



# NewsLetter

## The New Jersey Academy of Science

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Special Abstract Issue

### 49<sup>th</sup> Annual Meeting

The 49<sup>th</sup> Annual Meeting of the Junior and Senior Academies of the New Jersey Academy of Science was held on April 3, 2004 at Fairleigh Dickinson University in Madison, New Jersey. This special edition of the News Letter is devoted to publishing the abstracts for the award-winning oral presentations given by members of the Junior Academy at the Annual Meeting.

#### Biology Section 1

1. **Laura Toth**
2. **Kenny Liu**
3. **Samira Syed**

**Toth, Laura** DIFFERENCES IN BACTERIAL TRANSFER BETWEEN WOODEN AND PLASTIC CUTTING BOARDS, JFK High School (Piccinich)

Blocks from plastic and wooden cutting boards, both scored with a knife and un-scored, were exposed to an *E. coli* suspension of  $2.6 \times 10^6$  cfu/ml for fifteen minutes at room temperature. The blocks were removed from the *E. coli* suspension, drained for five minutes, and put into individual capped bottles containing 400 ml of a 0.8% saline solution. The bottles were shaken and then titered for *E. coli* by spreading onto LB Agar plates. Scored wooden blocks transferred ~ 100-fold more cfu/ml to the bottle solution than the un-scored wooden blocks, the scored plastic blocks, or the un-scored plastic blocks. This suggests that plastic cutting boards may transfer less bacteria to their surroundings compared to wooden cutting boards.

**Syed, Samira** THE EFFECTS OF VARIOUS STIMULI ON SEED GROWTH AND DEVELOPMENT, William L. Dickinson High School (Corcoran)

The purpose of this experiment is to explore factors not commonly associated with the mechanisms of seed germination: the earth's magnetic field, and the removal of early growth from root and stem tips to determine the difference in growth. Household bleach solutions were prepared ahead of time to wash and soak the corn, (*Zea mays*) seeds so that they would be free of any pesticides. Three chambers were made in ziplock plastic bags, and one kernel placed in each and subjected to various growth conditions- the presence of a magnet; alternating the presence of light and dark; and the removal of 3.175-mm growth from root and stem tips. After germination, seedlings were observed and roots measured for its length in millimeters. The data partially supported the hypothesis that the presence of the magnet will increase growth however the trimming of the stem and roots will decrease growth. Under some circumstances, such as where the magnet was present with light and not trimming the stem and roots, mean growth was higher. The trimming of the

stem and roots however, showed poorer growth overall. The highest mean growth was with the presence of the magnet and leaving the stem and roots attached. The data suggests that the magnetic field does indeed have an effect on seed growth. Hence, it is likely that the magnetic field enhances seed growth only under certain environment such as growing seedlings with light, the presence of the magnet, and leaving the stem and roots attached.

**Liu, Kenny** THE EFFECT OF SURFACE AREA OF ISLANDS ON SPECIES COLONIZATION, High Technology High School (Roche).

The objective of this experiment was to discover if the MacArthur-Wilson Equilibrium Theory of Island Biogeography holds true on a small-scale level. To test this, it was hypothesized that isolated polyurethane foam cubes with larger surface areas will contain greater numbers of protozoic species than those with smaller ones. A closed system was then created in which numerous small blocks were arranged around a large central block that had been exposed to pond organisms beforehand. During two weeks of isolation, the organisms inhabiting the "mainland" dispersed throughout the tank, occupying the islands. Once the experiment was over, three samples from each block were viewed under a microscope and the number of species found from each sample was tallied. After conducting statistical analyses, it was found that significant differences existed in five out of the six island scenarios, thereby supporting the research hypothesis.

#### Biology Section 2

1. **Adam Ardakanian**
2. **Garrett Raczek**
3. **Peter Yi**

**Ardakanian, Adam** THE EFFECTS OF ACIDIC ALGAE ON THE GROWTH OF MYSTERY SNAILS (*Pomacea bridgesi*), Ocean Township High School (Kowalivskyj).

The purpose of this study was to grow acidic algae by using sulfuric acid, and compare the growth of mystery snails that ate the algae to snails that ate typical algae. Sulfuric acid was placed into two one-gallon tanks until the pH was 5.5, and sodium

hydroxide was placed into the other two tanks until they reached a pH of eight. The tanks grew algae for two weeks. The pH of the acidic tanks were raised to eight with sodium hydroxide, so the snails would not die. Then, three mystery snails were placed in each tank. The combined weight of the snails in each tank was taken every other day. Preliminary results suggest that there is less growth in the snails that ate acidic algae. Data is still being collected.

**Raczek, Garrett** WHEAT AND CORN PLANTS' RESISTANCE TO SPOTTED KNAPWEED'S (CENTAUREA MACULOSA) POISON USING BEES WAX, Ocean Township High School (Kowaliwskyj)

The purpose of this experiment was to determine if applying bees wax to the roots of corn and wheat plants would make them immune to the spotted knapweed's catechin poison. The plants were grown, then four pots of soil were set up. A single wheat plant was placed into the pot, and five spotted knapweed plants surrounded it, each four inches from the wheat plant. Another pot was prepared the same way, but approximately .056 ounces of bees wax was spread all over the roots of the wheat plant. The next two pots followed the same procedure, but, instead of a wheat plant, a field corn plant was used. Preliminary results suggest that there is no significant difference between the control and variable groups. However, data is still being collected.

**Yi, Peter** THE EFFECTS OF ACIDIC RAIN ON SILKWORMS (BOMBYX MORI), Ocean Township High School (Kowaliwskyj)

The Purpose of this study was to test if acidic rain had any effects on a silkworm's ability to emerge from their cocoons. Silkworm eggs were obtained and placed into a plastic bowl. These eggs hatched into silkworms, and grew into adulthood. Twelve silkworms hatched. Six silkworms were put into the control group, and six silkworms were put into the variable group. The worms were fed an artificial scientific diet twice a day. An acid rain solution of .001 percentage acid was mixed containing a pH level of five. This solution was mixed into the food of the variable group. After the silkworms entered their cocoons, they were observed to see if they emerge out of their cocoons at the same time as the silkworms that were not fed the acidic diet. This was done to test if the acid rain had any effects on the enzymes in the silkworm's stomach, which allows them to dissolve the silk and emerge from their cocoons. Data is still being collected.

### Environmental Science Section 3

1. **Andrew Atalla**
2. **Rizvi Turab**
3. **Askash Shah**

**Shah, Aakash** THE ROLE OF HORMESIS IN THE TOXICOLOGY OF COPPER IN ROTIFERS, Academy for Medical Science Technology (Leonardi).

Hormesis is a documented phenomenon in which a low dosage of toxin is more beneficial to organisms than no exposure to toxin at all. However, the EPA disregards hormesis when conducting toxicity evaluations. This study investigates the role of hormesis in toxicity evaluations by observing the survival rate of *P. roseola* rotifers (aquatic, multicellular invertebrate animals) when exposed to several doses of copper. It was hypothesized that rotifers exposed to low dosages of the toxin, copper, would have a higher survival rate to heat shock than those unexposed. The

data clearly supports the hypothesis and a hormetic dose response curve was obtained. Rotifers exposed to copper concentrations ranging from 25 ppb to 1 ppm had a higher survival rate to the lethal dose of heat than the rotifers exposed to no copper at all. These findings suggest that the EPA should reevaluate current allowable limits by taking hormesis into consideration.

**Atalla, Andrew** A COMPARISON BETWEEN *Phragmites australis*, AND *Spartina alterniflora* IN A SALT MARSH ECOSYSTEM, William L. Dickinson High School (Corcoran).

Estimates of the damage caused by exotic species in Estuaries are estimated to about several billion USA dollars annually. *Phragmites australis* is an invasive marsh grass species found in disturbed or polluted soils. *Spartina alterniflora* is the native marsh grass that is highly regarded for erosion control, as well as fish and wild life values in its native range that provide links to a food chain. The purpose of this study is to identify the effects of the invasive grass *P. australis* and the native grass *S. alterniflora* in a salt marsh ecosystem. This research focused on the effect of *P. australis* and *S. alterniflora* on *Palaemonetes pugio* (grass shrimp). We also observed the different types of epifaunal communities associated with both plants, and the rate of moisture loss. After all experiments were conducted a complete analysis was conducted, which indicated that *P. australis* and *S. alterniflora* were significant ( $P > 0.05$ ) in moisture loss, epifaunal communities, and mortality rate among grass shrimp, which supported the hypothesis. Our results indicate there isn't any series harm caused by *P. australis* on our ecosystem or on the native plant *S. alterniflora*. Further study of the plants anatomy is in need to be studied in order to fully understand the risk factors of the plants.

**Rizvi, Turab** EXPERIMENTAL STUDIES OF STRATIFICATION IN A GRANULAR HELE-SHAW CELL, Dickinson High School (Michael Corcoran)

The aim of this experiment is to understand the sedimentary structures such as sandstones. If two grains of different sizes and shapes are thoroughly mixed, and deposited within a quasi-two-dimensional vertical Hele-Shaw cell, then spontaneous stratification will occur in the granular mixtures. This experiment was done when a mixture of small and large grains is simply poured in a granular Hele-Shaw cell (two transparent slabs separated by a gap of about 5 mm), the grains spontaneously stratify in alternating layers of small and large grains parallel to the surface of the pile. The spontaneous self-stratification occurs only when the large grains have a larger angle of repose than the small grains do. Conversely, spontaneous self-segregation was only obtained, that is the large grains are found near to the top, when the large grains have a smaller angle of repose than the small grains. The observed stratification might be of relevance to explain similar stratified patterns observed in Aeolian rocks.

#### Environmental Science Section 4

1. **Luisa Garcia**
2. **Jennifer Chire (Abstract Not Included)**
3. **Ivan Lavlinski**

**Garcia, Luisa** THE EFFECTS OF LIGHT POLLUTION ON THE CIRCADIAN RHYTHM OF AFRICAN VIOLETS (*Saintpaulia ionantha*), Ocean Township High School (Kowaliwskyj).

The purpose of this experiment was to examine whether incandescent lights, which are used often in daily life, would affect the circadian rhythm of African Violets. Two sets of plants received either a flash or ten minutes of light at night. The plants received light at the same time every Monday, Wednesday, and Sunday. Initial measurements were taken of the plants' leaves and flowers and then measurements were taken weekly. The color and overall health of the plants was also observed. Preliminary results suggest that a single flash of light is more harmful than continuous light. Data, such as the weekly measurements and the observation of the plant, is still being collected. A p-value will be determined to see whether the vegetative growth and the flowering were significantly affected.

**Lavlinski, Ivan** MEMBRANE PHOSPHOLIPIDS OF MICROORGANISMS, High Tech High School (Markese)

Siberian peat soil has more variety of microorganisms which is a result of diverse physical environment in this area, than in the forest soil collected upstate New York. Eleven fatty acids and their derivatives were identified to compare to nine compounds in forest soil by using Phospholipid Fatty Acid analysis (PLFA). High content of unsaturated fatty acids results in increased cell membrane fluidity. Peat soil is found to be rich with unsaturated fatty acids: phthalic acid, oleic acid, and 9-hexadecenoic acid. Low melting point fatty acids are found mostly in microorganisms habituating peat soil, among them a majority of unsaturated fatty acids such as bis (2-ethyl hexyl) phthalate with melting point of -50 °C and saturated nonynoic acid with melting point of -120°C. PFLA analysis can be used to analyze the changes of fatty acid content in the soil, reflecting interactions and relationships of microorganisms habituating in the soil.

#### Medicine / Health Science Section 5

1. **Wayne DeVico**
2. **Dina Alhelawe**
3. **Jennifer Luo**

**Alhelawe, Dina** THE EFFECT OF SALVADORA PERSICA AND AZADIRECHTA INDICA AGAINST S. MUTANS AND S. SANGUIS VERSUS TOOTHPASTE, School: JFK Memorial High School

Throughout ancient times even until today chewing sticks, which come from various roots and branches of trees, are used on oral health in many countries around the world. The aim of this study is to measure the antibacterial effectiveness of two different chewing sticks grown and used in the Middle East and in India. The sticks used are *Salvadora persica* and *Azadirachta indica*. The two sticks are compared to a basic toothpaste containing all the necessary ingredients to kill off dental plaque and bacteria within the mouth. The effectiveness of the sticks

is measured through its ability to inhibit periodontal bacteria that causes tooth decay and other oral problems. *Streptococcus sanguis* and *Streptococcus mutans* are known to be the most

prevailing bacteria causing dental plaque and other periodontal problems. The chewing sticks, which are known to possess antibacterial activity, should eliminate most of the bacteria, and will have a greater significant zone of inhibition in comparison to toothpaste.

**Luo, Jennifer** PLASMA P53 EXPRESSION IN FRENCH AND TAIWAN VINYL CHLORIDE FACTORY WORKERS, Academy for Medical Science Technology (Leonardi).

The present epidemiological study utilizes raw data from two previous studies on the influence of factors such as vinyl chloride exposure concentration and the effect of smoking and drinking on mutant p53 expression. Results revealed a significantly higher exposure concentration in French workers than in Taiwan workers ( $p < 0.05$ ) and a significant relationship between exposure and mutant p53 expression. There was a higher prevalence of p53 positives found in the French workers than in Taiwan workers ( $p < 0.001$ ). In the French control group, smoking was shown to exacerbate the incidence of mutant p53 expression ( $p < 0.001$ ). Within the exposure group from both studies, neither smoking nor drinking acted synergistically with vinyl chloride to increase p53 positive expression. The theoretical possibilities for the cause of these statistically significant results is discussed.

**DeVico, Wayne** THE EFFECT OF CONTACT LENSES ON THE CORNEAL DISPERSION OF CAUSTIC CHEMICALS, Colonia High School (Danch)

The protective qualities of contact lenses were tested. Artificial eyes consisting of glass spheres coated with an indicator-doped gel. An apparatus was designed using a light sensor to quantify the effect that contact lenses had on rate and degree of exposure of the gel to acids and bases. The gelled glass spheres with contacts showed significantly less exposure than spheres without contacts, indicating that contact lenses may offer some degree of protection to human eyes during the first few seconds of contamination.

#### Medicine / Health Science Section 6

1. **Sonia Sharma**
2. **Spencer Friedman**
3. **Madhavi Patel**

**Patel, Madhavi** THE CYTOTOXIC EFFECT OF THE HERBICIDE, 2,4-D ON CANCER CELLS IN VITRO, Academy for the Advancement of Science and Technology. (Leonardi).

The purpose of this experiment is to determine whether or not 2,4-D will lower the proliferation rates of rat lymphoma cells in vitro. A significant decrease in the mitotic rate of the cells cultured in the two highest concentrations of 2,4-D (50 and 75 ppm) could be seen when compared to the control. An increasing trend in the mitotic rate could be seen in the two lowest concentrations, 15 ppm and 25 ppm when compared to the control. The allowable levels of 2,4-D in drinking water are 70 ppb and the allowable level of water for irrigation is 100 ppb. Mitotic Index studies yielded significant results and showed a toxicity point between the 25 and 50 ppm. A positive dose-response relationship, as is shown in most toxicity studies, was not demonstrated. The suitability of the use of a dose-response curve for screening for rat toxicants should be reevaluated.

**Friedman, Spencer** THE EFFECTS OF XYLITOL ON ORAL STREPTOCOCCUS MUTANS (ENTEROCOCCUS VIRIDANS), Ocean Township High School (Kowaliwskyj)

Studies have shown that xylitol, a naturally occurring sugar substitute, inhibits the growth of streptococcus mutans, a cariogenic bacterium that inhabits the mouth. This study examined the effects of varied doses of xylitol. The hypothesis stated that a higher dose of xylitol would have a more dramatic effect than a lower dose. The subject's mouth was swabbed with a Q-tip, which was then cultured onto a blood agar plate. This was done before the gum was chewed and four times subsequently. Each subject was studied using the two doses of xylitol. Preliminary results appear to support part of the hypothesis. The higher dosage of xylitol did indeed reduce the population of streptococci mutants in the mouth; however, the lower dosage did not appear to have any significant effect. Data is still being collected.

**Sharma, Sonia** WATER ABSORBING CAPABILITY OF A POLYACRYLAMIDE-POLYVINYL ACETATE COMPOSITE UNDER SIMULATED HUMAN STOMACH CONDITIONS, Colonia High School (Danch)

The ability of a polyacrylamide-polyvinyl acetate composite (PPC) to absorb water under simulating stomach conditions was tested. 1.5g was placed in the beakers containing 300mL of stomach components HCl, pepsin and HCl+pepsin, and 100mL of trypsin, trypsin+pepsin, trypsin+HCl, and trypsin+pepsin+HCl. The control contained PPC and distilled water. Prior to and after the immersion in the test solution, the masses of the polymer samples were recorded. Afterwards, a t-test comparison was made on the PPC masses. Additional trials testing the ability to expand in pH 7.0 buffer were undertaken. Results indicated that HCl significantly reduced the ability of the polymer to absorb water and expand, while pepsin did not significantly affect expansion. Buffer did not significantly affect the PPC expansion. The physical integrity of the PPC samples was not affected by any of the solutions tested. The properties of super-absorbent polymers may provide a safer alternative to gastric bypass surgery for individuals who suffer from obesity through ingestion, and the feeling of fullness that the indigestible mass would provide.

#### Physics / Engineering Section 7

1. **Garrett Marino**
2. **Christopher Janover**
3. **John Servedio**

**Janover, Christopher** THE EFFECT OF TENNIS RACQUET DESIGN ON SHOCK AND VIBRATION TRANSMISSION, High Technology High School (Roche)

When a tennis ball impacts a tennis racquet, shock and vibration is transferred from the racquet head to the handle, then to the athlete's arm. Excessive vibrations can injure the athlete. If a new tennis racquet design could reduce vibrations many injuries could be avoided. A series of finite element analyses of an original and modified tennis racquet design are performed to determine if the modified design reduces vibration in the tennis racquet frame. The finite element model is shown to be an accurate representation of the actual tennis racquet by comparing the analysis results to physical tests results. The dynamic response of the modified racquet design turns out to be worse than that of the original design indicating that additional research should be performed on different racquets.

**Marino, Garrett** A MODEL FOR STEADY FLOW THROUGH A LONG COLLAPSIBLE TUBE, High Technology High School (Roche).

Flow through tubes that can collapse during normal operation characterizes virtually every bodily fluid-carrying vessel. A computer simulation was developed using MATLAB software to solve a one-dimensional numerical model for steady state collapsible tube flow. The numerical results were then compared with the experimental findings of another researcher. The model included an innovative series of coefficients to accurately define the relationship between the Reynolds number and skin friction coefficient. The results from the newly-developed computer simulation with refined coefficients are in significantly strong agreement with experiment and show an average error of less than ten percent. The current model will prove useful in many areas of practical and theoretical research of flow through collapsible tubes, such as in surgery where direct experimentation is difficult.

**Servedio, John** ACCURACY OF PAINTBALLS, High Technology High School (Roche)

This project attempted to determine if the cost of paintballs has any effect on accuracy of them. To test this, a Tippmann Model 98 Custom, using one of the most accurate barrels on the market as well as nitrogen to power the gun, was set up on a stand then clamped to a table to be tested. A laser pointer, temporarily inserted down the barrel of the gun, was used to line up the barrel with the targets bulls eye. While following the safety procedures for using a paintball gun, 25 shots of each brand paintball were shot at the target which was 40 feet away. After each shot, the distance from the bulls eye was measured, and the "splat" was cleaned from the target. The alignment of the gun was checked every 10 shots using the laser pointer. Surprisingly, there was a tremendous difference in the accuracy of the paintballs. The Zap paintballs, a more expensive brand, were much more accurate ( $p = 0.0043$  when  $\alpha = 0.05$ ) than the less expensive View Loader paintballs.

#### Chemistry Section 7

1. **Andres Brodsky**
2. **Yvonne Obusowho**
3. **Aisha Ahmad**

**Brodsky, Andrew** DISSOLVED OXYGEN RATES OF BOTTLED WATER, High Technology High School (Roche).

Tri-Water USA claims that their bottled water (O2GO) has up to eight times more oxygen than other bottled water. To test this claim a dissolved oxygen test was used on five brands of water. This test measures the oxygen contained in water in parts per million (ppm). The tests were conducted on twelve bottles of O2GO bottled water and twelve bottles each of Aquafina, Dasani, Poland Spring, and Deer Park bottled water. Once the tests were completed the data collected was analyzed using t-tests. The results of the statistical analysis show that the O2GO water had significantly less dissolved oxygen than Poland Spring and Deer Park, higher concentrations than Aquafina and no significantly different amounts than Dasani. In no instance did the O2GO bottled water have even two times the amount of dissolved oxygen.

**Obusowho, Yvonne Protection of Hair Surface with a Quaternized UV Filter**, John F. Kennedy Memorial High School, (Piccinich)\*

The use of UV filters is highly documented in the cosmetic industry to fight against UV damage to the hair. This has led to the creation of different types of UV filters that have absorption in the UV-B and UV-A ranges. This experiment is going to investigate the importance of substantivity (adhering) of these products when delivered from a shampoo base and how this can help to improve the damage surface of the hair. Due to the findings that water inside the hair fiber is a necessary prerequisite to photooxidation (light induced generation of negative sites) or photobleaching (light induced bleaching) of the hair during UV exposure, the experiment will also focus on the hydrophobicity (fear of water) of the hair. Experiment will focus on the hydrophobicity of the hair by way of contact angle measurement. Substantivity is a very important step in ensuring that products or active compounds are absorbed onto the substrates, this is the first step in showing the presence of an active on a substrate for a specific function.

**Ahmad, Aisha MEMBRANE CHARACTERIZATION USING DIFFUSION CELLS**, Dickinson High School (Corcoran).

Structural parameters like the pore radius (rp) and the ratio of membrane porosity to thickness ( $A_k/1x$ ) play an important role in developing models for rejection and flux previsions of all kinds of membranes (Nan filtration (NF), ultra filtration (UF), micro filtration (MF)). As a consequence, the experimental determination of these parameters is of prime importance. Although different techniques may be used to measure parameters of membranes different techniques may not be convenient, cost effective, and sufficiently measure these parameters. Diffusion of test solutes of known diffusivity is certainly one of the most convenient methods to determine the structural  $A_k/1x$  parameter. The structural parameter  $A_k/1x$  was determined by means of diffusion experiments using aqueous solutions of Phenol. Membranes were characterized using the diffusion rate of Phenol through different membranes (Bare Celgard Membrane and Modified Celgard Membrane). The driving force behind this research is to produce a better more efficient membrane which will be selective to only certain compounds and chemicals. Modified Celgard membrane showed selectivity to Phenol and had a significantly lower rate of diffusion. Modified Celgard membrane shows potential in helping in the removal of pollutant Phenol from liquids.

## **Psychology / Animal Behavior Section 8**

- 1. Nicole Caruso**
- 2. Yousef Mustafa**
- 3. Alexis Sowuleski**

**Caruso, Nicole EFFECT OF 1,3,7-TRIMETHYLXANTHINE ON INTERVAL TIMER**, JFK MHS (Piccinich).

Many scientists (e.g. Dr. Warren H. Meck, Dr. John Gibbon) have theorized about how we track time. One recent proposal is that a familiar period of time induces cortical nerve cells to act in unison before resuming back to their individual firing rates (Gibbon 2001). When the interval ends, the pattern of cortical nerve cells is stored. If this theory is accurate, 1,3,7-trimethylxanthine (which increases dopamine levels, accelerating cortical firing rates) should make external time seem to expand. After listening to 3 sounds of various durations, 72 participants are tested on recalling sound durations by listening to the sounds

and tapping a key when they remember them to end. The process is repeated with the administration of a beverage (decaffeinated—Control Group, caffeinated—Experimental Group) before participants are tested again. For the first test, there is no significant difference in results ( $\alpha=.05$ ). For second test, there is a significant difference ( $\alpha=.05$ ). The Experimental Group pressed the key earlier than the Control Group. When time perception inaccuracy was established, average disparities were more precisely proportional to the sound lengths, possibly due to the facilitation of firing processes. Caffeine's tendency to shorten reaction time now may be a result the acceleration of the interval timer, which is now more likely to be located in basal ganglia, where dopamine is produced. Damage to the interval timer now may be a factor in disorders centered at the basal ganglia (e.g. Parkinson's Disease).

**Sowuleski, Alexis BULL'S EYE!: DOES CONTRAST AFFECT ACCURACY?**, High Technology High School (Roche).

The United States Fencing Association enforces a rule that a fencer is not allowed to wear any contrasting patches or writing on the front of their uniform. This project was to test the validity of this rule. Two targets were made; one had a black dot in the middle of the bull's eye, the other had an open center. The fencer liberally applied pool chalk to the tip of their épée, and lunged at the target. The target was changed after each trial, and black and white were rotated for each trial. The data was representative; there were five levels, and the center counted for five points, while the 5<sup>th</sup> ring counted for one. All subjects completed 40 total trials: 20 filled, 20 open. After the data was analyzed, one could conclude that there was a very significant difference ( $p=2.87 \times 10^{-11}$ , where  $\alpha=0.05$ ) in the accuracy of the fencers when performing with the contrasting target.

**Mustafa, Yousef THE ROLE OF OPTIMAL FORAGING BEHAVIOR IN THE SURVIVAL OF MICE**, Dickinson High School (Corcoran).

The purpose of this experiment is to determine if mice have evolved to possess optimal foraging techniques. Firstly, ten seed trays containing 5, 10, and 15 seeds, a total of thirty trays, were placed over night in a park and retrieved the next day. Half of the seed trays were placed in safely covered areas while the rest were placed in risky (greater risk of predation) areas. Next, mice were placed in an artificial arena with exterior, interior and no walls with variations in the presence of food and light/noise. The position of the mouse at every ten seconds for five minutes was recorded. The results showed mice tend to forage in safer areas with greater seed densities. This supports the Optimal Foraging Theory and that mice do forage in an optimal behavior.

## **Psychology / Animal Behavior Section 9**

- 1. Nicholas Lordi**
- 2. Nishit Shar**
- 3. Jocelyn Sloan**

**Shah, Nishit GENDER DIFFERENCES IN ACADEMIC DISHONESTY**, Dickinson High School (Corcoran).

Academic dishonesty is a major problem in the American Education System. This research mainly focuses on the effect of subject difficulty on cheating behavior and on gender differences on cheating behavior. The hypothesis states that as the subject difficulty increases, the overall cheating behaviors among

students increase and the gender differences in cheating behavior decrease. Students are to take a regular classroom quiz. Students get their papers back the next day to self-score after they are photo-copied. Any changed answers of inflated scores determine if students cheated. The experimental procedure is first carried out in normal high school level classes of Biology, Chemistry, Physics, English, and History with about 50 students in each subject. The same experimental procedure is carried out with students taking respective AP classes. Overall cheating in normal classes was 18% while overall cheating in AP classes was 29.6%. Gender differences in cheating behavior normal classes were 11% while in AP classes were 6.4 %. Both hypotheses were supported by the data.

**Lordi, Nick** THE EFFECTS OF SOUND POLLUTION ON THE CHIRPING AND MATING HABITS OF HOUSE CRICKETS (*Acheta domesticus*), Ocean Township High School (Kowaliwskyj).

The purpose of this study was to examine the effects of sound pollution on the mating habits of House Crickets. It studied whether male crickets' chirps will be affected when they are exposed to a high-frequency noise for an extended period of time, and if this affects the female cricket's attraction to them. In order to test this, one group of crickets was exposed to a dog whistle's high frequency shrill for ten minutes a day. After a month, they were placed in an aquarium with a control group of crickets that was not exposed to the sound pollution, and a group of female crickets. The female crickets chose their preferred cricket. Preliminary results suggest that sound pollution affects crickets' chirps, but data is still being collected.

**Sloan, Joselyn** THE EFFECT OF EPHEDRA ON THE CHIRPING OF HOUSE CRICKETS (*ACHETA DOMESTICUS*), Ocean Township High School (Kowaliwskyj)

The purpose of this experiment was to test what kind of effect the drug ephedrine would have on the chirping patterns of the common house cricket. Forty crickets were used, ten in each of the twenty-gallon tanks. All four groups were given water and a few pellets of cricket food weekly. Two of the groups were left alone, to act as the control; the other two groups were fed pellets that were soaked with the drug ephedrine, to act as the variable. The amount of times each group chirped during a ten-minute period was measured each night for five consecutive days. Preliminary results suggest that the variable that has been introduced to the ephedrine will chirp more frequently than the control. Data is still being collected.

## Math/Computer Science

1. **Danielle Dai**
2. **Rafael Fernandez**
3. **Mohammad Anwar**

**Fernandez, Rafael** USING IMAGE ANALYSIS AS A TOOL FOR UNDERSTANDING THE CALCIFICATION ASSOCIATED WITH THE MICROSTRUCTURE OF THE GROWTH PLATE, William L. Dickinson High School (Corcoran).

The purpose of this project was to develop and follow a procedure for the Reindeer Graphics, Inc. Quantitative Image Analysis in order to convert images from the literature into quantitative data that will be used to study the complex structure of the growth plate. For this research, were applied as a test to find out how the imaging software functions. Methods were

manufactured for the image analysis software. It was possible to derive quantitative data from the images used. An error percentage for the method utilized was calculated. The methods were able to be revised as the project ensued. As the research progressed, results seem much improved. This data can be used in order to manufacture a biomaterial that can mimic growth plate activity in order to make an implant that will heal bone quickly.

**Anwar, Mohammad** THE EFFECT OF ELEMENTAL ORDER ON FINITE GROUPS , Dickinson High School (Corcoran)

The purpose of this project is to write all the general or abstract finite groups that exist for that order (number of elements of that group) in a multiplication table form. If the order is prime there will only be one finite group; if the order is non-prime there will be more than one finite group. Multiplication tables were created to find out the amount of finite groups that could be created per order used. These tables had seven rules that were followed for every order. In comparison with previous research the results were similar for finite groups with orders one, two, three, five, six, seven, and eight. For order four researchers had discovered two finite groups. However, through this research a third finite group for order four was discovered. The method used in this research was quite effective in displaying finite groups. Future research may include redoing the finite groups for non-prime orders; this may also derive new ways of representing groups. More significantly further research can lead to new finite groups that have yet to be discovered.

**Dai, Danielle** TO SWITCH OR NOT TO SWITCH: MALE AND FEMALE REACTIONS IN A MONTY HALL SITUATION, High Technology High School (Roche).

The research experiment was inspired by the popular show, Let's Make a Deal, starring host Monty Hall. In this situation, a subject chooses one of three doors. Then, he is shown one of two doors not picked, and now has the choice of staying with the original door or switching. The experiment's main focus was to test whether males or females would switch in this situation, and a smaller focus was to test the odds of winning if one switches. Playing cards were used instead of doors. It was hypothesized that males would switch more than females. Twenty-two teenagers were tested, raw data was collected, and summative data was formulated. A t-test was used to analyze the results and showed that males did not switch more than females. This rejects the hypothesis. Also, the raw data shows that the subject has a 2/3 chance of winning if he switches.

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