



# 67th PITTSBURGH REGIONAL SCIENCE & ENGINEERING FAIR

## SENIOR DIVISION ABSTRACTS

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Pittsburgh Regional Science & Engineering Fair is a major event of the SciTech Spectacular

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## SENIOR DIVISION – BEHAVIORAL AND SOCIAL SCIENCE

Project Number: SBS001      Grade: 12

Title: Effect of Emotion on Pain Tolerance

Abstract: This project investigated the effects of emotions on pain tolerance and intensity, predicting that positive emotions would increase pain tolerance and decrease intensity. Pain was elicited in humans by submerging hands in ice. To alter emotional states, subjects were shown positive, negative or neutral film clips. The PANAS survey determined the effectiveness of emotional stimulation; the VAS survey measured pain intensity; the length of time hands were in ice determined pain tolerance. Although the films successfully altered emotions, there was little statistically significant evidence supporting the hypothesis. Instead, data suggests that watching any film increases pain tolerance and decreases intensity.

Project Number: SBS002      Grade: 11

Title: Who Has More HIV/AIDS Knowledge?

Abstract: To determine who had the most knowledge regarding HIV/AIDS between the Male and Females in grades 11th and 12th

Project Number: SBS003      Grade: 10

Title: Speech Development in 2 Year Olds

Abstract: The reason why I did my project because all 2-year-olds talk different than we do. SO what I did was I got two 2-year-old and had them say sentences on a tape recorder and after they would see the difference with the 2-year-old and myself. What I found is that they talk with a high pitch and they have more to learn than we do. What we should care about is that maybe after the project you will understand them more than you use to. What I can do is put more details and more information into my project.

Project Number: SBS004      Grade: 12

Title: The Effect of Physical Exercise on Learning Ability

Abstract: Studies show that physical exercise has a positive effect on learning ability. These experiments intended to prove the studies right. It was hypothesized that exercise increases learning ability. The first experiment tested two different groups; those who exercise and those who do not. The results showed that the people who exercised regularly scored higher on their memory tests than those who did not exercise. The second experiment tested two equal groups. They were given a memory test before exercising and a memory test after the workout. The results showed that the scores were higher after the workout. The experiments proved the studies right.

Project Number: SBS005      Grade: 12

Title: The High School Drop Out

Abstract: The purpose was to find out if there was a correlation between the drop out rate of African American males, class size, and racial break up. My hypothesis was that the larger the class size the lower the graduation rate would be among African American males. Collected data from the Pittsburgh Public Schools was analyzed.

## SENIOR DIVISION – BEHAVIORAL AND SOCIAL SCIENCE

Project Number: SBS006      Grade: 12

Title: The Effect of Hip Hop on Teenage Violence

Abstract: To determine if hip hop music has an effect on teenage violence.

Project Number: SBS007      Grade: 11

Title: Breakfast Burdens

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS008      Grade: 12

Title: Am I Still Smarter Than You?

Abstract: Determining if males from New Jersey have the highest SAT test scores in math and verbal skills compared to other geographic areas in the year 2004-2005.

Project Number: SBS009      Grade: 12

Title: Stress on Short-Term Memory

Abstract: My project observed the affects of stress on short term memory and how it differs between genders. To test this I had twelve rats (*Rattus norvegicus*) divided into six groups, with two same sex rats in each group. One male and female group was exposed to no stressor (stressor- radio noise), one male and one female group was exposed to occasional stress (1hr/day, 2 days/week,) and one male and female group was exposed to constant stress (5hrs/day, 5 days/week.)The rats ran through a radial arm maze to test short term memory.

Project Number: SBS010      Grade: 12

Title: Foods, Migraines, and Teens

Abstract: The purpose of the experiment is to discover if certain foods trigger migraines. To test this hypothesis, I conducted a survey about migraines and eating habits. The survey includes questions related to migraine headaches and eating habits. Subjects were required to record the food that they ate over a period of a week. After the week is over, the surveys were colleted. The data was recorded and compared to see if there is any correlation between migraine headaches and foods. From the data I was able to conclude that certain foods can influence migraine headaches.

Project Number: SBS011      Grade: 12

Title: The Effect of Light on S.A.D.

Abstract: Does supplementing winter daylight with simulated sunlight affect the activity and weight of mice? If normal winter daylight is supplemented with simulated sunlight for 30 and 60 minutes daily, I believe the group of mice that received 60 minutes of light will not gain weight – they will be more active in the light. The group that receives 30 minutes of the light will gain some weight - they will be slightly less active due to limited amount of light. The group of mice that receives no additional light will gain the most weight because their activity level will be low.

## SENIOR DIVISION – BEHAVIORAL AND SOCIAL SCIENCE

Project Number: SBS012      Grade: 12

Title: Can Teenagers Recognize Mental Illness in Visual Art?

Abstract: I plan to show a group of 15-20 teenagers a slideshow of about 25 paintings done by four artists with bipolar disorder, some paintings done before and some done after the artist was diagnosed with bipolar disorder. I will ask them to identify the period in which the paintings were created (before vs. after the diagnosis), after showing the paintings to them both individually and in sets (based on the period in which the paintings were created). I will then compare the results to those I gathered from a previous experiment involving adult psychiatrists and lay adults.

Project Number: SBS013      Grade: 10

Title: Dreams and Academic Success

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS014      Grade: 10

Title: The Effects of Stress on Testing Ability

Abstract: The purpose of the experiment is to test the effects of stress, by using a time limit, on testing ability. This was done by creating a test and administering it to 100 students. 50 students had a time limit while the other 50 students did not have a time limit. The data showed that students with the time limit had a lower correct percentage on the test than the students without a time limit. Therefore, stress negatively effects testing ability, causing the students' correct percentage to lower with the added stress.

Project Number: SBS015      Grade: 9

Title: Subliminal Messages? Where?

Abstract: The purpose of this study is to test the effectiveness of subliminal messages on the human mind. The subject will be exposed to a short video clip that contains a quick flashing subliminal message on the screen stating "I will pick the \*color\* ball." Immediately following the video they will be shown 3 different colored balls and asked to pick one.

Project Number: SBS016      Grade: 12

Title: The Cause of Obesity

Abstract: Over ten percent of American children are obese, a condition caused by taking in too many calories without a balance of enough exercise. Does social activity have an effect on the amount of exercise performed, food eaten, and weight gained? I placed ten mice in individual compartments and ten mice in groups of five. All twenty mice received a variety of junk foods in addition to unlimited nutritious pellet feed. I believe the isolated mice will gain weight as they have reduced exercise and interaction, and the weights of the mice in groups will remain stable throughout the experiment.

Project Number: SBS017      Grade: 12

Title: I Can Remember More Than You

Abstract: To identify and determine if age has any effect on the process of short term memory.

## SENIOR DIVISION – BEHAVIORAL AND SOCIAL SCIENCE

Project Number: SBS018      Grade: 10

Title: What effect does time of day have on your reaction time?

Abstract: The purpose of this project is to find out if the time of day effects the reaction time of people. Will a person move slower or faster depending on the time of day.

Project Number: SBS019      Grade: 9

Title: The Musical Emphasis On Education

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS020      Grade: 9

Title: Catching "The Yawn"

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS021      Grade: 9

Title: Concentration

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS022      Grade: 9

Title: Tune into Sleeping

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS023      Grade: 9

Title: How Fast Can You React?

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS024      Grade: 9

Title: Do You See What I See?

Abstract: Please visit student's exhibit for abstract

Project Number: SBS025      Grade: 9

Title: Wanna Play Halo Dude?

Abstract: Please visit student's exhibit for abstract.

Project Number: SBS026      Grade: 7

Title: Black and White or Colored Text

Abstract: Not available. Please visit student's exhibit for abstract.

## SENIOR DIVISION – BIOLOGY

Project Number: SBI001      Grade: 12

Title: In vitro study of aerosol flow through carina model

Abstract: The purpose is to verify the viability of the carina mode. Develop a closed system containing a throat model, carina model, two HEPA filters acting as the bronchi of the lungs, a respirator, and an aerosol creator. Create a .5M standard solution of NaCl to be atomized and used as the test aerosol. Run trials using the in vitro model through both the unobstructed and obstructed models of the carina to test the viability of the model. Implement different methodologies using steps 1-3 to examine aerosol deposition in the bronchi (HEPA filters). Examples of methodologies include heliox and ferromagnetism. Record all data and document statistical factors.

Project Number: SBI002      Grade: 10

Title: Vitamin C and Regeneration

Abstract: The purpose of this experiment was to evaluate the effects of the antioxidant Vitamin C on the regeneration rate of *Lumbriculus variegatus*. I cut the worms into three segments each. I counted the number of worm segments in each section and recorded them. I created different vitamin C solutions using spring water and pure vitamin C powder. The worms died from the vitamin C solutions due to the high acidity. I continued the experiment until I found a solution in which they survived. In conclusion, statistically the vitamin C could not be proven to aid in the worms' regeneration.

Project Number: SBI003      Grade: 11

Title: Calcium Content of Milk Products

Abstract: Please visit student's exhibit for abstract.

Project Number: SBI004      Grade: 11

Title: The Effect of Caffeine on *Transcantia sebrina*

Abstract: Three different caffeine solutions and a control were made and placed into plastic cups. The cups were covered with wax paper which was secured with a rubber band. Plant cuttings were placed through a hole in the wax paper. The recorded data was subjected to a Chi Square test to determine significance.

Project Number: SBI005      Grade: 9

Title: Sensory Strategies for Learning

Abstract: I tested a number of people in order to see in what way people learn the best between having information presented with words, words and sounds, and words with pictures. Each person had 14 words to memorize, and seven seconds per word. When they were done looking at each word, they had to count backwards from 15 to see if anything was stored in their Long term of Short term memory.

Project Number: SBI006      Grade: 12

Title: The Case for Domains: A Biocomputational Approach to Phylogenetics

Abstract: In order to find evidence for the existence of phylogenetic domains, the accession numbers for random 16s genome sequences in all six kingdoms in order to construct ten groups

## SENIOR DIVISION – BIOLOGY

of twelve organisms. The accession numbers were entered into the SwissProt/Trembl program in order to ascertain the full sequences, which were subsequently entered into the ClustalW multiple sequence alignment program to construct a phylogenetic tree. The trees were analyzed for evidence of domains.

Project Number: SBI007          Grade: 11

Title: Atkins Diet vs South Beach Diet: Which is Best?

Abstract: Test subjects will be family members. For two weeks no diet will be followed. The following two weeks will be the Atkins diet, followed by two weeks of no dieting. The final two weeks will be the South Beach diet, followed by two weeks of no dieting. Height, weight and body measurements will be taken and analyzed.

Project Number: SBI008          Grade: 9

Title: Plant Morphology & Micropropagation

Abstract: Micropropagation, a method of plant tissue culture, has a variety of advantages over regular plant propagation techniques. This experiment utilizes micropropagation to study and identify any morphological, or structural, variations between regular plants, growing in vivo, and cultures undergoing in vitro micopropagation. Microscopy was performed at regular intervals to study and compare the plants and the cultures. Preliminary results and research suggest that there are distinct morphological differences between the cultures and the plants.

Project Number: SBI009          Grade: 10

Title: Identifying Opsins in Inia Geoffrensis Tissue

Abstract: Cellular anatomical analysis of the retina of the Inia geoffrensis reveals the presence of rods and cones, an indicator of color vision. A molecular approach was used to determine if two classes of cone visual pigments are present, using procedures (PCR, gel electrophoresis, TA cloning) for cloning and characterizing dolphin visual pigment genes. Amplification of Inia opsin gene was successful. The Inia short-wave length opsin gene was successfully cloned and sequenced. Preliminary molecular data suggest this species possesses color vision.

Project Number: SBI010          Grade: 11

Title: SC & ADWG of Bull affect PSA?

Abstract: Please visit student's exhibit for abstract.

Project Number: SBI011          Grade: 10

Title: Pesticides on Plant Growth

Abstract: Pesticides are often used to exterminate pests. The intention of the project is to find the effect of pesticides upon the growth of plants. Different brands of pesticides were watered in a solution onto radish plants. Color change and height were recorded. It was determined that pesticides cause plants to dehydrate when used in excess. Pesticides had little effect when used in an appropriate amount. Future work is planned to determine the affects of individual chemicals found within pesticides on plant growth.

## SENIOR DIVISION – BIOLOGY

Project Number: SBI012          Grade: 9

Title: Daphnia Activity induced by MSG

Abstract: We take many things that occur in everyday life for granted. Purpose was to look for how MSG can affect the heart and the activity of an organism. Did so by adding it to daphnia. Using a timer and a stereo-microscope, I timed the heartbeats of the daphnia before and after the MSG was added, using a 3% and a 7% solution. Results came to show that the daphnia's heartbeats had a measurable increase due to the higher MSG concentrations. Moreover, the activity of the daphnia had increased, and some died as a result of over-stimulation of the heart.

Project Number: SBI013          Grade: 9

Title: Got Water?

Abstract: What percentage of water is in different kinds of fruit?" My hypothesis was that the fruit that are more porous and juicy fruits such as the lemon, lime and orange would have the most water and the denser, less juicy fruits would have the least. I found that my hypothesis was correct for the most part. The lemons, limes and oranges had the highest percentage of water. The other fruits were mixed within each other. From highest to lowest, the fruit's percentages: Lemon-89.33%, Lime-88.82%, Orange-87.07%, Apple-86.22%, Cherries-81.88%, Grapes-80.83%, Pear-80.81%, and Banana-74.02%.

Project Number: SBI014          Grade: 9

Title: Rainbow Snails: Fact or Fiction?

Abstract: The project I intend to show at the science fair is biology based about the effects of dye with snails. My hypothesis was that the snails would change the color of the dye I used, which was red, and that they would be more attractive to humans. Firstly for this project I bought six snails. I then separated them into two groups of three one being my control group while the other being my experimental group. I then added eight drops of normal food coloring dye to ! the experimental group's tank. Through my observations I noticed nothing unusual in the experimental group's progress with the dye. Also, they started to first turn a bright pink color then a dull red. Next I noted that this procedure of dyeing snails was both safe and humane for the snails. After that I took a small census of twenty five people asking if they would want a colorful snail and over half of them said they would. So, in my conclusion I found that they were much more attractive to humans and this was a safe way to do it. This leads me to think about other animals able to be dyed and if they would be wanted more than normal species.

Project Number: SBI015          Grade: 11

Title: The Effects of Digitalis Purpurea vs Rutin Trihydrate on the Heart Rate of Daphnia

Abstract: Please visit student's exhibit for abstract.

Project Number: SBI016          Grade: 9

Title: Oil Spill in a Test Tube

Abstract: Oil spills have become more common and the possible adverse environmental effects also increase. The purpose of my experiment was to find if a single strain of bacteria that is known to perform bioremediation is more efficient than a consortium of bioremediation bacteria. The single strain of bacteria used was an isolate of *Pseudomonas fluorescens*. The consortium consisted of an isolate of *Pseudomonas fluorescens*, an isolate of *Pseudomonas fragi*, an isolate of *Klebsiella oxytoca*, an isolate of *Klebsiella pneumoniae*, an isolate of *Bacillus subtilis*, and an

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isolate of *Bacillus cereus*. The results of the experiment supported a consortium degrading oil faster than a single strain.

Project Number: SBI017          Grade: 9

Title: Is Soil Necessary for Plant Growth

Abstract: Please visit student's exhibit for abstract.

Project Number: SBI018          Grade: 12

Title: Noise and Concentration

Abstract: Humans listen to calming sounds to relax them. Do calming sounds have the same effect on rats? I taught ten rats a maze, and then tested the effects that different sounds had on the rats' productivity in the maze. The sounds I tested included silence (control), white noise and a heartbeat. Each rat ran the maze for five trials in silence, five trials with white noise playing in the background, and five trials with a heartbeat sound in the background. I believe that these sounds will calm the rats and decrease the time for each rat to complete the maze.

Project Number: SBI019          Grade: 9

Title: The Effect of Spices on *B. Cereus*

Abstract: Divide the bacteria, *Bacillus cereus* evenly into petri dishes filled with nutrient agar. Allow the bacteria to grow overnight in an incubator. Label each petri dish with the name of a spice and add equal amount of spice to the respective dishes. Measure the zone of inhibition in each dish and compare the results.

Project Number: SBI020          Grade: 9

Title: The Best Water for Plants

Abstract: I researched which type of water out of rain water, tap water, and distilled water is the most effective in growing plants. I used radish plants in my research because of their rapid growth rate. I created my own scale of different shades/ intensities of green to measure the growth of the radish leaves. My hypothesis was proven correct. If I were to do this project over again, I would find a much better way of measuring and collect my data.

Project Number: SBI021          Grade: 10

Title: Watering Plants At Various Times

Abstract: The purpose of this investigation is to determine if the time of day at which plants are watered affects their growth, as measured in height and root mass.

Project Number: SBI022          Grade: 12

Title: Heat's Effect on Mutation

Abstract: New studies in the field of genetics could solve many modern medical problems. For this reason, I conducted a genetic study of *Drosophila melanogaster*. I exposed three sets of flies to varying levels of heat ranging from 25-35°C. One set of flies was kept at room temperature. Each set reproduced over several generations. For each generation, I determined the sex of each fly, its eye color, and wing shape. The point being to determine if the flies exposed to

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greater heat showed more mutations. I predicted the higher the heat, the more mutations the flies would have.

Project Number: SBI023          Grade: 10

Title: Temp and Cellular Respiration

Abstract: Dissolve 7 grams of yeast in 100 mL of water. Prepare a 5% solution of glucose solution. Put 3 test tubes with 2 mL of glucose solution into a room temperature bath of water. Add 2mL of yeast solution to the test tube. Allow the 4mL of combined solution to incubate for 10 minutes. Take readings for 4 minutes with a CO2 sensor. Three trials each repeated for 0, 30 and 60 degrees (C).

Project Number: SBI024          Grade: 12

Title: Chemo Induces Stem Cell Differ

Abstract: Chemotherapy knocks out rapidly dividing cells of the human body, including human sperm. By the end of the decade, 1 in 25 males will be cancer survivors, and chemotherapy may cause them to have non-functional sperm. In the present study, spermatogonial stem cells are taken from the animal and are induced to carry the GFP gene. After chemotherapy, GFP+ stem cells are re-inserted and new stem cell colonies in the testes are tracked using GFP. The potential of this study is limitless, with the foremost goal to restore fertility to cancer survivors.

Project Number: SBI025          Grade: 11

Title: The Effect of Herbs on Bacteria

Abstract: Please visit student's exhibit for abstract.

Project Number: SBI026          Grade: 9

Title: Big Fish in a Small Pond?

Abstract: Please visit student's exhibit for abstract.

Project Number: SBI027          Grade: 9

Title: Chocolate Anyone?

Abstract: Please visit student's exhibit for abstract

Project Number: SBI028          Grade: 10

Title: Jell-no!

Abstract: Please visit student's exhibit for abstract.

Project Number: SBI029          Grade: 10

Title: Cell Growth on Scaffolds

Abstract: Please visit student's exhibit for abstract.

## SENIOR DIVISION – CHEMISTRY

Project Number: SCH001      Grade: 9

Title: Chemically Based Transistor

Abstract: I built and tested a chemically based transistor because of my prior interest in learning about how transistors work. To complete the experiment, I first constructed an apparatus which consisted of a control and output circuit. Next in the control part of the apparatus I varied the concentration of the salt solution into which the electrodes were introduced. Finally, I recorded the current in the output circuit. My hypothesis was disproved.

Project Number: SCH002      Grade: 9

Title: The Effect of Sucrose of Yeast Fermentation Time

Abstract: This experiment is testing the amount of time it takes yeast to release enough carbonic acid to neutralize a strong base, representing fermentation. Various percentage sucrose solutions were tested in a yeast, bromthymol blue, and NaOH solution. When the solution was neutralized, shown by the green color the timer was stopped. It was found that with lower percentages it took longer for the yeast to ferment, as sucrose increased the time decreased. When too much sucrose was added the yeast took that it had reached a plateau, there was too much sugar to that amount of yeast.

Project Number: SCH003      Grade: 11

Title: Effect of Cinnamaldehyde on Steel Rust

Abstract: My project involved cinnamaldehyde, a natural oil extracted from the bark of cinnamon trees. I hypothesized that cinnamaldehyde would prohibit rust as well as a store-bought anti-rust product. I tested three sets of nails in a humid environment to see which ones rusted. The first set of nails was coated with cinnamaldehyde, the second with Rust-oleum anti-rust paint, and the third was my control group of plain steel nails. While observing the nails each day, I concluded from the results that the cinnamaldehyde did prevent rust, but because the cinnamaldehyde did not adhere as well to the metal, the Rust-oleum worked better.

Project Number: SCH004      Grade: 10

Title: Calcium Levels of Dairy Foods

Abstract: In my project, I intend to break down dairy foods in order to test the amount of calcium present in them.

Project Number: SCH005      Grade: 10

Title: Wheat Flours: Hydrogen Bonding

Abstract: By observing the viscosity of the dough, which is the property of resistance to flow in a fluid, hydrogen bonding must be the force that contributes to the elasticity of the dough, because of the electronegative atoms present and the characteristic of progressing through time. Time does not necessarily affect the strength of other intermolecular forces. Therefore, if the elastic property is not dependent on time, then hydrogen bonding is not the force that contributes to its property. It was concluded that hydrogen bonding was the force that developed the elastic property; further experimentation was done to discover concentration effects.

## SENIOR DIVISION – CHEMISTRY

Project Number: SCH006      Grade: 11

Title: Extracting Hydrogen From Water

Abstract: The purpose: Test the percent yield of hydrogen using different elements when performing single displacement reactions. Determine the amount of Magnesium needed by performing a molar calculation, setup the equipment, measure 100.0 mL of water from a burette and pour it into the flask, fill the beaker half-full with water, fill the graduated cylinder with water, flip it over, and place it into the beaker (make sure there is no air in the cylinder). Place the Mg into the flask and immediately place a cap on the flask. After five minutes, measure the amount of empty space in the graduated cylinder. Record this value and find the percent error. Repeat steps 1-8 five times for each element. Strontium produced more Hydrogen than did Calcium or Magnesium. Calcium was fairly close to Strontium, and Magnesium produced the least amount of gas.

Project Number: SCH007      Grade: 11

Title: Alternative Energy Fuel Source from Yogurt Bacteria

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH008      Grade: 10

Title: Soil Amendment Chemistry - II

Abstract: Water retention, pH, Ca<sup>2+</sup>, NH<sub>4</sub><sup>+</sup>, NO<sub>3</sub><sup>-</sup> and Cl<sup>-</sup> were measured on water samples collected from three-month outdoor exposures of beds (55 x 65 cm) containing clay soil and amended soil mixtures (50:50 volume %) to compare waste-based amendments (recycled wallboard and hardwood bark) to a commercial amendment (peat moss) for improving soil chemistry. All three amendments reduced water retention by ~10% and available nitrogen by >50%. Bark and wallboard increased water pH relative to neat soil. Wallboard was the only amendment to increase available Ca<sup>2+</sup> and Cl<sup>-</sup>. These results prove that bark and wallboard could be reused as soil amendments.

Project Number: SCH009      Grade: 10

Title: Enzymes In Cheese Production

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH010      Grade: 11

Title: Storage Technique for Vitamin C

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH011      Grade: 10

Title: Effects of Sacrificial Anodes

Abstract: The purpose of this experiment was to determine which sacrificial anode protected carbon steel the most in a salt water environment. The control was an unprotected carbon steel coupon. The variables were carbon steel galvanized with magnesium, aluminum, or zinc. Masses were compared before and after four weeks. The control lost the most mass, which shows corrosion protection is necessary. Sacrificial anodes give up more of their electrons in the oxidation process, which allows the cathode to prolong its life. The zinc protected the carbon steel

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the most because unlike magnesium, it doesn't have a high activation potential, and unlike aluminum, it doesn't form a protective coating around itself.

Project Number: SCH012      Grade: 11

Title: Fruits and Vitamin C

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH013      Grade: 10

Title: How do Gypsum and Polyacrylamide affect Soil Permeability of Sodium Treated Soils?

Abstract: The experiment tested how gypsum and polyacrylamide affect soil hydraulic conductivity of sodium-treated soils. 30 treatment cells were isolated and hydraulic conductivity was measured. 9 days later, sodium chloride was applied to 18 cells. 28 days later, hydraulic conductivity was measured, polyacrylamide was applied to 6 cells, and gypsum was applied to 18 cells. 12 days later, hydraulic conductivity was measured. Statistical data showed hydraulic conductivity of sodium chloride cells significantly decreased. The hydraulic conductivity of gypsum and polyacrylamide cells significantly increased. Results suggest using both gypsum and polyacrylamide to increase soil permeability, reversing effects of sodium chloride de-icing salt.

Project Number: SCH014      Grade: 10

Title: Questionable Carrots

Abstract: A popular brand of baby food carrots has been removed from store shelves in Taiwan and Israel. Cadmium was sighted as a contaminant. Research shows 30 to 40 times more than the accepted safety level of cadmium was present. This experiment was done to prove or disprove the presence of cadmium in this product. Experiments were done to identify the metal by qualitative precipitation. No amount of cadmium was detected in the samples tested.

Project Number: SCH015      Grade: 9

Title: A Study of Liquid Densities and Their Various Pressures

Abstract: Gasoline is something that we use everyday in our cars. Have you ever wondered about it's pressure? How about something like glycerin, or even water? These liquids all have very different densities which I wondered if it had an effect on pressure. The tests determined that density did not play a large role in pressure. The densities were in intervals, but the statistics had no obvious pattern. Future work could be done to determine a larger factor in pressure than density.

Project Number: SCH016      Grade: 10

Title: Packing in Cylindrical Space

Abstract: Seeing how many objects can fill a certain volume has puzzled humans for thousands of years. My study is designed to show how packing densities of spheres and ellipsoids in relatively small cylindrical space behave and compare with one another. To address this problem, I calculated the theoretical packing density of spheres and ellipsoids in cylinders and physically measured the packing densities. I concluded that overall the ellipsoids had higher and steadier packing densities than spheres. Candy companies can benefit when determining optimum container sizes. At the nano-scale, this study predicts how particles/molecules/atoms will pack into tubular confinements.

## SENIOR DIVISION – CHEMISTRY

Project Number: SCH017      Grade: 11

Title: Correlation Between Oxidation and Caffeine

Abstract: The purpose of this experiment was to determine the correlation between the time that tea is allowed to oxidize and the amount of caffeine contained in that tea. To do this I extracted the caffeine from the various types of teas used, utilizing a procedure known as the Isolation of Caffeine From Tea Using Liquid-Liquid Extraction. After running the experiment, I was able to determine that the least oxidized teas (such as Green and White Tea) contains considerable less caffeine than the more oxidized teas (such as Black and Oolong teas), creating a positive correlation between oxidation time and caffeine contents.

Project Number: SCH018      Grade: 12

Title: Inhibition of Kidney Stones

Abstract: This research dealt with the inhibition of kidney stones by controlling the pH in the environment in which they were grown. The pH of the kidney stones ranged from zero to fourteen. Magnesium hydroxide was used to change the pH. Results from pilot studies (involving magnesium, iron, and vitamin C) were incorporated into this research, the only variable now being the pH environment. It was found that in the presence of calcium oxalate alone and with magnesium, pH inhibits the growth at seven. In the presence of calcium oxalate with vitamin C and iron, pH had no effect.

Project Number: SCH019      Grade: 12

Title: Effects of Nicotine on Lung Cancer Cells

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH020      Grade: 11

Title: Antioxidant Potential of Teas

Abstract: The purpose of this experiment was to study the antioxidant potential (or power) of many different beverages and substances, focusing on teas. I used the Ferric Reducing Ability of Plasma (FRAP) method to find the reduction potential of beverage samples. I prepared the samples and the FRAP reagent and used a spectrophotometer to find the absorbance values of the solution. I then compared these values to a calibration curve of known ferric reduction potential to find the antioxidant potential.

Project Number: SCH021      Grade: 9

Title: Electrolysis on Solution

Abstract: The purpose is to decide which products are formed by oxidation and reduction when electric currents are passed through distilled water, copper (II) chloride, tin (II) chloride and barium chloride.

Project Number: SCH022      Grade: 10

Title: Disinfectants and Corrosion

Abstract: This experiment determined which disinfectant would cause the highest rate of corrosion on common pipe materials in untreated spring water. I designed a test apparatus that allowed me to test galvanized steel, black iron, and copper pipe samples by adding the

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disinfectants, chlorine, iodine, and hydrogen peroxide, into the water for a period of thirty days. The data that I observed showed that galvanized steel was the worst at preventing corrosion while copper was the best. I concluded that the best pipe and disinfectant would be chlorine and copper because this is most effective and least expensive.

Project Number: SCH023      Grade: 10

Title: A Study of Fe Vitamin Label Ac

Abstract: Iron, a necessary mineral, is toxic in excess amounts. Therefore, "Do iron vitamins labels accurately reflect the iron in the vitamins?" The absorbance of the standards & samples was measured. An iron-calibration graph was charted from Fe<sup>2+</sup> standards, then used to determine the iron mass of the samples. Iron mass (mg) for each sample: Centrum:13, 23, 17, 17; Giant Eagle:15, 19, 17, 18; One A Day:10, 24, 45, 14. Standard Deviation, Confidence Intervals, t Test, & Q Test assisted in analyzing these results. In conclusion, the vitamin labels are accurate statistically, but some vitamins in each group did not meet FDA standards.

Project Number: SCH024      Grade: 9

Title: Alternative Stain Removal

Abstract: Since bleach can remove color from fabrics, there must be a safe way to remove stains that will not damage the color of the fabric. Dish washing liquid, glass cleaner, body wash, and hair spray are common products found in most people's homes. Therefore, will any of these common household products be effective in removing stains from cotton fabrics (denim) without damaging the fabric?"

Project Number: SCH025      Grade: 12

Title: Tensile Strength of Cement

Abstract: Determine which cement mix is strongest.

Project Number: SCH026      Grade: 9

Title: Effective Calcium Content in Antacids

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH027      Grade: 12

Title: pH In Cosmetics

Abstract: The title of my project is pH in Cosmetics. The purpose of this experiment is to test whether cosmetics are an acid, a base, or neutral. My hypothesis is, if six samples of Cover Girl Cosmetics are tested for their pH levels, they will either be acidic or neutral, because for healthy skin cosmetics should balance the slight acidity of the skin. The procedure of this experiment is as follows: Obtain all materials needed, put four leaves of red cabbage in a blender and blend until the color is a seep purple, pour the liquid into a small bowl, place all cosmetics into plastic bowls, add two to three drops of the red cabbage indicator to each sample, record any color change, match the color change with the pH scale used from the Virtual Biology Course to determine the pH level.

## SENIOR DIVISION – CHEMISTRY

Project Number: SCH028      Grade: 11

Title: Creating Silicon From Sand

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH029      Grade: 10

Title: Nanotechnology's Effect on Fabrics

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH030      Grade: 9

Title: Acid Rain Effect on Materials

Abstract: This experiment determines whether acidity harms materials. Use sulfuric acid to lower the pH of water. Place 50 tomato, radish and mustard seeds in water solutions. After 14 days, count the number of seeds that germinated. Plant seedlings and grow them in Styrofoam cups. grow the seedlings watering with pHs of 7-3. Count leaves and obtain their biomass. Place squares of copper, aluminum, steel, marble and limestone with different pH waters. Check the mass after 3 weeks. The seeds and plants grew and germinated best in a pH of 6. Aluminum, copper, steel and marble were corroded in a lower pH.

Project Number: SCH031      Grade: 11

Title: The Effects of Delaying Corrosion on Concrete Bridges

Abstract: To research and determine if pretreating concrete with different solvents will prevent sodium chloride from corroding cement.

Project Number: SCH032      Grade: 9

Title: Food For Thought

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH033      Grade: 9

Title: Grow or No?

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH034      Grade: 9

Title: Nail Polish

Abstract: Please visit student's exhibit for abstract.

Project Number: SCH035      Grade: 9

Title: Fruit's Impact On the Flow of Electricity

Abstract: Please visit student's exhibit for abstract.

## SENIOR DIVISION – COMPUTER SCIENCE/MATH

Project Number: SCM001      Grade: 9

Title: Sound of Math

Abstract: Please visit student's exhibit for abstract.

Project Number: SCM002      Grade: 11

Title: Risk Probabilities

Abstract: Please visit student's exhibit for abstract.

Project Number: SCM003      Grade: 12

Title: The Application of Music in Cryptography

Abstract: Using music as a vehicle for transferring text is especially safe because the audio format disguises itself from being recognized as a ciphertext. The plaintext is first converted into ciphertext using the RSA crypto system. The ciphertext is then converted into a set of notes through modular arithmetic. Non-coding padding is then added to make the piece pleasant sounding. Such a piece of "cipher music" can be produced using the procedures defined in this project, but there is always room for improvement in the musical aspect of the cipher to disguise it as completely normal sounding music.

Project Number: SCM004      Grade: 10

Title: Atari 2600 Emulator on DS

Abstract: Convert an existing Atari 2600 system emulator for the PC to the Nintendo DS handheld device. The emulator provides a nearly exact replication of the Atari 2600's CPU and hardware. Set up an ARM cross-compiler and a library to develop arbitrary code for the DS. Rewrite specific parts of the emulator to be compatible with the Nintendo DS and run on its hardware. Use methods such as altering the DS firmware and using flash cartridges to run the code on the actual Nintendo DS device. The result is a Nintendo DS that is able to play Atari 2600 games.

Project Number: SCM005      Grade: 11

Title: Dosing Warfarin with Python

Abstract: Methods for dosing Warfarin, an anticoagulant, are inconsistent and sometimes dangerously inaccurate. This study investigated whether a Python program could accurately predict patient's future anticoagulation levels (INRs) using little past data. A program was developed that solved a multivariate regression equation using patient INRs, doses, and time changes and saved the most accurate coefficients in a database. This database was used to predict new patients' future INRs using current data and past data from one, two, or three prior doses. Error was lowest using one prior value and averaged 16.4%. This approach could be used in real-time clinical situations.

Project Number: SCM006      Grade: 10

Title: Data Storage and Transfer

Abstract: The purpose of my procedure was to improve the efficiency of data storage and transfer in everyday computer usage. I judged medium storage based on time of data creation, writing, deletion, and memory usability. For data transfers, I tested for corruption, temporary

## SENIOR DIVISION – COMPUTER SCIENCE/MATH

utilizations, and time. My tests showed that optical mediums had horrible memory to space usage and bad anti-corruptibility, no garbage collection, but good transferring rates. Magnetic devices were better for storage, but were slightly weaker for transferring onto. Overall, magnetics were the best for storage and homo-medium transfers were slightly less efficient than inter-medium transfers.

Project Number: SCM007      Grade: 9

Title: Fractals in Medicine?

Abstract: My science fair project was to create a program that could distinguish between normal and abnormal MRI brain images, using fractals. My software extracted identifying features from MRI brain images, such as fractal dimension and measures of symmetry. I used a one layer neural network to classify normal and abnormal images. The software had 97% accuracy rate when testing for abnormalities using only fractal dimension, and a 100% rate when using the symmetry measure. Therefore, fractals and other image features can be used to find abnormalities in MRI brain images.

Project Number: SCM008      Grade: 10

Title: Evacuating a Building

Abstract: The purpose of my project was to determine the maximum height of a building in order to evacuate the occupants within a certain time frame. I created equations in which details of a building's floor plan, occupancy, and height could be entered to provide the time needed for total evacuation. The project was divided into four phases. In the first, I modeled the building with two stories to find the time needed to descend one floor and exit. In the second phase, I introduced multiple stories. In the third, I devised egress plans, and in the fourth phase I factored in human behavior.

## SENIOR DIVISION – EARTH/SPACE/ENVIRONMENT

Project Number: SES001      Grade: 11

Title: Human Hormone Effects on Peas

Abstract: Two substances sometimes found in water supplies were tested on the pea plant. Premarin, a conjugated estrogen, and tribulus terrestris, a herb containing sterols, were diluted in distilled water to levels of 200uM, 20uM, and 2uM, per 2.5ml. The experiment consisted of germinating the seeds and watering the specimens with the solutions, and measuring growth, mass and flowers per plant. Averages were calculated to determine trends. Overall, all specimens had enhanced growth and mass over the control, and most had more flowers. Further research would be needed to determine if plants absorbed the substances.

Project Number: SES002      Grade: 12

Title: The Tanzanite Trials

Abstract: Precious gemstones are difficult and expensive to synthesize. The focus of this research was to create an economically efficient procedure to synthesize tanzanite. Having done so, a variety of impurities were introduced to color the samples. The chemical composition was reproduced, therefore confirming the presence of tanzanite. This was accomplished by combining chemicals following the percent composition. Aluminum ions in addition to a  $AlCl_3$  solution created a metallic environment in which the tanzanite were enlarged. The method proved to be successful in that tanzanite was produced and provided coloration of the tanzanite crystal.

Project Number: SES003      Grade: 9

Title: Is Pressure Treated Wood Environmentally Safe?

Abstract: To determine if the new pressure treated wood was less toxic to the old pressure treated wood. New pressure treated wood containing CCA would be less toxic to the old pressure treated wood found in old pressure treated wood. I tested 12 minnows for each type of water for three weeks to determine if the different types of wood containing different chemicals had an effect on the minnow's heart rate. The data I collected showed that the old type of wood containing ACQ was less toxic than the wood containing CCA. The heart rate of the minnows that were tested in the water that contained CCA rapidly increased and then stayed high. The heart rate of the minnows tested in water that contained ACQ slowly increased and stayed the same for the rest of the trials. In conclusion my hypothesis was proved wrong. My data showed that the old wood was less toxic than the new wood.

Project Number: SES004      Grade: 10

Title: Run Away Dirt!

Abstract: My project "Run Away Dirt" will test various man-made methods that control erosion versus natural plant materials in holding back soils. From this experimentation I hope to be able to determine the most effective means of erosion control on a small model that may be applied to work in real life applications.

Project Number: SES005      Grade: 9

Title: Road Salt and Bacteria

Abstract: My experiment tested if road salting in winter affects bacteria in creeks near roads. Water was collected from two creeks before and after salting. The samples were spread over agar plates, and the number of bacterial colonies was counted for five days. The salinity level of each water sample was also tested using a conductivity setup. It was found that while the number

## SENIOR DIVISION – EARTH/SPACE/ENVIRONMENT

of bacterial colonies decreased after road salting, the salinity level remained constant. Therefore, the conclusion was reached that the number of bacteria in creeks decreases during the winter, but this is not caused by road salting.

Project Number: SES006      Grade: 12

Title: Morphing Minerals

Abstract: It is a geological fact that malachite is a pseudomorph of azurite. This research focused on the synthetic production of both. Once the production of azurite was completed, the environments were changed to promote or prevent the growth of malachite. The characteristics of the mass, angles, reproducibility, chemical composition, and gem-like quality of the crystals were monitored and analyzed. Azurite was successfully produced under standard laboratory conditions, as was the production of malachite, but only having been induced by a carbon dioxide environment.

Project Number: SES007      Grade: 9

Title: Correlation Between Sunspot Activity and Tropical Storms

Abstract: This Project was created to find if there was a connection between sunspot activity and tropical storm occurrence. To do this I went onto the internet and collected data on sunspot activity by month from [www.dxlc.com/solar/history/](http://www.dxlc.com/solar/history/) and the number of hurricanes and tropical storms each month from <http://weather.unisys.com/hurricane/atlantic/index/html>. Once all the data was collected I put it into a chart and then graphed it. After all the data was compiled, it did not show a correlation, so I can conclude that there is no connection between sunspot activity and the occurrence of tropical storms.

Project Number: SES008      Grade: 11

Title: Permethrin and pH

Abstract: This project determined whether an added stress factor of a varied pH would compound the lethality of the chemical Permethrin in an aquatic ecosystem. I used Scuds as my test subject. I tested six groups with 10 vials of 5 scuds in each group. The following groups were tested: control (using unaltered pond water), raised pH, lowered pH, Permethrin, lowered pH and Permethrin, and raised pH and Permethrin. I found that the effects of the permethrin were compounded by the altered pH; I proved this mathematically using a statistical analysis.

Project Number: SES009      Grade: 10

Title: Effect of Juglone on Invasive Plants

Abstract: The purpose of the experiment was to find a natural way to eliminate invasive plant species. A black walnut hull solution containing juglone was created. *Lythrum salicaria* seeds, the invasive plant species, and sunflower seeds, the control species, were watered with different concentrations of black walnut extract and also with water. The results did not support my hypothesis. The *Lythrum salicaria* seeds did not germinate in any of the conditions, including the control. However, the sunflower seeds germinated in both water and in all concentrations of black walnut extract.

## SENIOR DIVISION – EARTH/SPACE/ENVIRONMENT

Project Number: SES010      Grade: 11

Title: The Effects of Mercury on Duckweed and Yeast Populations

Abstract: This experiment was designed to test the environmental impact of mercury on duckweed as the first phase and yeast in the second phase. The form mercuric-nitrate was used because of its availability and abundance in the water bodies of the United States. In the first phase, 30 duckweed seedlings were placed in 3 tanks and treated with 1 liter of .2ppm and .002ppm of mercuric-nitrate, as well as 1 liter of distilled water for the control. The EPA regulation for mercury is .02ppm. In the second phase, 1 gram of sugar and yeast were placed in 3 test tubes connected to 3 graduated cylinders to determine how much carbon dioxide is produced from the process of fermentation. In conclusion, the mercuric-nitrate proved to be extremely harmful to the duckweed and yeast, changing the duckweed's color (green to white), size, and development. The mercuric-nitrate also limited the production of carbon dioxide in the experimental groups compared to the control group.

Project Number: SES011      Grade: 11

Title: Underground Electrical Imaging

Abstract: Please visit student's exhibit for abstract.

Project Number: SES012      Grade: 9

Title: Three Rivers Water Study

Abstract: I tested the rivers of Pittsburgh for various harmful attributes. I tested for lead, oil, phosphates, chloride, and PH.

Project Number: SES013      Grade: 12

Title: Soap Water Contaminants

Abstract: Please visit student's exhibit for abstract.

Project Number: SES014      Grade: 9

Title: The Effects of Detergents on Water

Abstract: Please visit student's exhibit for abstract.

Project Number: SES015      Grade: 11

Title: The Endurance of Breakwaters Against the Rebounding Waves

Abstract: My project involved the extended amount of time of waves exerting energy on an breakwater. First, I needed to build a large enough water tank to conduct my experiments. Next, I constructed my wave creator and then my wall. MY wall creator is automatic and only needs to be turned on to run. Five trials of waves hitting the wall would commence for an extended amount of time, each wall a different type. After all these tests, I would find the force that was walls absorbed and calculate which wall could absorb the most. I would then compare these to my theoretical experiment for source of error.

## SENIOR DIVISION – EARTH/SPACE/ENVIRONMENT

Project Number: SES016      Grade: 12

Title: Mine Reclamation

Abstract: The purpose of this investigation is to determine if streams along the Youghiogheny River are still being contaminated by run off from reclaimed mines.

Project Number: SES017      Grade: 12

Title: Synthetic Wonder

Abstract: As of date, there are but three known processes for synthesizing Beryl,  $Al_2Be_3(SiO_3)_6$ ; flux growth, hydrothermal, and lechleitner. This research was done to develop yet a fourth method of synthesizing Beryl. The process replaces heat and pressure with solvents to break existing bonds, thus allowing Beryl structures to form. A second phase of the process requires the reactants to be introduced in a specific order. The later of the research is still in progress. Crystal structures were produced and are being analyzed for chemical content.

Project Number: SES018      Grade: 10

Title: CCA vs. ACQ: Which is Safer?

Abstract: The purpose of the experiment was to see if ACQ, used in new pressure treated wood is really safer than CCA used in old pressure treated wood. I tested how quickly each solution leached into water by placing samples of the wood into water, and using a spec-20 to determine the absorbance of the substances. I also tested the each preservative on the heart rate of daphnia to see which would be more toxic. My data showed that the wood treated with ACQ was actually more toxic than wood treated with CCA

Project Number: SES019      Grade: 10

Title: Pollution in Plum Creek

Abstract: Please visit student's exhibit for abstract.

Project Number: SES020      Grade: 12

Title: Generating Gypsum

Abstract: Synthetic gypsum,  $CaSO_4 \cdot H_2O$ , has been made before, but has never been produced for the purpose of obtaining calcium (II) sulfate crystals. Gypsum is a main ingredient in the production of drywall, and is created for that purpose. The purpose of this experiment, however, is to produce  $CaSO_4 \cdot H_2O$  crystals and prove that these crystals can be refined to gem quality stones. A calcium (II) sulfate solution was made, and initial trials done with sand inclusions had little success, but gem-like crystals were eventually produced using radiation. These crystals were very small and future research will attempt to enhance size.

Project Number: SES021      Grade: 9

Title: Water Everywhere Not a Drop to Drink

Abstract: Please visit student's exhibit for abstract.

## SENIOR DIVISION – ENGINEERING/ROBOTICS

Project Number: SER001      Grade: 12

Title: An Indestructible Mailbox

Abstract: Create a design to reflect the force of a blow so that it does not damage the mailbox. Gather the needed materials to create the mailbox. Build the mailbox. Test the strength through various force applications to the mailbox. Draw conclusions.

Project Number: SER002      Grade: 10

Title: Robotic Navigation: No Strings Attached

Abstract: This project involves testing a homemade robot to determine whether it can use a decision-making process to navigate its environment and avoid obstacles. I built the robot and the test arena from commercially available parts, and then conducted ten trials, testing for the ability to reach defined points, time per course segment and total trial time. The robot completed the course in all but one trial. My robot successfully responded to changes in its environment and avoided obstacles. This research takes a step towards developing useful robots that can act on their own without requiring expensive technology and equipment.

Project Number: SER003      Grade: 11

Title: Comparison of 6061 and 7055 Grade Aluminum

Abstract: Aluminum is a metal that is used in many things today. In this experiment, I tested two types of aluminum to see which would machine more easily. To test their machinability, I drilled holes through 0.635 cm plates of each of the grades, recording the time it took to drill the whole way through. Before statistical analysis, my results show that 7055 grade drilled more easily than 6061 grade. Further tests are planned to test if one of these grades welds more easily than the other.

Project Number: SER004      Grade: 12

Title: Do Hard Hats Really Work?

Abstract: This project is designed to test the durability and strength of hard hats using a crush test, by dropping a 2.6 kg weight on the hard hat from a constant height and by performing a projectile test using a pneumatic nailer set to fire nails at the hats at a constant velocity. Overall three of the hats performed very well and one (the most expensive) performed poorly. While hard hats can't protect you from everything the still should be worn for the small affect of protection they can give.

Project Number: SER005      Grade: 12

Title: Emissions of Two-Stroke Engines

Abstract: Please visit student's exhibit for abstract.

Project Number: SER006      Grade: 11

Title: To Make Seeing Eyes Blind

Abstract: Please visit student's exhibit for abstract.

## SENIOR DIVISION – ENGINEERING/ROBOTICS

Project Number: SER007      Grade: 9

Title: Bumps on Hull Humps

Abstract: Please visit student's exhibit for abstract.

Project Number: SER008      Grade: 12

Title: Maglev Body Efficiency Designs

Abstract: Please visit student's exhibit for abstract.

Project Number: SER009      Grade: 11

Title: A Tale of Two Keyboards

Abstract: Millions of bacteria are transmitted via everyday products like keyboards and computer mice, spreading colds and influenza. Even with the use of consumer disinfectants, most germs are still spread from hand contact. Ultraviolet radiation is used in hospitals to sterilize instruments for surgery. The purpose of the project is to see if the effects of UV rays on bacteria in the design of a UV light scanner to be used in public settings. Hopefully the results of this project will aid in lessening the amount of sickness in condensed public areas by controlling/killing bacteria/viruses on a computer device.

## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH001      Grade: 12

Title: The Effect of Isothiocyanates on H.Pylori

Abstract: Nearly half of the world's population is infected with helicobacter pylori bacteria in the stomach. H. pylori is labeled as a carcinogen, and the presence of it in the stomach increases the chances of developing gastric cancer up to six times. Isothiocyanates are sulfur-containing phytochemicals found in vegetables that have anti-cancer properties. I have taken three of the strongest isothiocyanates and subjected them to the same strain of H. pylori in a cultured medium to monitor their inhibition of bacterial growth for the span of a week.

Project Number: SMH002      Grade: 12

Title: Antibiotics with Titanium

Abstract: A.) The purpose of this experiment was to test the effectiveness of the antibiotic Vancomycin with Titanium over a certain time period.

B.) The procedure was as follows:

1. Culture Staphylococcus epidermidis
2. Reconstitute Vancomycin
3. Boil 8 Titanium pieces, then soak 6/8 in Vancomycin
4. Place 4/6 Titanium soaked pieces in sterile environment
5. Pipette 1mL of Staphylococcus epidermidis onto petri dish
6. Place a soaked Titanium piece in the center of the petri dish
7. Repeat procedure with one more soaked Titanium piece and two unsoaked Titanium pieces
8. Three days later, repeat step 7 and take measurements of previously incubated plates
9. Repeat entire procedure with a four day interval

C. The zone of inhibition did not decrease as time when on during my experiment.

D. The effectiveness of Vancomycin in combination with Titanium does not decrease over a short period of time.

Project Number: SMH003      Grade: 11

Title: Comparison: PET/CT Scan and CT Scan

Abstract: Survival from cancer depends on early detection/diagnosis and subsequent detection/diagnosis, during definitive therapy, of recurrent/residual lesions. CT scans and PET/CT scans are the nation's primary imaging modalities used in the follow up of cancer patients receiving therapy. A comparison was conducted between the ability of PET/CT scans and CT scans to detect and diagnose cancerous lesions during definitive therapy. Each patient underwent CT scanning followed by PET/CT scanning. A statistical analysis was conducted to determine which modality is more reliable. The overall statistical analysis of PET/CT scans greatly exceeded that of CT scans, rendering PET/CT scanning more accurate.

Project Number: SMH004      Grade: 9

Title: Are ants attracted to artificial sweeteners?

Abstract: The purpose of my experiment was to test whether ants were attracted to artificial sweeteners. I dissolved table sugar, Splenda, Sweet n' Low, Equal, and stevia, in water. Sugar was the control. I made solutions in separate Petri dishes, and set them outside on a concrete path in our garden. I counted the number of ants that came to the dishes for 30 minutes intervals, four times. This resulted in an average of four ants attracted to the artificial sweeteners, and an average of 30 ants to the sugar. According to this experiment, ants are not attracted to artificial sweeteners.

## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH005      Grade: 11

Title: Will TAML+H<sub>2</sub>O<sub>2</sub> Inhibit Viruses

Abstract: The investigation was designed to examine if TAML activators, which are environmentally friendly catalysts activated by hydrogen peroxide, are able to decontaminate viruses in minute concentrations. The T2 bacteriophage, which infects E. Coli, was used as a model for this study. Through the use of the common overlay technique, it was determined whether TAML activators could potentially be used as water or surface disinfectants. It appeared that as concentrations of activated TAML increased, viral survivorship decreased. Additionally, TAML activators seemed to decrease T2 infectivity more effectively than hydrogen peroxide alone. These conclusions were supported by statistical analyses performed on the data.

Project Number: SMH006      Grade: 9

Title: Garlic - The New Antimicrobial?

Abstract: The antimicrobial effects of varying concentrations of garlic on gram positive and negative bacteria were tested. Various concentrations of garlic were made. Eight agar plates were inoculated with Staphylococcus epidermis and eight with Escherichia coli. Plates were divided into four sections. I put .5 mL of the same concentration of garlic in three wells for two plates, control in one. The plates were incubated, and zones of inhibition were measured. Data shows the garlic had a greater effect on the Staphylococcus epidermis. When concentration decreased so did the zone of inhibition for both bacteria. The data partially supported my hypothesis.

Project Number: SMH007      Grade: 10

Title: Bacteriophage Nursery

Abstract: My project investigates the affects of temperature on growth of mycobacteriophage and Mycobacterium smegmatis

Project Number: SMH008      Grade: 10

Title: Calcium Concentrates In Growing Bacteriophage

Abstract: Altered calcium (CaCl<sub>2</sub>) concentrations when growing bacteriophage konstantine, in order to alter the amount of phage growth. Finding the best amount of CaCl<sub>2</sub> to grow the phage with.

Project Number: SMH009      Grade: 11

Title: Ultrasound on Bacteria

Abstract: To determine if diagnostic ultrasound is an effective way of eliminating bacteria.

Project Number: SMH010      Grade: 12

Title: Effect of Nicotine on Bacteria

Abstract: Please visit student's exhibit for abstract.

## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH011      Grade: 10

Title: Does ADEM = MS

Abstract: Please visit student's exhibit for abstract.

Project Number: SMH012      Grade: 11

Title: Lytic Ability of Diff Body Fluids on Bacteria

Abstract: Please visit student's exhibit for abstract.

Project Number: SMH013      Grade: 12

Title: The Effect of Hormone Concentration and Vitamin A on the Development of Limbs in Tadpoles

Abstract: Thyroxin and Vitamin A concentration have an effect on the development of limbs in tadpoles. I used four containers, one being my control, each with different levels of thyroxin and vitamin A levels. Over a period of six to ten weeks, I analyzed and record the tadpole activity daily. I also made sure the tadpoles had proper living conditions and nutrients. When I first got the tadpoles, three of them died upon their delivery. Instead of thirty tadpoles, I had twenty-seven. I will be using *Xenopus Laevis* tadpoles.

Project Number: SMH014      Grade: 10

Title: Wine vs. Grape Juice Analysis

Abstract: My experiment tested to see if red wine and/or grape juice increased the lifespan and affected heart rate of *Daphnia Magna*. My hypothesis was that the *Daphnia* in wine and grape juice would live longer than the control group and that their heart functions would be stronger and more consistent. I used solutions of 1/4, 1/8, 1/16, 1/32, and 1/64 of wine and grape juice to test my theory. My results showed that the 1/64 wine group lived consistently longer because of antioxidants and increased nitric oxide production. Sugars in the grape juice caused more bacteria and molds to grow.

Project Number: SMH015      Grade: 9

Title: Is Your Water Safe?

Abstract: Please visit student's exhibit for abstract.

Project Number: SMH016      Grade: 11

Title: The Power of a Smile

Abstract: The purpose of my project was to determine if Crest Night Time Whitening System was the most effective over the counter teeth cleaning product compared to other teeth cleaning products used instead of a professional dental cleaning.

Project Number: SMH017      Grade: 10

Title: The Alliaceae Family and *E.coli*

Abstract: Can plant derived compounds that occur in nature be used to control the growth of some bacteria?

## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH018      Grade: 9

Title: Whose Mouth is Cleaner?

Abstract: wanted to know whose mouth was cleaner, a canine or a human, and if toothpaste really helped get rid of bacteria in the mouth. Petri dishes with agar were used to identify bacteria from the human or dog's mouth. The inoculated petri dishes were placed in an incubator for three days, to facilitate the bacterium growth. The human mouths had more bacterium colonies than the canines, and brushing teeth with toothpaste did reduce the bacterium in the mouth. My hypotheses were accepted. I enjoyed learning more about agar in petri dishes, incubators, sterilization of bacterium, and minute data collection.

Project Number: SMH019      Grade: 12

Title: Targeted Gene Therapy for T-cell Lymphoma

Abstract: Please visit student's exhibit for abstract.

Project Number: SMH020      Grade: 12

Title: Does Washing Fruit Help?

Abstract: Please visit student's exhibit for abstract.

Project Number: SMH021      Grade: 10

Title: Effects of Tanning on Yeast

Abstract: The purpose of this experiment was to determine if tanning beds or sunlight cause more damage to yeast. The yeast strain was grown, and a heavy suspension was made. The yeast suspension was inoculated on 20 plates. The plates were covered on the top and bottom half with black cardstock, which was the control. 10 plates were exposed to 20 minutes of the tanning bed, and 10 plates were exposed to 20 minutes of artificial sunlight. The plates exposed to the tanning bed had little to no yeast growth, while the sunlight plates had almost entire coverage of yeast.

Project Number: SMH022      Grade: 12

Title: Household Bioterrorism Heat Inactivation Strategies

Abstract: Please visit student's exhibit for abstract.

Project Number: SMH023      Grade: 11

Title: Resistance via Transformation

Abstract: The purpose of this experiment was to determine whether natural or artificially induced ampicillin resistance is more effective in *E. coli* JM101. First, starter plates of naturally resistant bacteria and un-resistant bacteria were prepared. Resistance (puC8) plasmids were added to suspensions of non-resistant bacteria; bacteria of both types were heat-shocked. The bacteria were then streaked onto agar plates containing ampicillin. After a growth period, bacteria of each type were re-plated. Growth in this final set of agar plates showed that *E. coli* with natural resistance proliferate more quickly in the presence of ampicillin than *E. coli* with artificially induced resistance.

## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH024      Grade: 10

Title: MRSA - From Physician to Community?

Abstract: Methicillin-Resistant Staphylococcus Aureus (MRSA), a common hospital pathogen, has emerged as a source of community-acquired infections. The epidemiology of community outbreaks is unclear, but physicians who have frequent contact with infected patients may be vectors of transmission into the community. This study was undertaken to determine the incidence of MRSA colonization in physicians and their families. Nasal swabbings were obtained from participants, cultured, and tested for MRSA. Neither physicians (15) nor family members (15) were colonized with MRSA. This observation indicated that infection control methods are effective in preventing transmission of MRSA from patient to physician to family.

Project Number: SMH025      Grade: 12

Title: Shop 'til Ya Drop

Abstract: My project "Shop til Ya Drop" was designed to test the cleanliness of shopping cart handles and test a more effective way to keep the shopping cart handles bacteria free. Bacterial survival tests were conducted from different stores, both with and without my disinfectants. My hypothesis is that multiple bacteria colonies are present on the handles, and that none of the commercially available cleansers work as well as my own formula. Ultimately, the results prove my hypothesis correct in that bacteria are found on the shopping cart handles and that my cleanser has effectively cleansed the handles of the carts.

Project Number: SMH026      Grade: 12

Title: Effect of Ginseng on Mice Weight

Abstract: Ginseng is commonly known as the 'wonder herb', curing everything from sicknesses to obesity. In this experiment, I tested the effects of ginseng on the weight loss on mice. The test groups were given differing volumes of ginseng mixed into food. The mice were weighed and the results were compared to the initial weigh as well as the weight of the control group. The ginseng, along with the food, was distributed every other day, and they were weighed prior to giving new food. The expected results were that the test group with the greatest volume ginseng will lose the most weight.

Project Number: SMH027      Grade: 11

Title: Contact Lens and Corneal Ulcers: Any Relationship?

Abstract: The purpose of the experiment was to do a retrospective chart study on causes pertaining to keratitis, and analyze the data after viewing 104 charts. From the help of Dr. Mah, asst. professor of ophthalmology, I was given charts over a 4-year history of patients having Keratitis. I analyzed age, gender, duration, and days to resolution. I collected data on a spreadsheet, and found that roughly younger generation wore contact lens; contact lens was main cause of keratitis among the 104 cases (68%). It was to generally see any relationship that existed between contact lens wearers, and keratitis.

Project Number: SMH028      Grade: 10

Title: Effect of Temperature on *S. marcescens* to Antibiotics

Abstract: Will the growth of *Serratia marcescens* be inhibited the most by the antibiotics Penicillin, Ceftazidime, Imipenem or Amikacin and at what temperature will the antibiotic inhibit the growth of *S. marcescens* the most?

## SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY

Project Number: SMH029      Grade: 10

Title: Differentiation of Osteoclasts

Abstract: Osteoporosis is a major health concern in the United States. This experiment is intended to learn about the mechanisms of the differentiation of osteoclasts, which may provide novel avenues for curing bone diseases. Four different concentrations of RANKL were used to attempt the differentiation of hematopoietic cells. The results demonstrate that a higher concentration of RANKL yields more differentiation of osteoclasts, which are correlated to TRAP and Integrin  $\alpha$ -3 production as well as dentine absorption. Future work is planned to see how different therapeutic drugs, such as dexamethasone or Vitamin D, affect the differentiation of osteoclasts.

Project Number: SMH030      Grade: 9

Title: The Inhabiting Effect of Garlic Juice

Abstract: The purpose of the experiment is to see how effective is common species to cure common microorganisms. The hypothesis was that garlic juice will limit the growth of E. Coli. Thaw the frozen E. Coli and grow the E. coli for 16 hours in a LB. On day two, we prepare the agar on the Petri dishes. Dilute the E. coli into 1:100 ratios, add 100. ml diluted E. coli on to the Petri dish. Then divide the dishes into 4 parts, Part I, Part II, Part III, and Part IV. Get some fresh garlic juice and add 1 drops of garlic juice on Part II, 2 drops on Part III, and 3 drops on Part IV. Grow the dishes for 16 hours. The data was positive, on part II there 1cm of radius of garlic juice, there was no sign of E. coli growth on that. Part III had 1.2cm of radius of garlic juice, there too, had no sign of E. coli growth. Part IV had 1.3 cm of radius of garlic juice, there was no sign of E. coli growth. The experiment was proven the hypothesis to be correct. Garlic juice can limit the growth of E. coli.

Project Number: SMH031      Grade: 10

Title: Celecoxib and Liver Cancer

Abstract: My experiment was designed to determine the potential therapeutic effects of new non-steroid anti-inflammatory drugs (NSAIDs) and related compounds on liver cancer cell growth. For this purpose, cultured human liver cancer cells were treated with two NSAIDs (celecoxib and NS398), fish oil, corn oil, docosahexaenoic acid, and arachidonic acid for 24-48 hours. The number of viable tumor cells was measured by using the cell proliferation reagent (WST-1) as well as transmission microscopy (light microscopy). Celecoxib was found to be the most potent compound that inhibited liver cancer cell growth, which was predominantly mediated through programmed cell death called apoptosis.

Project Number: SMH032      Grade: 11

Title: A Study of Neuroprotection in CHIP6B Cells

Abstract: Alzheimer's disease is the prevalent cause of dementia in elderly people. A-beta and Glutamate are two notable oxidizing agents responsible for neuronal damage which characterizes the disease. This project investigates the neuroprotective qualities of co-enzyme CHIP in resisting both forms of stress. CHIP is naturally present in HT22, a cell line derived from rat hippocampus neurons. Trials were designed to compare how these HT22 cells react to both forms of oxidative stress compared to CHIP6B cells, a stable cell line of HT22 cells transfected with a CHIP plasmid to increase CHIP production. Cell viability was evaluated through Propidium Iodine staining.

## **SENIOR DIVISION – MEDICINE/HEALTH/MICROBIOLOGY**

Project Number: SMH033      Grade: 9

Title: Bacteria in Your Mascara?

Abstract: Please visit student's exhibit for abstract.

## SENIOR DIVISION – PHYSICS

Project Number: SPH001      Grade: 11

Title: Incline Surfaces And Friction

Abstract: My project was to determine at what angle will gravity allow kinetic friction to occur between two surfaces. I hypothesized that objects with lighter mass would slide at lower angles. Books were stacked and a board was placed over them to act as an incline. Items with the lighter mass slid down first. My hypothesis was partially incorrect.

Project Number: SPH002      Grade: 9

Title: Rocket Nosecone Drag Analysis

Abstract: The purpose of this experiment was to test the drag of different shapes of rocket nosecones. My hypothesis was that the less surface area, the less the drag would be. I turned four different nosecone shapes out of foam on a lathe. They were each set on a jig which held them in place. They rested on a spring so they could move when wind was blown on them. When wind was blown the compression of the spring was recorded. My hypothesis was disproved. The nosecones were in a different order from least to greatest drag than I predicted.

Project Number: SPH003      Grade: 10

Title: Home Appliance Power Usage

Abstract: Please visit student's exhibit for abstract.

Project Number: SPH004      Grade: 9

Title: Gimmie a Lift

Abstract: The purpose of my project was to see whether the shape of a plane's wing affects lift. I was interested in this because I make WWI models. I constructed four models of the same plane, but I made differently shaped wings for each. I built a wind tunnel and used a leaf blower to create wind. I tested each plane three times at three different speeds. I expected the plane with the most curvature on the wings to have the most lift. When I averaged the results, it came out as expected, but there was variation within individual trials.

Project Number: SPH005      Grade: 10

Title: A Unification Theory

Abstract: Please visit student's exhibit for abstract.

Project Number: SPH006      Grade: 12

Title: Gas or Electric, Which Is More Time Efficient

Abstract: Please visit student's exhibit for abstract.

Project Number: SPH007      Grade: 10

Title: Oil Additive and Static Friction

Abstract: My dad and I use Slick 50 in our pick-up so I wanted to find which oil additive tested is the best at reducing static friction.

## SENIOR DIVISION – PHYSICS

Project Number: SPH008      Grade: 12

Title: Sound Retention by Various Sound Barriers

Abstract: My experiment was to test the sound retention of certain materials in highway sound barriers. I tested the mediums of wood and cement, which are the two most commonly used building materials in highway sound barriers. I used two different consistent sounds from multiple distances and a decibel reader to measure my results. My control had no sound barrier in the test. After my experiment I concluded that the wood barrier reduced sound by a large margin, however the cement barrier reduced sound the most from every distance and both consistent sounds.

Project Number: SPH009      Grade: 11

Title: Saving Sound

Abstract: Light, a wave often converted into electrical energy, bears many similarities to sound. This project applies the concept of solar panels to sound waves. A pure frequency was played and the resulting sound wave recorded. Increasingly large squares of copper were then placed in front of the collecting microphone, and the altered sound waves were compared to the standard. The 6.5 cm copper square proved to capture energy the most efficiently. Further experimentation with different material characteristics could both establish the best construction for a sound panel and evaluate the possibility of using sound as an alternative energy source.

Project Number: SPH010      Grade: 10

Title: Earthquakes and Truss Bridges

Abstract: The purpose of my project was to test to see which type of truss bridge could remain in tact longest during a simulated earthquake. I constructed three models of four types of bridges; a King's Post Truss, English Post, Truss, Warren Truss, and Through Pratt Truss. I also built a shake table which shook the models in two directions at the same time, causing torsion, to test on. I hypothesized that the King's Post Truss would remain standing longest, closely followed by the English Post Truss. This was due to their light triangular structures. Also, there would be a significantly larger difference between the standing time of these two bridges and the Warren Truss and Through Pratt Truss. My experiments results led me to conclude that the bridges remained in tact in the order of my hypothesis. I also ran a statistics test which proved that my claim was supported at each level and these results were no due to chance.

Project Number: SPH011      Grade: 12

Title: Heat and Color Absorption

Abstract: I am doing my heat absorption experiment with various colors of the same material. My purpose is to discover what color of clothing is appropriate in different climates. I researched information for my experiment and experiments that were similar to mine. I purchased all the materials I needed for my experiment. I cut six different colored pieces of material. After that, I stretched the material over frames and attached them with Velcro. Then, I attached liquid crystal temperature strips to each piece of material. I used a forty watt light bulb as my heat source. I then placed the frames 8.6 cm from my light source. Then, I completed timed tests for 1-5 minute intervals on each color. I recorded the temperatures for each test. After that, I repeated my test a second and third time to see if the results were similar. Finally, after getting my results, I made bar graphs to show my findings. My test results from my experiment concluded that the tan cloth absorbed the least amount of heat. The black cloth absorbed the most amount of heat. In my hypothesis, I expected the white to absorb the least amount of heat. I can not explain why the tan absorbed the least amount of heat in my experiment. The other colors in my experiment absorbed

## SENIOR DIVISION – PHYSICS

slightly higher degrees than tan and white, but considerably lower than black. I concluded from my experiment that tan and white color clothing would be the best in warm climates. I also concluded that black color clothing would be the best to wear in cold climates.

Project Number: SPH012      Grade: 11

Title: Static Electricity at Gas Pumps

Abstract: To find out why static electricity causes fires at gas pumps.

Project Number: SPH013      Grade: 10

Title: Methods for Estimating Current Velocity

Abstract: In this project, I wanted to improve boating safety on the Allegheny River by calculating river velocity. I wanted to see if there was a relationship between the United States Army Core of Engineers published flow data and my velocity measurements without expensive equipment.

Project Number: SPH014      Grade: 12

Title: 87, 89, or 93?

Abstract: The purpose of my experiment is to determine if buying a higher octane rated gasoline is saving money. I tested the amount of time it took for 40cc of octane rated 87, 89, and 93 gasolines to be burned in a combustible engine. The prices have a direct relationship with the octane rating. The amount of time it took for 3 types of gasoline to burn was directly related to the octane rating. The costs of each fuel price/second were extremely close in price. After statistics, there is a direct relationship between the price of gasoline and its octane rating.

Project Number: SPH015      Grade: 11

Title: The Effect of Angle of Incidence of Refraction

Abstract: The purpose of this experiment is to determine the effect of varying  $q_i$  on refraction of light. This will also test an accepted model for refraction, and Snell's Law. To perform this experiment, light was shot through a medium, water, at varying  $q_i$ . The ray's exit point was marked, and connected to the point it entered. This was the path of the refracted ray. The  $q_i$  and  $q_r$  were then measured and compared. The results found were  $q_r = -.002(q_i)^2 + .748(q_i)$ . These results could be applied to communications involving sending rays through different mediums, and impacting substances contained in a medium with rays.

Project Number: SPH016      Grade: 10

Title: Insulation Materials

Abstract: (a) The purpose of this experiment was to determine if there is a better insulations material than fiberglass. (b)

1. Gather materials
2. Secure bulb in the center of the 30.48 cm<sup>3</sup> box and close it.
3. Put the 30.48 cm<sup>3</sup> box into the 35.56 cm<sup>3</sup> box and fill the one-inch space with fiberglass.
4. Place box outside on platform so that bottom of the box is not touching the ground.
5. Turn on the digital stem thermometer and record starting temperature.
6. Start timer and plug bulb in at the same time.
7. Record temperature every minute.
8. Unplug bulb at twenty minutes and continue recording temperature every minute until temperature is in the single digits or 60 minutes is reached.

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9. Repeat steps 4-9 with feathers, foam, hay, and air.
  10. Calculate the R-values using the inverse of the formula for conductivity.
- (c) Foam was the best insulation material.  
(d) Foam individually should be considered as an insulation material.

Project Number: SPH017      Grade: 11

Title: Technologically Advanced Golf Clubs

Abstract: Through my experimentation, I am attempting to determine what category of golfer would benefit the most from using technologically advanced golf clubs. To accomplish this, I divided the subjects into groups based upon their skill level. Each golfer hit balls with four different types of clubs. I monitored the improvement as a result of better clubs through several shot components. I then compared the results among the groups in an attempt to determine which group derived the most benefit from playing the technologically advanced clubs.

Project Number: SPH018      Grade: 12

Title: Sound Waves

Abstract: To test frequency on the thermoacoustic refrigerator for negative or positive results.

Project Number: SPH019      Grade: 12

Title: Explore Rare Earth Metal Superconductors

Abstract: The project attempts to create new and more effective superconductors. The research investigates the superconductivity of the compounds made based on the high temperature superconductor  $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ , with substitution for yttrium using various percentages of gadolinium, dysprosium, erbium, and Holmium. Resistance test and magnetic susceptibility test are performed individually. Conclusion regarding superconducting potential of the four elements is made through the holistic analysis of the compounds' lattice structures, critical temperatures, current dependency, and magnetic interaction between elements.

Project Number: SPH020      Grade: 9

Title: Pump It Up!

Abstract: Please visit student's exhibit for abstract.

Project Number: SPH021      Grade: 9

Title: Tuning With Temperature

Abstract: Please visit student's exhibit for abstract.

Project Number: SPH022      Grade: 9

Title: Is Everything Old, New Again?

Abstract: Please visit student's exhibit for abstract.