



# NewsLetter

## The New Jersey Academy of Science

Rutgers University, Beck Hall, Room 215, 99 Avenue E, Piscataway, NJ 08854-8040

Volume 38, Number 2

Spring 2006

### 51<sup>st</sup> Annual Meeting

The 51<sup>st</sup> Annual Meeting of the Junior and Senior Academies of the New Jersey Academy of Science was held on April 8, 2006 at New Jersey Institute of Technology. The following are the abstracts for the award-winning oral presentations given by members of the Junior Academy at the Annual Meeting.

#### Animal Behavior Section 1

##### **FIRST PLACE**

**Hou, Kevin** Animal Behavior THE EFFECT OF SOY DIETS ON THE BIOMASS PRODUCTION OF PROCAMBARUS CLARKII, High Technology High School (Teacher: Michael T. Roche).

An experiment was conducted to determine whether or not juvenile red swamp crayfish, *Procambarus Clarkii*, on a supplemented soy diet will demonstrate a greater, more significant difference in biomass than crayfish on a regular commercial pellet diet. Three diets were fed to three different groups of crayfish: Total soy diet, 50% soy/50% commercial pellet diet, and total commercial pellet diet. Amounts fed were consistent at 0.2 grams, every Tuesday and Friday, for a span of 26 days. Each group of crayfish resided in a tank divided into equal compartments for each individual. The research hypothesis was that there would be a significant difference in biomass production of juvenile crayfish on a total soy diet. Statistical analysis revealed no significant differences among the three diet groupings.

##### **SECOND PLACE**

**Haratz, Joshua** Animal behavior THE EFFECTS OF ETHANOL WITHDRAWAL IN BROWN PLANARIA (*DUGESIA TIGRINA*), Ocean Township High School (Teacher: Dina Kowaliwskyj).

The objective of this research was to soak brown planaria in different solutions of ethanol and measure their locomotive effects in water to see how the flatworms react under withdrawal. Quantitative data was measured through planarian locomotor velocity (*p*LMV), a statistic gained by seeing how many gridlines a planarian crosses when placed in a petri-dish over graph paper. One control was made up of planarians that were first soaked in water for one hour then tested in water. A second control group consisted of planarians soaked in ethanol, then tested in ethanol. The test group consisted of planarians soaked in ethanol, then tested in water. Data currently suggests that the planaria have increased locomotor activity when

withdrawn from ethanol, but additional data is still being collected.

##### **THIRD PLACE**

**Stevenson, Craig** Zoology THE EFFECTS OF THE ANTIOXIDANT VITAMIN E ON THE MEMORY OF *BETTA SPLENDENS*, High Technology High School (Teacher: Michael T. Roche).

The purpose of this project was to test the hypothesis that Vitamin E, a popular and widely available antioxidant, would help to increase the capacity for memory in the Siamese Fighting Fish, *Betta splendens*. For 25 days, the control group was fed a gel diet with 160 IU/kg of vitamin E, while the variable group was fed a gel diet with 1600 IU/kg of Vitamin E. Each group contained six fish. The memory was tested by timing the fish as it went through a horizontal maze, measured in seconds from moment the maze was placed in the testing tank until the time at which the fish emerged from the maze near the surface. Three tests were done for each fish, an initial, a practice, and a final test. Statistical analysis was done with an unpaired, one tailed t-test, using a level of significance of 0.05. The research hypothesis, which predicted improved times for fish in the experimental diet group, was not supported.

#### Biochemistry Section 2

##### **FIRST PLACE**

**Shum, Andrew** Biochemistry/Health ALTERNATIVES TO PARTIALLY HYDROGENATED OILS FOR STABILIZATION OF GRANOLA BARS, High Technology High School (Teacher: Michael Roche).

Unsaturated vegetable oils used in foods are often partially hydrogenated to produce a desirable semi-solid texture and to increase resistance to oxidative rancidity. However, studies have shown that hydrogenation of oils can produce *trans* fatty acids, which may contribute to atherogenesis. This study investigated three alternative approaches to partially hydrogenated soybean oil for minimizing lipid oxidation in granola bars: stabilizing the unsaturated soybean oil by addition of antioxidants, substituting polyunsaturated soybean oil with monounsaturated olive oil,

and packaging under inert gas or vacuum. Granola bars were produced from five formulations, each stored under air, argon, and vacuum at 37°C for up to two months, and then analyzed for lipid oxidation by chemiluminescence for early oxyl radicals and secondary carbonyl products; by gas chromatography–mass spectrometry (GC-MS) headspace analysis for non-volatile oxidation products; and by analysis of polar non-volatile products. Innate resistance to oxidation of each type of oil was measured by oxygen consumption of the oils in an oxygen bomb under high oxygen pressure at 100(C. Data collection and analysis are in progress. Statistical analysis of differences between formulations and packaging environments will be conducted using an Analysis of Variance (ANOVA) test.

### SECOND PLACE

**Shifrin, Barry** Biochemistry PH ADJUSTED PHOTODYNAMIC THERAPY, John F. Kennedy Memorial High School (Teacher: Kathleen Piccinich).

Photodynamic therapy (PDT) is a treatment of tumors and infectious bacteria that employs a photosensitizer (PS), a specially engineered drug that is sensitive to high-wavelength light. This is especially useful for superficial and localized infections. It has been shown in Cunderlikova, et al. 1999 that adjusting the pH of the area around PDT targeted cells to between 5.0 and 5.5 will maximize absorption of the cerium-6 photosensitizer. In this experiment, it was hypothesized that PDT eradication of *Staphylococcus epidermidis* could be achieved through lowering the pH of the medium. In comparing treatment of the bacteria at pH levels of 7.4 (human blood) and 5.5 (ideal), lower pH resulted in greater eradication. A t-test comparing the change in bacterial coverage before and after treatment was not statistically significant. However, there is the potential of using pH adjustment as a method of improving PDT, specifically to treat MRSA infections in hospitals.

### THIRD PLACE

**Roache, Kelly** Biochemistry ABILITY OF HUMAN OFFSPRING TO DISTINGUISH MATERNAL PHEROMONES, High Technology High School (Teacher: Michael Roche)

This experiment's purpose was to defend the existence of maternal pheromones, by which offspring identify their mothers. The hypothesis stated that a significantly larger number of subjects would be able to, via maternal pheromones, determine and identify which shirts their mothers had worn, versus those able to do so randomly. Fourteen pairs, each consisting of a high-school aged child and mother, were tested. The mothers wore identical white cotton shirts to bed for three consecutive nights, barred from the use of scented soaps, perfumes, etc. These fourteen shirts were then placed adjacent to one another, along with a control. The students attempted to identify their mothers' shirts via smell. Over one month, shirts were shuffled in a double blind study, challenging each subject to complete fifteen trials in which they attempted

identification. It was concluded that there was no significant difference between the number of students who could identify their mothers' shirts and those who could do so by chance, as the P-value was greater than the alpha level of 0.05.

### Biology

### Section 3

#### FIRST PLACE

**Toth, Laura** Biology INVESTIGATION OF LIFESPAN LENGTH WITH MUTANT NEMATODES GROWN ON *A. FAECALIS*, JFK High School (Teacher: Kathleen Piccinich)

The nematode *Caenorhabditis elegans* is used as a model to study the lifespan of multicellular organisms. The *C. elegans* lifespan mutant age-1 is able to live 60% longer compared to the wild type (N2) when grown on *E. coli* as a food source. Last year, this researcher found that the normally long-lived age-1 mutant, a mutant in the insulin-like signaling pathway (ILSP) was significantly short-lived compared to the N2 when grown on the bacteria *A. faecalis* as a food source. This researcher concluded that the *A. faecalis* food source is able to dominate the ILSP. To extend this hypothesis 2 other mutants of the *C. elegans* ILSP, *daf-2* and *daf-28*, were tested with *A. faecalis* as the food source. On the *A. faecalis* food source the 2 long lived mutants *daf-2* and *daf-28* had a significantly shorter lifespan compared to their lifespan when grown on *E. coli*. These results extend the observation that the *A. faecalis* food source decreases the lifespan of different mutants in the ILSP which normally increases lifespan. This researcher is attempting to isolate suppressor mutants of the age-1 mutant grown on *A. faecalis*. Using ethylmethylsulfonate as a mutagen, 2 potential suppressor mutants were isolated that lived twice as long on the *A. faecalis* food source compared to the age-1 strain. Interestingly, these two suppressors both had small outgrowths visible on their posterior end.

#### SECOND PLACE

**Zheng, XinYi** Biology THE EFFECT OF WORM CASTINGS ON PREVENTING PYTHIUM ROOT ROTS IN BROCCOLI, Ocean Township High School (Teacher: Dina Kowaliwskyj)

The purpose of this project was to set up an experiment to discover whether worm castings can prevent Pythium root rot in broccoli plants. For this experiment broccoli plants, worm castings, and Pythium fungus were used. Broccoli plants were grown in soil containing worm castings. A second group of broccoli plants were grown in normal potting soil as a control. After leaves sprouted on the plants the Pythium fungus was implicated onto them. The plants were watered daily and exposed to light via a plant light. Samples were taken from the root tips of the cell once a week and observed under a microscope. Samples were observed to see whether the root tips showed any sign of the Pythium fungus. Data is still being collected for this experiment.

### THIRD PLACE

**Mau, Elaine.** THE EFFECT OF POLYETHYLENE TEREPHTHALATE (PET) RESINS ON THE DIAMETER AND CELL GROWTH OF YEAST (*SACCHAROMYCES CEREVISIAE*), Academy for the Advancement of the Science and Technology (Teacher: Donna Leonardi).

The purpose of this study was to look for possible health effects of drinking bottled water from PET water bottles exposed to high temperatures by examining the diameter growth of yeast cells. PET Poland Spring © water bottles were incubated at 25°C, 40°C, and 60°C for seven days. Yeast was grown in sterilized YPD nutrient broth solution and was transferred using aseptic techniques to YPD nutrient broth solutions made from the incubated water. The yeast were pipetted on to the slide and viewed 1000X through a calibrated microscope to measure the diameter of the yeast cells. A hemocytometer was used to count cells. Diameter of yeast cells and cell counts are hypothesized to decrease with the addition of PET resin accumulated during incubation.

### Biology

### Section 4

#### FIRST PLACE

**Szigety, Katherine** (Biology) EFFECTS OF TIME AND COLCEMID CONCENTRATION ON THE POLYMERIZATION OF MICROTUBULES, Bergen County Academies (Teacher: Donna Leonardi)

Colcemid is a chemical that is known to inhibit the formation of microtubules by inhibiting their polymerization. One possible use of this chemical could be in the treatment of cancer – mutated cells treated with colcemid would not be able to divide, thus stopping the further growth of tumors. The purpose of this experiment was to test the effect of time and concentration of colcemid on microtubule formation. Mouse fibroblasts were sub-cultured and 0, 0.01, 0.1, and 0.5 mL of commercially obtained (10 µg/mL) colcemid was applied to each culture flask containing 2 million cells and five mL of RPMI1640. Samples were observed after .5h, 3h, 8h, and 24hrs subsequent to the addition of colcemid. Visualization with Oregon Green 488 paclitaxel bis-acetate was employed to evaluate the samples.

#### SECOND PLACE

**Ashton Gooding** Biology OPTIMUM TEMPERATURE FOR THE CULTIVATION OF POLYPOROUS SQUAMOSUS, High Technology High School (Teacher: Michael T. Roche)

This experiment was modeled to test for the optimum temperature to grow *Polyporus squamosus*. Fungi in its family have shown cancer-fighting properties. If this fungus indeed does have medicinal properties, then knowing the optimum temperature would allow for maximum production. The experiment lasted three weeks and consisted of monitoring and logging the fungus through pictures, which were taken weekly. The fungus was grown at 20°C, 25°C and 30°C. Each temperature held

5 plates of *Polyporus squamosus*. The plates were then analyzed for the amount of mycelium growth that covered the agar by using histogram tools in Adobe Photoshop. The t-tests were conducted to determine if the differences between the means of the percent of mycelium coverage at each temperature were significantly different from each other. As hypothesized, 25°C was the optimum temperature for growing *Polyporus squamosus*, with the highest percentage of mycelium coverage being 61.82%. *Polyporus squamosus* grew better when incubated at 25°C than it did at 20°C or 30°C.

### THIRD PLACE

**Ezer, Daphne** Biology EVOLUTION OF THE *asp-6* ASPARTYL PROTEASE PARALOGS IN *C. remanei* nematode. Waksman Institute (Mentor: William Sofer)

We have been sequencing cDNA clones from the roundworm *C. remanei* to investigate its evolutionary relationship to other nematodes. One of the genes we identified, the aspartyl-protease *asp-6*, contains multiple paralogs that lie in a cluster. To determine the evolution of the *asp-6* gene cluster, we have constructed a map of the *asp-6* paralogs in relation to the *C. remanei* genome and have compared the sequences to each other and to the homologous genes in *C. elegans* and *C. briggsae* (close relatives of *C. remanei*). The first duplication event was most likely a gene inversion followed by two independent gene duplication events. Data will be presented showing the conserved nature of the paralogs in the different species and possible regulatory elements that may control the expression of these genes.

### Biology

### Section 5

#### FIRST PLACE

**Wang, Damon** Biology. RAGE ACTIVATION BY FETAL BOVINE SERUM, Bergen County Academies (Teacher: Donna Leonardi)

Advanced Glycation End products (AGEs) are a group of glycoproteins and glycolipids whose formation is promoted by hyperglycemia and oxidative stress. AGEs interact with their receptor RAGE to induce fibrogenesis and inflammation, conditions implicated in nephrological diseases such as glomerulosclerosis and interstitial fibrosis, as well as in cardiovascular diseases such as diabetic atherosclerosis. Consequently, RAGE blockade is a promising approach to new therapies for diabetic complications and other nephrological diseases. However, experiment duration is limited by cell survival because researchers must use unsupplemented or poorly supplemented (0.1%, 0.5%, 1.0% FBS) media to avoid introducing a second variable through the undefined serum. This experiment aims to find a compromise between the interference of fully-supplemented (10% FBS) media and the limited experiment duration by comparing the degrees of RAGE activation with the degree of serum supplementation.

## Biology

## Section 6

### **FIRST PLACE**

**Shell, Brian** Microbiology/Biology THE EFFECTIVENESS OF COMMERCIAL BIOREMEDIATION ENHANCERS, High Technology High School (Teacher: Michael T. Roche).

The primary objective of this study was to determine if there was a significant improvement in the effectiveness of the bioremediation of oil spills when aided by a commercial bioremediation enhancer. The research hypothesis was that there will be a significant increase in effectiveness when a bioremediation enhancer is used. Using the resources and safety facilities of a university laboratory, the test flasks were filled with water, oil, and sediment from Kearny Marsh alone or with S200, a bioremediation enhancer. Bioremediation enhancers are often used to accelerate the rate at which natural biodegradation occurs. Sediment from Kearny Marsh provides a sufficient array of bacteria to simulate a natural environment. The effectiveness of the biodegradation was determined by using phenanthrene as a model compound, representing recalcitrant petroleum hydrocarbons. The study is still in the stages of data acquisition, so there has not been a statistical conclusion as of yet. The data will be analyzed through the use of a t-test and other statistical analyses.

### **SECOND PLACE**

**Kingshia, Manalika** Biology THE EFFECT OF PURPLE GRAPE JUICE ON THE ADHERENCE OF *STREPTOCOCCUS MUTANS* TO TOOTH SURFACES, JF Kennedy High School (Teacher: Kathy Piccinich).

Polyphenol, an antioxidant found in purple grapes, has been reported to prevent cardiovascular diseases and decrease blood pressure. Moreover, polyphenols from tea and cocoa bean have been linked to the prevention of tooth decay in previous studies. This study was based on finding a link between polyphenols from grape juice and the prevention of tooth decay. In this study, hydroxylapatite pieces were used to resemble tooth surfaces. Surfaces were coated with grape juice and exposed to  $10^{-2}$  bacteria dilution for 24 hours. The pieces were then rinsed in saline. The saline/bacteria mixture was plated and grown for 24 hours, after which colonies were counted, recorded and analyzed. Data suggests that exposure of grape juice to dental surfaces inhibits the adherence of bacteria. This link may help in decreasing dental caries.

### **THIRD PLACE**

**Yang, David** Biology THE BIOINFORMATICS APPROACH TO ACTIN NUCLEATION, The Waksman Institute (Mentor: William Sofer).

The regulation of actin nucleation is essential for many cellular processes, including cell locomotion, axonal motion, cellular morphology. The primary proteins responsible for actin nucleation in the *C. elegans* nematode include the GEX family of proteins. GEX stands for “gut-on-the-exterior,” since *gex* mutations cause *C. elegans*

embryos to not undergo morphogenesis properly, resulting with gut cells on the outside of the embryo. By comparing the nucleotide and protein sequences of the GEX proteins in *C. elegans* and related nematodes, I have constructed a phylogenetic tree, detailing the evolution of the genes involved in actin nucleation. Through a bioinformatics approach, it is possible to define relationships between the organisms and elucidate characteristics of this system, highlighting the similarities of the actin nucleation pathways.

## Engineering

## Section 7

### **FIRST PLACE**

**Ng, Amanda** Engineering THE EFFECT VARIOUS BRIDGE DESIGNS HAVE ON THE AMOUNT OF WEIGHT THE BRIDGE CAN SUSTAIN, High Technology High School (Teacher: Michael T. Roche)

This experiment tests the strength in different bridge configuration, specifically arch and beam designs. Twelve bridges of each design were built using craft sticks, Elmer’s wood glue, and black binder clips. As ideally all 24 bridges needed to be the same mass, the same number of craft sticks was used to construct each bridge, and glue amounts were kept constant as much as possible. Test bridges were built first, based on preliminary sketches and calculations to find a method of constructing the bridges so that they were all the same length, width, and mass. The arch and beam bridges were built at home and kept in the same environment. The bridges were tested in a high school classroom using a stress analyzing machine that graphed the load sustained by the bridge in relation to the displacement. After testing, the results showed that there was indeed a significant difference ( $p=0.03$ ,  $\alpha=0.5$ ) between the two structures, and that the model arch bridges could sustain heavier loads than the beam bridges.

### **SECOND PLACE**

**Sauer, Franz** Engineering MAGLAUNCH - A MAGNETIC LEVITATION LAUNCH ASSIST SYSTEM - THE EFFECT OF VARYING DISTANCE BETWEEN OPPOSING HALBACH ARRAYS ON THE PRELEVITATION DISTANCE ALONG A MAGLEV TRACK, High Technology High School (Teacher: Charles Christoe)

A maglev track was built that used magnetic fields created by parallel Halbach arrays, inductance with a copper track and a pulley system to accelerate a vehicle. It was hypothesized that increasing the distance between opposing Halbach arrays in a magnetic levitation track will yield a significant difference in the distance required for the vehicle to levitate. The data showed that at a 1.8-cm distance separation, the vehicle traveled an average of 23.2 cm before levitation. At a 2.4 cm distance, it traveled an average of 40.8 cm and at a 3 cm distance it traveled an average of 46.3 cm. Statistical results with a 2-tailed, paired t-test, revealed a p-value of 1.63819E-10 between the 1.8 cm and 2.4 cm distances, a p-value of 0.00387301 between the 2.4 cm and 3 cm distances, and a p-value of 2.4922E-10 between the 1.8

cm and 3 cm distances. There was a significant difference between all distances because each p-value was lower than the significance value of 0.05. The null hypothesis was rejected and the research hypothesis was supported. An application for this track would be to fulfill current design goals of the armed forces and NASA for new launch tracks that launch airplanes off aircraft carriers or into space in shorter distances.

### **THIRD PLACE**

**Waldman, Abraham** Chemistry ENGINEERING A MULTI-CHAMBERED AQUATIC AERATING SYSTEM, High Technology High School (Teacher: Michael T. Roche)

This experiment involved the comparison of two different aquatic aerating systems and analyzed which added more dissolved oxygen to the water. One was the Carolina Lobster Kit and the other was a system engineered by a student. Additionally, a bucket of water with no aeration served as the control group. For each trial, the systems ran (aerated the water) for 23hrs and 50min. Dissolved oxygen levels of the Carolina system, the engineered system, and the control group were then taken using the CHEMetrics vacuole vial system. A total of 12 trials were conducted for each system. After the data was collected, an Analysis of Variance (ANOVA) single factor test was used to test the claim that there was a significant difference between the dissolved oxygen levels of the three systems. The ANOVA test supported the claim that there was a significant difference in the dissolved oxygen levels of the three systems. Three T-tests ( $\alpha = 0.05$ ) were then utilized to see exactly where the significant difference took place. The T-tests showed that the engineered system added significantly more dissolved oxygen to the water than both the Carolina ( $p\text{-value} = 0.0029$ ) and control group ( $p\text{-value} = 0.0004$ ); and the Carolina system added significantly more dissolved oxygen to the water than the control group ( $p\text{-value} = 0.02$ )

### **Environmental Science Section 8**

#### **FIRST PLACE**

**Kim, So Yeon** Environmental Science EFFECTS OF FLUID MOTION ON PHILODINA ROTIFERS EXPOSED TO TOXICITY, Academy for the Advancement of Science and Technology (Teacher: Donna Leonardi).

The purpose of this experiment was to study the toxic effects of herbicide 2,4-D under turbulent conditions on the freshwater rotifer, *Philodina* sp. Four cultures were established, each with a known concentration of *Philodina* sp. A concentration of herbicide that led to 50% encysted and/or dead rotifers was applied to cultures 1 and 2 while cultures 3 and 4 contained no herbicide. Cultures 2 and 3 were affected with fluid motion for a short period of time while no flow was applied to cultures 1 and 4. The experiment was repeated with higher concentrations of herbicide and rate of flow. Data was collected by enumerating encysted, dead, and living rotifers and interpreted using ANOVA and Student T-test.

### **SECOND PLACE**

**Miller, Timothy Bryce** Environmental Science/Biology THE EFFECT OF SIMULATED ACID RAIN ON CHLOROPHYLL CONCENTRATIONS OF BLUE SPRUCE (*Picea pungens*) SEEDLINGS, High Technology High School (Teacher: Michael T. Roche)

This study's goal was to explore the effect of acid rain pH on the photosynthetic ability of blue spruce evergreen seedlings. The proposed research hypothesis predicted that blue spruce seedlings exposed to simulated acid rain for an extended period of time would contain significantly lower levels of chlorophyll concentration than blue spruce seedlings exposed to normal rain for the same time. The setup for testing this hypothesis involved the watering of forty individual seedlings; half were administered water of pH 5.6 and half were administered water of pH 4.4. At both the beginning and end of the experiment, chlorophyll extracts from the plants were analyzed using a protocol taken from SAPS (Science and Plants for Schools). The procedure involved grinding of the needle samples in 95% ethanol, centrifuging of the extracts to remove debris, testing within a spectrophotometer for absorption readings, and inserting these results into given equations. The collected data revealed a t-test p-value of 0.108. With an alpha value of 0.05, the null hypothesis failed to be rejected. Simulated acid rain of pH 4.4 does not significantly affect chlorophyll concentrations in blue spruce seedlings over a thirty-day period.

### **THIRD PLACE**

**Lebron, Alex** Environmental Science THE USE OF RUBBER CRUMBS AS A SYNTHETIC WETLAND BIOFILTER, Marine Academy of Technology and Environmental Science (Teacher: Tina M. Held).

Wetlands clean and filter water; they absorb harmful contaminants and excessive nutrients preventing harmful algae blooms. Many agricultural areas, water treatment plants, and industrial plants are using natural and artificial wetlands as an effective and inexpensive way to decontaminate and clean wastewater, sludge, and runoff. The purpose of this study utilizes rubber crumbs as a substrate to grow bacteria and to test its efficiency in breaking down nutrients, nitrates and phosphates, through decomposition or absorption. An experimental system was engineered with a 20 gallon aquarium and a secondary container consisting of a layer of gravel and a layer of rubber mulch. Together the system contained 76 L of water constantly circulating. In Phase-one, the system ran for two weeks to allow bacteria growth. In Phase-two, nutrients were added. Phosphates and nitrates were tested daily using colorimetric methods. By using bacteria and the absorbance properties of rubber, I believe that rubber crumbs have the potential to be used in biofilters as an inexpensive synthetic substrate in artificial wetlands to collect and break down excessive nutrients.

## Environmental Science Section 9

### **FIRST PLACE**

**Hayes, Tyler** Environmental Science IDENTIFICATION OF POLLUTANTS IN DEAL LAKE AND THEIR REMOVAL BY LETTUCE PLANTS (*LACTUCA SATIVA*), Ocean Township High School (Teacher: Dina Kowaliwskyj).

The purpose of this project was to determine what pollutants are contaminating Deal Lake, and to examine the effects of lettuce plants on the reduction of the toxins by phytoremediation. Deal Lake has been identified by the Environmental Protection Agency and other environmental groups as being eutrophic, a condition in which there is high concentration of dissolved nutrients. Four samples of soil and water were collected from the lake and placed in four large tanks. Lettuce plants were grown in potting soil. Phosphate levels, E. coli and coliform counts, and dissolved oxygen measurements were taken from the tanks. After the initial assessment, the lettuce plants were transplanted into the soil of two of the tanks, and all of the containers were exposed to light to stimulate photosynthesis in the lettuce. The preliminary tests were again performed on each tank once a week for one month. Data is still being collected.

### **SECOND PLACE**

**Patel, Vihar** Earth Science THE EFFECT OF CALCIUM ON THE GROWTH OF WISCONSIN FAST PLANTS, John F. Kennedy Memorial HS (Teacher: Kathleen Piccinich)

In this experiment, this researcher tested the effect of calcium on the growth of Wisconsin Fast Plants, commonly known as *brassica rapa*. This experiment involved 2 experimental groups and one control group. The two experimental groups were given different amounts of calcium. The control group received no calcium. The control and experimental groups were grown under the same conditions. The control and experimental groups were given 500 mL of water in each pot over a span of two days at a time. The plants were grown in a growth chamber at a constant temperature of 75 degrees. All plants received the same amount of light from a fluorescent light bulb. Preliminary data shows that the growth among the plants that received a higher calcium amount was greater than the group that received a lower amount of calcium. Statistical analysis will be applied using the F-Test and the T-Test to determine the validity of the experiment. A 95 percent confidence level will be try to met after the experiment is completed in its entirety.

### **THIRD PLACE**

**Jones, Christian** Environmental Science THE EFFECTS OF SALT ON THE HABITAT OF A *DUGESIA TIGRINA*, Ocean Township High School (Teacher: Dina Kowaliwskyj)

The purpose of this experiment is to discover the most suitable conditions for the regeneration of *Dugesia tigrina*, common planaria, by using sodium chloride, or salt.

Sodium Chloride, the necessity to all life, helps all organisms live more efficiently, so by using it to make the regeneration more proficient appears to be an obvious solution. The lab is tested by severing the planarian cell and allowing it to rejuvenate in a solution with a increased salinity concentration. While this is being conducted, compare the rate of restoration to a similar divided planarian cell in ordinary spring water. After discover the rate of regeneration, the efficiency, and compare the solutions. This experiment is still being conducted.

## Environmental Science Section 10

### **FIRST PLACE**

**Patel, Mitesh** Environmental Science SALINITY: EFFECT ON *Lycopersicon esculentum*, John F. Kennedy Memorial High School. (Teacher: Mrs. Kathleen Piccinich)

Terrain varies from climate to climate, drastically affecting crop growth. An experiment was to design an experiment that would determine how irrigation, over time can cause damage to crop roots. Irrigation is used to make arid lands fertile, which are suitable for growing cash crops. However, excessive irrigation leads to an increase in salinity levels in the soil in ground water. These high salinity levels negatively affect the roots of vegetation, affecting the production of the crops. In this study, the effects of three different concentration levels of NaCl would be used to observe the effect on the germination of seeds of *Lycopersicon esculentum*. The seeds would be exposed to distilled H<sub>2</sub>O, 2 ppm of NaCl, and 6 ppm of NaCl. Statistical analysis (t-test) would be used to compare the compare the experimental groups, as well as the control. Preliminary data indicates that the roots would show stunned growth, as salt concentrations increased. As over-irrigation is commonly practiced, crop sizes production would dramatically decrease.

### **SECOND PLACE**

**Lee, Rebecca** Environmental Science THE STUDY OF THE EFFECTS OF IRON INFUSED WATER ON THE STRENGTH OF THE BYSSAL THREADS OF THE COMMON FRESHWATER MUSSEL, Ocean Township High School (Teacher: Dina Kowaliwskyj)

The purpose of this project was to determine the effects of iron infused water on the strength of the byssal threads of the common freshwater mussel. Mussels were held in two separate tanks, one tank being filled with iron infused water, and the other filled with freshwater. Iron levels in the water was tested before adding iron, immediately after adding the iron, and after the iron has been filtered through the mussels to test exactly how much iron the mussels took in. The byssal threads of mussels from both tanks were then removed and subjected to a stress strain test in order to test any differences in strength. Data is still being collected.

### THIRD PLACE

**Piazza, Michael** Environmental Science EFFECTS OF THE ISOLATION OF FACTORS PERTAINING TO THE CIRCADIAN RHYTHM IN LIMA BEANS (*PHASEOLUS LUNATUS*), Ocean Township High School (Teacher: Dina Kowaliwskyj).

The purpose of the experiment was to increase the growth of lima bean plants through changes in the circadian rhythm. First, a group of twenty lima bean seeds was germinated in a wet paper towel for four days. When the seeds reached germination they were planted in four separate plant trays, five seeds to a tray. After a week the seeds sprouted. The first tray was placed in sunlight, another was placed in sunlight with some leaves cut, the third was placed in a large storage bin with a mounted black light, the last was placed in a large storage bin with a plant growth light (to be turned off during the day and on at night). Data is still being collected.

### Health

### Section 11

#### FIRST PLACE

**Leibowitz, Kari** Health PRESERVATIVE PROPERTIES OF ALOE VERA ON VARIOUS FRUITS Ocean Township High School (Teacher: Dina Kowaliwskyj)

The purpose of this project was to test the preservative properties of aloe vera on various fruits. First, eight each of grape bunches, plums, peaches, and tomatoes were obtained, four of which were covered in aloe vera, and two of which were placed in a refrigerator at approximately 40°F. The remaining two were left on a table at room temperature, or approximately 65°F. Out of the four left of each fruit, which remained uncoated, two were placed as controls in the refrigerator, and the other two were placed as controls at room temperature. Over a period of eight weeks, the fruit will be observed and the various states of spoilage will be recorded every three days, based on skin color, firmness, mold growth, and weight loss. Data is still being collected.

#### SECOND PLACE

**Rawal, Sandhya** Health The Effect of Acrylamide on Mouse Fibroblasts, Bergen County Academies (Teacher: Donna Leonardi)

Acrylamide, or  $C_3H_5NO$ , is a known carcinogen. Acrylamide is used in soil stabilization, for repairing sewers, and in acrylamide gels used in biotechnology laboratories. To investigate the effect of the chemical compound, the experiment reported here measured the rate of apoptosis, or cell death, of mouse embryonic fibroblasts exposed to varied solutions (5 mM, 2.5 mM, 1 mM, .5 mM, and 0 mM) of acrylamide. The results will indicate the toxicity of acrylamide in mouse fibroblast cells. The hypothesized finding in this experiment is a dose response increase of fibroblast apoptosis, proportionate to the increase of acrylamide concentration.

### THIRD PLACE

**Babeu, Nina** Medicine THE EFFECTS OF BATHROOM CLEANERS ON MOLD, JFK Memorial (Teacher: Kathleen Piccinich)

The purpose of this project was to compare non chlorinated bathroom cleaners against Clorox, a chlorinated cleaner, to see how efficient the non chlorinated cleaners were. This was because people who suffer from asthma or who get asthmatic symptoms shouldn't use chlorinated cleaners because the fumes cause reactions to their sinus' and bring about coughing, sneezing, and other breathing and congestion problems. *Aspergillus niger* was streaked on Sabouraud Dextrose Agar using the standard biological procedure. After given time to let the mold grow, sterilized 5 centimeter disks were then dipped in either Clorox, Scrubbing Bubbles or an Eco-Friendly cleaner for 5 seconds and then placed in a triangular shape about 1 centimeter from the other disks and the walls of the dish (3 disks to each plate.) After 48 hours, the zone of inhibitions were then measured in centimeters and recorded. It is predicted that Scrubbing Bubbles will be more efficient then the Eco-Friendly cleanser because past experiment show it cleans almost as well as a chlorinated cleanser without the harmful effects of the fumes.

### Health Section 12

#### FIRST PLACE

**Lisica, Steven** Health ADAPTIVE RESISTANCE OF *E. COLI* TO TRICLOSAN AND CROSS-RESISTANCE TO ANTIBIOTICS, Bergen County Academies (Teacher: Donna Leonardi)

Recent concern has been directed towards the public health risks imposed by the increasing prevalence of antibiotic-resistant bacteria, which may be caused by the unregulated use of biocides in households. It has been suggested that many of these bacteria could be direct results of the natural phenomena of adaptive resistance to biocides and cross-resistance to antibiotics. The purpose of this research was to test if the adaptive resistance of *E. coli* K12 to triclosan led to cross-resistance to antibiotics. The bacteria were cyclically exposed to sub-lethal concentrations of triclosan and tested for antibiotic resistance after each sequence. It is hypothesized that the adaptive-resistance of *E. coli* will gradually cause the bacteria to become more resistant to the antibiotics, signifying that the uncontrolled use of biocides may have potential health effects.

#### SECOND PLACE

**Ito, Lisa** Health EFFECTS OF CAFFEINE ON CELL APOPTOSIS AND COUNTER EFFECTS OF FLUVOXAMINE, Bergen County Academies (Teacher: Donna Leonardi).

Studies have shown that caffeine inhibits the growth of cells by blocking vital cellular processes and inducing apoptosis. To test these effects, normal diploid mouse fibroblast cells were treated with varying concentrations of caffeine. The cells were counted 24 hours after exposure, and the rate of apoptosis and the LD<sub>50</sub> concentration of caffeine was

determined. Fluvoxamine, an antidepressant drug that blocks certain neurotransmitters, is a substance proven to negate the effects of caffeine in the body. To test if fluvoxamine antagonizes the effect of caffeine on cell apoptosis, the same mouse fibroblast line was treated with the LD<sub>50</sub> of caffeine and varying concentrations of fluvoxamine. The cells were counted 24 hours after exposure to calculate apoptosis rates. It is hypothesized that fluvoxamine would counter apoptosis caused by the caffeine.

### THIRD PLACE

**Shao, Belinda** Health GREEN TEA TO CURE ACNE? Bergen County Academies (Teacher: Donna Leonardi).

*Propionibacterium acnes* are anaerobic bacteria that live in human hair follicles and feed on sebum (skin oil). These bacteria produce propionic acid, an irritant that causes inflammation manifested as acne. Recent studies using (-)-epigallocatechin-3-gallate (EGCG), a component of green tea, have shown its bactericidal effect on a variety of bacteria. Green tea has been an age-old Chinese remedy for acne. This study investigates the effect of EGCG on *P. acnes*. Anaerobic liquid cultures of *P. acnes* were treated with EGCG dissolved in DMSO, incubated for 72 hours, and were examined via spectrophotometry for absorbance, indicative of the bacteria's viability. Expected results show EGCG's bactericidal effects on acne's causal agent in vitro. Since prior research indicates that EGCG is not harmful to somatic cells, this research suggests the use of EGCG as a topical acne treatment.

### Medicine

### Section 13

#### FIRST PLACE

**Novosedlik, Emily** Medicine/Health THE EFFECT OF VICKS VAPORUB ON TRICHOPHYTON RUBRUM, John F. Kennedy Memorial High School (Teacher: Kathleen Piccinich)

Onychomycosis is a fungal infection of hand and foot nails. It is the most common nail disease and is caused by dermatophytes, yeasts, and molds. *Trichophyton rubrum* and *Trichophyton mentagrophytes* are the two main causative fungi of onychomycosis. The treatment for this kind of nail infection is complex. Such concerns are the side effects of the treatments, the worry of drug resistance, and the persistence of the disease. Most antifungal treatments used to cure onychomycosis are not approved for children. Vicks' VapoRub has been an alternative treatment for cases of foot fungi, but little to no research has been done to prove its effectiveness. The purpose of the experiment was to evaluate Vicks' VapoRub as an alternative treatment. Terbinafine cream and a Petrolatum gel were also evaluated. The Petrolatum gel acted as the Vicks' VapoRub without its active ingredients. *T. Rubrum* was grown in [http://wardsci.com/product.asp\\_Q\\_pn\\_E\\_881701\\_A\\_Sabouraud+Dextrose+Agar](http://wardsci.com/product.asp_Q_pn_E_881701_A_Sabouraud+Dextrose+Agar) Sabouraud Dextrose Agar plates. Disks of Vicks' Vaporub, Terbinafine cream, and Petrolatum were placed on the fungus. The rings of

inhibition were measured and analysis was conducted through use of a T-Test. This experiment is still undergoing changes in the procedure using the gel made from the Vicks' Vaporub without its active ingredients. Preliminary results indicate that Vicks' Vaporub is effective.

### SECOND PLACE

**Sanghavi, Kruti K.**, Medicine/Health THE EFFECT OF RADON ON THE INCIDENCE OF ALZHEIMER'S DISEASE, John F. Kennedy Memorial High School (Teacher: Kathleen Piccinich)

Radon is a radioactive element produced as a by-product of uranium mines and coal combustion. It has been linked mostly with the p53, tumor suppressor gene. Radon alters this gene, creating mutants of the p53 protein, which cannot function to suppress tumors. The p53 gene is also linked to Alzheimer's disease, a neurodegenerative disease found prevalent in many parts of the United States. Alzheimer's proposed causes include the Beta Amyloid Theory, which states that beta amyloid peptides are the primary cause of the disease. There are many amyloid peptides; the most toxic is the Abeta-42, which causes programmed neuron death. The mutant p53 gene that is produced from radon prevents the Abeta-42 from affecting the neuronal cells. Another predisposing cause of Alzheimer's is the gene PS1. This gene has shown to increase the chances of early onset Alzheimer's disease. The p53 mutants can cause a down regulation of PS1, which can prevent the early onset of the disease. With the methods of a population study, there was an indirect correlation between the levels of radon and the incidence of deaths indirectly caused by Alzheimer's. Results showed with an increase in the radon levels decreased the number of deaths. This aspect could be researched further to find an isotope of radon most effective to reduce Alzheimer's symptoms.

### THIRD PLACE

**Bhalja, Aakruti** Medicine/Health EFFECTS OF UV RADIATION ON THE PREVALENCE OF OSTEOPOROSIS, John F. Kennedy Memorial High School (Teacher: Kathleen Piccinich)

Many people are experiencing the painful effects of Osteoporosis. The aim of this study was to clarify whether increased UV radiation results in reduced prevalence of Osteoporosis. Although ozone exposure is known to cause various types of cancer and other serious diseases, few people know that vitamin D from sun exposure is necessary to maintain healthy bones. Monthly averages of UV indices and data regarding hospitalizations for Osteoporotic factors were obtained for the years 1997, 2000, and 2001 for New Jersey, Arizona, Florida, and Hawaii. This data was tabulated into Excel and correlated using the Pearson Correlation. Preliminary data indicates an inverse relationship between UV radiation and Osteoporosis. This is due to exposure to vitamin D, which increases the calcium absorption in bones; thus, reducing the risk of Osteoporosis. Therefore, the hypothesis is supported. This study reveals that UV radiation may be a beneficial factor to the

prevention of Osteoporotic conditions. In order to gain a better understanding of such a correlation, further research should include a larger sample size over a longer period of time, and socioeconomic and meteorological factors.

**Mathematics/Physics** **Section 14**

**FIRST PLACE**

**Sanghvi, Apurva** Physics THE EFFECT OF CELL PHONE RADIATION ON BP, John F. Kennedy Memorial High School (Teacher: Kathleen Piccinich)

Previous studies show that cell phones are a danger and weaken the blood-brain barrier along with the dopamine opiate system. Children due to thinner skulls at more risk to these dangers. This study examined the correlation of blood pressure in relation to the amount of time spent on a cell phone. The experiment consisted of 25 volunteers. Each volunteer was observed while him/her were on the cell phone. Volunteers were exposed to cell phone radiation for 15 and 30 minutes. Blood pressure was measured at each interval. The mean of all the volunteers was 113.24/74 at resting point. At 15 minutes, the average was 114.64/76.04, while the final blood pressure average was 116.88/77.08 at the end of 30 minutes. This research was significant with a 95% confidence level.

**SECOND PLACE**

**Ziegler, Brandt** Physics THE DURABILITY OF DIFFERENT BRANDS OF BASEBALLS, High Technology High School (Teacher: Michael T. Roche)

The purpose of this experiment was to discern a difference in the durabilities of different brands of baseballs. The research hypotheses are that there will be a significant difference in the internal durabilities between different brands of balls, and that there will be a significant difference in the external durabilities between different brands of balls. The balls were tested at the University of Massachusetts: Lowell's baseball testing laboratory, in their durability-testing machine. Four different brands of balls were used, Rawlings ROLB 1, Rawlings OLB 3, Pro-Mark M1-Pro, and Worth LL1 A1074. There were six balls of each brand, and they were fired at a 2-inch thick steel plate at 136 mph 25 times to simulate the pitch and the hit of a real baseball game. The results showed that the Rawlings OLB seemed to have the worst internal performance of all the brands, and that the Pro-Mark M1 PRO had the worst external performance. Knowing which baseball is the most durable would be key in saving organizations money on buying baseballs.

**THIRD PLACE**

**Yau, Patricia** Behavior THE EFFECT OF A NONTRANSPARENT (WOODEN) BACKBOARD ON SHOOTING ACCURACY, High Technology High School (Teacher: Michael T. Roche)

There are two different types of backboards used in basketball: opaque (wooden or plastic) and transparent (glass). Transparent are the most widely used. The objective of this experiment was to observe whether an opaque backboard offered a more accurate perception of

depth than a transparent one, therefore resulting in higher accuracy. Because a transparent backboard allows the shooter to see structures behind the basket, it may distort his or her perception of depth. Subjects (female high school basketball players) shot a series of twenty-five foul shots at each type of backboard. Each made and missed shot was recorded, and accuracy percentages at each backboard were recorded and compared. A paired two-tailed t-test produced a p-value of 0.515, much higher than the level of significance of 0.05 and therefore failing to reject the null hypothesis. The research hypothesis was not supported. The transparency of the backboard did not seem to have an effect on shooting accuracy during this experiment.

**Mathematics/Physics** **Section 15**

**FIRST PLACE**

**Zakhalyavko, Maria** Physics THE POLARIZATION PHENOMENON IN OPTICALLY ACTIVE SUBSTANCES, High Technology High School (Teacher: Michael T. Roche)

The objective of the experiment was to find out whether sucrose solutions of varying concentrations rotate the polarization plane. The research hypothesis under study was "There will be different rotations of the polarization plane for each concentration of the substance." Each concentration of sucrose was measured and prepared. The experiment was set up with such instruments as a flashlight, two polarization sheets, a metal tube filled with the sucrose solution, and a digital camera, all in a vertical position. The data showed that the concentration did, in fact change the angle of the polarization plane. Statistical results with an ANOVA test (two-factor without replication) and a t-test (two-tailed distribution with two-sample unequal variance) revealed that the angle changed significantly. The P-value of the ANOVA was 1.8166E-89, which is much smaller than the alpha, 0.05. The null hypothesis ("There will not be different rotations of the polarization plane for each concentration of sucrose.") was rejected, and the research hypothesis was supported.

**SECOND PLACE**

**Gayen, Sujoy** Physics ABSORPTION SPECTRUM OF THE  $Cr^{3+}:Sc_2SiO_5$  CRYSTAL VERSUS THAT OF THE  $Cr^{3+}:Al_2O_3$  CRYSTAL, High Technology High School (Teacher: Michael T. Roche)

The  $Cr^{3+}: Sc_2SiO_5$  crystal is a newly developed crystal. Until now, its absorption properties were not known. The purpose of this research was to measure the absorption spectrum of this crystal and compare its absorption spectrum to the previously studied absorption spectrum of the  $Cr^{3+}: Al_2O_3$  (ruby) crystal. The research hypothesis of this experiment was that the absorption spectrum of the  $Cr^{3+}: Sc_2SiO_5$  crystal would be significantly different than that of the  $Cr^{3+}: Al_2O_3$  crystal. A UV-Visible-NIR spectrophotometer was used to measure the absorption spectrum of both crystals. The light source within the spectrophotometer shone a range of wavelengths of light onto each crystal sample, and a graph of the absorption spectrum appeared on a computer

connected to the spectrophotometer. Statistical analysis with a t-test ( $p=0.016$ ,  $\alpha=0.05$ ) revealed that the absorption spectrum of the  $\text{Cr}^{3+}$ :  $\text{Sc}_2\text{SiO}_5$  crystal is significantly different than that of the ruby crystal. The null hypothesis is rejected, and the research hypothesis is supported. The  $\text{Cr}^{3+}$ :  $\text{Sc}_2\text{SiO}_5$  crystal has a unique absorption spectrum.

### THIRD PLACE

**Cheng, Harrison** Mathematics THE EFFECT OF PLAY COUNT ON SONG SELECTION FOR APPLE PRODUCTS IN SHUFFLE MODE, High Technology High School (Teacher: Michael T. Roche).

The purpose of the research project was to observe the impact that high play counts have on song selection when put in Shuffle Mode on Apple products. Four hundred songs were placed into iTunes, and played continuously to obtain play counts ranging from zero to 150 for each song. A playlist was created and all 400 songs were added. The list was ranked from highest to lowest play count. An imaginary group was created for the 100 most played songs, called Favorites. The play list was put on Shuffle, and 100 songs were played. Another tally was made for the number of songs from Favorites that were played within the first 25 songs, next 25, and so on. This procedure was repeated 12 times. Afterward, the totals of each tally group were tested in a Chi-square test for significant differences that might be found in the qualitative data sets. The research hypothesis, which stated there would be a significant decrease in the frequency of plays for songs with high play counts between each tally group, was not supported. The Shuffle Mode does appear to utilize a truly random algorithm in generating song sequences.

### Psychology Section 16

#### FIRST PLACE

**Piccoli, Chris** Psychology THE EFFECT OF WEIGHTED BASEBALL WARM-UP DRILLS ON DISTANCE ACCURACY USING STANDARD BASEBALLS, High Technology High School (Teacher: Michael T. Roche)

The purpose of this study was to observe the effect of weighted baseball warm-up drills on distance accuracy using standard baseballs. The research hypothesis was that the use of weighed baseballs before throwing standard baseballs would increase the distance the standard baseballs are thrown during distance accuracy tests. The set up of the experiment consisted of creating a grid using string and popsicle sticks in order to accurately measure the distance each baseball was thrown. The subjects were divided into six different groups, and the groups warmed up with different weighted baseballs (standard 5 oz, 7 oz, or 9 oz) for seven minutes. After warming up, the subjects threw ten standard baseballs at a target located 120 feet away. Statistical results with a paired, one-tailed t-test using an alpha level of 0.05 showed that subjects did not throw the standard five-ounce baseball significantly farther after warming up with a seven-ounce baseball than after warming up with a five-ounce baseball, yet subjects threw

the ball significantly farther after warming up with a nine-ounce ball than after warming up with a five-ounce ball. Therefore, the research hypothesis was supported. Warming up with weighted baseballs does significantly affect the throwing distance / distance accuracy of standard baseballs.

### SECOND PLACE

**Vandermolen, Stephen** Psychology THE EFFECTS OF GROUP PRESSURE UPON PERCEPTUAL RESPONSES IN ADOLESCENTS, High Technology High School (Teacher: Michael T. Roche).

In 1956 psychologist Solomon Asch reported that individuals are susceptible to a dramatic social conformity effect. The present study investigated conformity by testing adolescents, who are more prone to "peer pressure." The research hypothesis under examination was that there would be a significant difference between the number of correct responses from the human subjects in the control group and the research group. Two separate groups of twelve subjects were shown a series of line judgment tasks in which they were asked to match a specific line to one of three other lines of varying length. Individually, the subjects in the research group viewed these tasks in a room with seven confederates. The confederates were not real subjects; they were instructed to give false responses in a portion of the trials. These subjects were exposed to the responses of the confederates before making their selections. The subjects in the control group gave their responses without any outside influence. The data was analyzed by multiple t-tests and it was determined that there was a significant difference ( $p\text{-value} = 0.0122$ ,  $\alpha = 0.05$ ) between the number of correct responses in the two groups. According to this study, adolescents have a tendency to conform to the accurate and/or erroneous majority. The results demonstrate that Solomon Asch's conformity effect is present in adolescents in the 21<sup>st</sup> century.

### THIRD PLACE

**Kim, Junho** Psychology THE EFFECT OF MUSIC ON LONG TERM MEMORY, High Technology High School (Teacher: Michael T. Roche)

The objective of this experiment was to discover if classical music has an effect on long-term memory. This objective was achieved by testing two different groups: one group tested the memory of fifteen people without listening to any music, while the other tested the memory of fifteen people while listening to classical music. In the first group, each person was led to a picture of various objects. The person was then asked to memorize as many objects as he or she was able to in a two and a half minute period. After the allotted time was finished, the person was asked to compile a list, naming as many objects as he or she was able. After a period of 24 hours, the person was asked to name as many objects as they were able to remember from the original list they had compiled. In the music group, the procedure was similar, the only difference being that each person listened to classical music while viewing the picture. To analyze data, a two tailed paired t-test was utilized. The p-value found was

0.92. After comparing this to a significance level of 0.05, it was concluded that classical music did not have any significant difference with respect to this task..

### **THIRD PLACE**

**Lu, Peiruo (Patty)** Behavior THE EFFECT OF BOUMA CONSISTENCY ON MUMBER RECOGNITION, High Technology High School (Teacher: Michael T. Roche).

This research project studied the difference between the accuracy of recognition of numbers written with a consistent word bouma (word shape) and the accuracy of recognition of numbers written with an inconsistent bouma. A Flash presentation was shown to 20 volunteers

from both freshman and sophomore classes and they were asked to recognize (from choices given) a number on the previous slide that were shown for 1/30<sup>th</sup> of a second. The process was repeated, alternating between numbers with consistent bouma and numbers with inconsistent bouma until there were 20 pieces of data for each type of number. The end result yielded 40 pieces of data from each volunteer (20 on consistent bouma and 20 on inconsistent bouma). The findings were then analyzed using a T-test and an alpha-value of 0.05. It was concluded that there is a significant increase ( $p = 0.012$ ,  $\alpha = 0.05$ ) in the accuracy in recognition of numbers written with an inconsistent bouma over numbers written with a consistent bouma.

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miller@imcs.rutgers.edu

#### **High School Liason:**

Dr. Graham Cleaves  
Ridge High School

#### **Web Manager:**

Dr. Louise Wootton  
Georgian Court University  
woottonl@georgian.edu

#### **Office Manager:**

Sabera M. Munshi  
njacadsc@rci.rutgers.edu  
**Office:** NJAS, Rutgers University  
Beck Hall, Room 215  
99 Avenue E, Piscataway, NJ  
08854-8040  
Phone / Fax: 732-463-0511  
njacadsc@rci.rutgers.edu  
<http://www.njas.org>

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NJAS, Rutgers University  
Beck Hall, Room 215  
99 Avenue E  
Piscataway, NJ 08854-8040