of oranges. I split nine oranges into six sections each. I stored five of the six sections of each in three different temperautres. I tested one slice from each of the nine oranges (three from each temperature) for Vitamin C content every three days for fifteen days. I used Indophenol and added drops of juice to it. I recorded the number of drops needed to turn the Indophenol clear. My results show that storing oranges in freezers retains the most Vitamin C.

Project Number: SPH020

Grade: 11

Title: Minimizing Drag in Boat Hull Design

Abstract: Find how differences in water type, temperature and speed effect amount of drag on a scale model boat hull. Hull surface will also be modified with different texture substances such as paint, wax, etc.

Project Number: SPH021

Grade: 9

Title: Let's Pick It Up

Abstract: The purpose of this experiment was to determine if AA batteries, C batteries, D batteries or 9V batteries will pick up the most paper clips. 15 coils of copper wire were wrapped around an aluminum nail. The ends of the wire were attached to each battery. The nail was held over a stack of paper clips. The number of paper clips picked up were co;unted. The procedure was conducted 3 times and was also conducted with an iron nail. It was found the the D battery with the aluminum nail picked up the most paper clips in all the trials. The hypothesis was supported by the results. The D battery did work the best.

Project Number: SPH022

Grade: 10

Title: The Significance of the Water / Cement Ratio in Concrete

Abstract:

Project Number: SPH023

Grade: 11

Title: The Accuracy of CT Scans

Abstract:

## SENIOR DIVISION – PHYSICS

Project Number: SPH024

Grade: 11

Title: Windmill Blade Quality Efficiency

Abstract: