

The New Jersey Academy of Science Kean University, Center for Science, Technology & Math Education

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#### NJAS 54<sup>TH</sup> ANNUAL MEETING, 18 APRIL 2009 ANNUAL MEETING KEYNOTE SPEAKER

Kenneth Miller, Ph.D.

Climate and Sea-Level Changes in New Jersey: Should I Sell My Shore House?

Rising sea level threatens coastal communities, yet the extent of this threat is often exaggerated, scaring citizens into thoughts of a real estate exodus. Global processes, including ice melting and thermal expansion, regional subsidence, and local compaction affect sea-level rise. The maximum global rate of sea-level rise prior to 1850 was 0.75±0.25 mm/y. Recent studies have documented 20th century global sea level rise was 1.8±0.3 mm/y, but has accelerated over the past 15 yr and is rising today at 3.3±0.4 mm/y. Thus, we attribute <<30% of the modern global rise to natural causes. The IPCC best estimate, that global sea level will rise 40 cm (1.2 ft) by 2100, is too low: we are currently tracking a minimum global rise of 80 cm (2.4 ft) by 2100. The upper limit of global rise by 2100 is not well constrained but maximum rates observed in the geological record are ~30 mm/yr indicating a maximum global rise by 2100 of less than 2 m. Regional and local subsidence, ranging from 10-20 cm along the U.S. east coast to over a meter in southern Louisiana, exacerbate the global rise. Regional subsidence is caused by isostatic adjustments to removal of the Laurentide ice sheet or sediment loading; local subsidence is typically caused by groundwater withdrawal and compaction. Together, these three effects will cause a minimum of 1 m of rise along the U.S. Atlantic and Gulf seaboard resulting in loss of land (1-3% of the U.S. east coast), loss of marshland, and higher beach erosion. The effect of global temperature rise on storm intensity and frequency are not clear, but sea-level rise will exacerbate flooding during storms. By 2100 much of the New Jersey barrier islands will be impacted causing flooding of bays, streets and Newark airport.

#### Congratulations to those who were awarded top honors at this year's Annual Meeting

#### JUNIOR ACADEMY ORAL PRESENTATIONS

#### ENVIRONMENTAL SCIENCE/ECOLOGY

- 1<sup>st</sup> Emily Villa
- 2<sup>nd</sup> Jamie Gu
- 3<sup>rd</sup> Andrew Chien

#### **HEALTH/MEDICINE SESSION**

- 1<sup>st</sup> Kelsey Cromie
- 2<sup>nd</sup> Sdia Tahir
- 3<sup>rd</sup> Shivangi Gupta

#### CELL & MOLECULAR BIOLOGY/MICROBIOLOGY

- 1st James Ting
- 2<sup>nd</sup> Smriti Agrawal
- 3<sup>rd</sup> Joshua Chao

#### PSYCHOLOGY/ANIMAL BEHAVIOR

- 1<sup>st</sup> Manisha Kintali
- 2<sup>nd</sup> Rebecca Handlin
- 3<sup>rd</sup> Kelsey Noll

#### PHYSICS/ENGINEERING SESSION A

- 1st Jordan Moldow
- $2^{nd}$  Joshua Ma
- 3<sup>rd</sup> Moyukh Chatterjee

#### PHYSICS/ENGINEERING SESSION B

- 1<sup>st</sup> Sidney Buchbinder
- 2<sup>nd</sup> Jake Wood
- 3<sup>rd</sup> Nicholas Walters

Abstracts from these presentations are included in this NewsLetter.

#### SENIOR ACADEMY ORAL PRESENTATIONS

MOST OUTSTANDING ORAL PRESENTATION

Jared Rosenblum

#### SESSION A

- 1st Jared Rosenblum
- 2<sup>nd</sup> Anthony Suleski
- 3<sup>rd</sup> Mark Marasigan

#### SESSION B

- 1<sup>st</sup> Joseph Jablonski
- 2<sup>nd</sup> Nina Oshiokpekhai
- 3<sup>rd</sup> Michael Enechukwu

#### Abstracts from these presentations are included in The Bulletin.

#### NJAS SCIENCE FOR BREAKFAST

The New Jersey Academy of Science and The Science Academy at Morristown High School partnered on Saturday April 25, to offer a Science for Breakfast program to interested high school students. The program kicked off with introductions, followed by the opportunity for everyone to pick up some breakfast, and then mingle for about two hours. The program provided a casual setting where students and scientists could interact, learn from one another, and gain valuable insights about various fields and students and careers. Twenty six science professionals from the New Jersey Academy of Science gathered to participate in this wonderful event. Thank you to the following scientists you breakfasted with the students:

Eric Iannacone, Ph.D., Biological and Allied Health Sciences, Director of Allied Health Sciences at Fairleigh Dickinson University

Paul A. X. Bologna, Ph.D., Director Aquatic and Coastal Sciences Program Department of Biology and Molecular Biology at Montclair State University

Laura Y. Lorentzen, Ph.D., Director, New Jersey Center for Science, Technology & Mathematics Education at Kean University

Gail P. Carter, M.S., P.G., C.P.M., NJ Department of Environmental Protection Division of Science, Research, & Technology, Health Science and Environmental Assessment

John R. D'Agostino, Research Scientist 3, Coastal Planning Office New Jersey Department of Environmental Protection

## NJAS HAS THE FOLLOWING OPEN POSITIONS

**Executive Secretary:** Responsible for keeping the Executive Board aware of deadlines for varied activities of the Academy, as well as procedural deadlines for elections and similar functions.

**Junior Academy Director:** Work to oversee the high school student membership constituents of the

NJAS, specifically to expand the membership base of participating high schools in the state in the many NJAS high school orientated initiatives like Science for Breakfast an Grant in Aid. The Jr Acad director will play a large role in the organization of the annual NJAS meeting.

Grant-In-Aid Chairperson: GIA chair handle the yearly Grant-in-Aid program that is funded by AAAS to accept science/math research proposals from high school students each fall that are reviewed by senior scientists. Highest-ranking proposals are awarded small funds to offset the cost of the student's research project. GIA chair works with the participating high school science/math sponsoring teachers to encourage all GIA participants to present their research at the annual NJAS meeting.

**Program Development Coordinator:** Works to keep NJAS activities up-to-date, and continuously advancing. Keeps abreast of programs sponsored or developed by other State Academies, the National Academy, educational organizations, and similar groups in order for the NJAS to engage in program partnership opportunities as they arise.

Science For Breakfast Coordinator: Once or twice a year the NJAS hosts a Science for Breakfast program for high school students in different areas throughout the State. The coordinator maintains contact with interested schools, arranges for scientist in various disciplines to be present for the event, coordinates advertisement of the event, maintains registration and similar activities which are required to host a successful event.

**Web Manager:** Web Manager: Maintains the NJAS official web page and makes changes to the site as requested by the Executive Board. Keeps the web site up-to-date and interesting for Academy members.

Nominations should be sent to Dr. Laura Lorentzen, NJAS President at llorentzen@hotmail.com or to the NJAS directly at Kean University, CSTME, Townsend Hall, T117, 1000 Morris Ave, Union, NJ 07083 or njacadsc@rci.rutgers.edu

#### THE FOLLOWING ARE THE ABSTRACTS OF THE WINNING JUNIOR ACADEMY ORAL PRESENTATIONS

#### PSYCHOLOGY / ANIMAL BEHAVIOR

Manisha Kintali, J.F.K. Memorial High School, Iselin NJ 08830

## "ONE'S BRAIN DOMINANCE INFLUENCES WHILE LEARNING WITH GESTURES"

Gestures are hand movements that have been known to be reliable in the cognitive state of mind. People who are predominantly right-brained speak with many gestures and pre-dominantly left-brained speak with few gestures. The purpose of this study was to see if student's brain dominance influences while they were learning with gestures. It was hypothesized that if students are taught with gestures and speech then it enhances their learning. It was also hypothesized that if students are pre-dominantly right-brained, then they will profit from instruction with gesture and speech. After subjects filled out a brain dominance questionnaire, two groups were presented with stimuli and they were asked to answer questions at the end. ANOVA showed that high school students learned significantly better when they were taught with speech and gesture without even looking at their brain dominance. However, for right-brain and left-brain dominants, when they were taught with gesture and speech, it was very beneficial. The most interesting result of the study is that left-brain dominants performed better than right-brain dominants when instructed with gestures.

<u>Rebecca Handlin</u>, Marine Academy of Science & Technology High School, Highlands, NJ 07732

# "EARLY MOTIVATION AND GENDER AS A PREDICTOR OF SUCCESS IN UNITED STATES NAVY JUNIOR RESERVE OFFICERS TRAINING CORPS"

Congress designed JROTC programs to instill in students values of citizenship and personal growth. Recent years have seen increasing numbers of women in JROTC and the armed forces. This study examines motivational and gender factors affecting success of program cadets and their inculcation of core values taught in the program. MAST, a public high school, requires NJROTC participation. Two hundred and thirty three students from all four grades completed a 46-question survey examining attitudes prior and subsequent to enrollment as cadets. While only 19% of students indicate they chose to attend MAST because of NJROTC, the program is widely successful in achieving goals, with students indicating by 3:1 margins their positive reception of skills. Leadership and teamwork were identified as some of the skills taught in the program. The strongest relationship was between students' "early motivation," to participate in NJROTC and their subsequent experiences. "Early motivated" students had more positive perceptions on every measure. Men were more likely than women to be "early motivated," but both equally enjoyed NJROTC after experiencing at least three months of the program. Due to impacts of early motivation, outreach should be done at middle school levels, with women as a special target.

<u>Kelsey Noll</u>, High Technology High School, Lincroft, NJ 07738

## "THE EFFECT OF DISTRACTERS ON THE ABILITY TO ACCURATELY RECREATE A SIMPLE LINE DRAWING"

This study investigated effect of distracters on the ability to accurately recreate a simple line drawing. It was hypothesized that drawings recreated from an abstract reference with distracters would be significantly more accurate than drawings recreate from a clean reference with no distracters. Twenty subjects were recruited and assigned the task of recreating a simple line drawing. In the control group, the reference picture was a simplified drawing of a rabbit that had no internal or overlapping lines. In a different group, subjects recreated the same image, but with an addition. The second group's reference included other lines, known as distracters, which intermingled with the lines that composed the rabbit. This created a much more abstract reference in which the rabbit was no longer identifiable. To determine the accuracy of the drawings, the subjects' drawings were imported into Adobe Photoshop 7.0 and overlaid with the image of the reference drawing. Areas in which the subject had drawn but the reference was not and vice versa were counted as 'areas of difference.' These areas were quantified using a pixel count. In non-control trials, the only areas analyzed were the ones the made up the rabbit - the distracters were ignored in the analyzing. After conducting a one-tailed, independent data T-Test, it was concluded that drawings recreated from an abstract reference with distracters were not significantly more accurate (a = 0.05, p =  $3.36 \times 10^{-1}$ ) than drawings recreate from a clean reference with no distracters. This signifies that the distracters did not significantly enhance a subject's ability to recreate a simple line drawing of a rabbit.

#### **HEALTH / MEDICINE**

Kelsey Cromie, Morristown High School, Morristown, NJ 07960

#### "APPLICATION OF WII FIT IN ADOLESCENTS AS A NON-TRADITIONAL METHOD TO IMPROVE BALANCE, AGILITY, AND COORDINATION"

Balance is a state of bodily equilibrium that helps one to remain stable whole completing tasks. Agility is the ability to change body position or direction rapidly. Traditional balance and agility improvement methods can be monotonous, causing participants to ignore the need to improve balance. Wii Fit, a video game that is part of the Wii video gaming system produced by Nintendo has been implemented in rehabilitation institutes worldwide as a new method to improve balance in patients. The purpose of this study was to determine if Wii Fit is an effective and enjoyable balance improvement method. The investigator compared the balance improvement and pleasure of Wii Fit to traditional balance improvement methods in a study of 15 adolescents. Subjects were placed into either a

control or experimental group and performed either traditional or nontraditional balance improvement method activities. Scores of pre and post tests were compared for both groups. Subjects were also surveyed to measure levels of enjoyment during activities. It was determined that Wii Fit may be a viable tool to improve balance, and may be more enjoyable than traditional balance improvement methods.

Sadia Tahir, Science Department, JFK Memorial High School, Iselin NJ 08830

## "CORRELATION BETWEEN PARTICULATE MATTER & HEART DISEASE IN DIFFERENT STATES"

Particulate matter has been known to cause several lung diseases, but until recently, particulate matter was not known to have an effect on the heart. Particulate matter is present in the air we breathe due to air pollution, resulting from fires, road dust, etc. The purpose of this study is to statistically observe a correlation between particulate matter and heart disease in states in the U.S. who have high and low levels of particulate matter. States with highest levels of particulate matter include Alaska, Texas, California, and Florida. States with low levels of particulate matter include Vermont, Delaware, Rhode Island, and District of Columbia. Data was retrieved for heart disease mortality in each state. Then, Spearman's Rank Correlation test will be used to assess whether there's a correlation between particulate matter and heart disease. Pearson's Correlation Coefficient will be used to determine direction and correlation between particulate matter and heart disease. A linear regression model will also be used to statistically analyze the data.

<u>Shivangi Gupta</u>, Science Department, John F. Kennedy Memorial High School, Iselin, NJ 08830

## "DIETARY AND ENVIRONMENTAL ASSESSMENTS OF VENDING MACHINE SNACKS"

Teenagers' food preferences of high-fat foods in the United States have led to increases in obesity rates and various diseases. The purpose of this project was to analyze students' food habits and determine the magnitude to which vending machine meals affect their body mass. The environmental impact of the waste created from snack bags was also assessed. To analyze the students' dietary habits, an initial survey was completed by 500 randomlyselected students. Based on their answers, the students were grouped into those who eat snacks from vending machines and those who eat proper lunches. The selected students then maintained a dietary record for three days to confirm their eating habits. The Body Mass Index of students from both groups was calculated and the number of snacks consumed by the student body was counted. On average, 542 snacks were consumed by a student body of 1240 students. The results were statistically analyzed by the Spearman Rank's Correlation Test and showed no correlation between the type of meal consumed and the mass of the students.

#### PHYSICS / ENGINEERING - SESSION A

Jordan Moldow (speaker), Daniel Abolafia, Steffen Kaefer, Ilya Vakhutinsky (all students) Bergen County Academies, Hackensack NJ 07601

## "SYNTHESIS OF CONDUCTIVE POLYMERS FOR USE IN NANO-CIRCUITRY"

We report efforts to synthesize stable, solvent-soluble and solution-processible conducting polymers (CP's), singlewalled nanotubes (SWNTs), and their composites, for use as conducting conduits and electrodes for nanocircuitry and molecular electronic devices. The conducting polymer(s) used were based on the polythiophene and polypyrrole framework due to their ease of formation using simple wet chemistry methods and their superb stability at room temperature. These polymers were chemically synthesized through the chemical oxidation of their monomers in aqueous solutions, and in the presence of a suitable oxidant and a dopant. In our initial analysis, we investigated the suitability of organic acids that can be used as dopants that can render the polymer conductive, but still processible, in basic organic solvents. Pristine SWNTs are generally insoluble in both aqueous and organic solvents in their state, so they were functionalized with moieties that retained the conductive properties of the nanotubes while making them soluble in solvents. After the synthesis was completed, the solubility of the synthesized polymers and nanoparticles in a series of candidate solvents were investigated. When the optimal solvent was determined, a small amount of material was dissolved within the solvent, and a line of solution was traced along a piece of overhead transparency which served as a flexible substrate. Resistances of different concentrations of conducting polymers, functionalized carbon nanotubes, and conducting polymer/nanotube composites and blends were recorded. The resistance was also measured while bending the transparency, to see if substrate stresses affected the conductivity of the processed materials. These obtained results, including the properties of a crude electrooptic device designed to highlight the applicability and usefulness of such organic conducting materials, are reported.

Joshua Ma, High Technology High School, Lincroft, NJ 07738

# "INCREASING THE SPEED OF TARGET ACQUISITION THROUGH THE DYNAMIC CREATION OF MAGIC CORNERS IN A GRAPHICAL USER INTERFACE"

In the context of computer interfaces, Fitts' Law postulates that  $T = a + b \log_2(\frac{D}{W} + 1)$  where T is the time to acquire a target with the pointer, D is the distance to the target, W is the width of the target along the axis of movement, and a and b are empirical constants. A screen corner has  $W = \infty$  because a user's cursor will not move past it, even if the physical mouse overshoots the button by a large distance. Termed magic corners, they are useful in expediting user interaction. This study proposes a keyboard shortcut to restrict pointer movement to within the current window, turning its corners into magic corners. The objective is to

determine the improvements, if any, in user efficiency with the proposed modification. The research hypothesis is that the modification will produce significant decreases in the average time to reach a window's targeted corner. A Flash application simulates an environment with and without the proposed modifications. Presented with the outline of a window and shaded areas representing corners, users are asked to click the indicated areas. The application measures elapsed time, and a one-tailed dependent T-test tests for significant decrease. The calculated P-value from the T-test is 0.0094098. Compared to an alpha-value of 0.05, the T-test indicates that the research hypothesis is supported, while the null hypothesis is rejected. It is concluded that the interface modification does indeed result in a significant decrease in movement time.

<u>Moyukh Chatterjee</u>, High Technology High School, Lincroft, NJ 07738

## "GROWTH AND IMAGING OF BISMUTH NANOWIRES"

This research project aimed at successfully synthesizing bismuth nanowires. The target was synthesis of wires 200 nanometers in diameter and about 10 microns long. Growth of these wires involved the evaporative process being detailed. A small Al<sub>2</sub>O<sub>3</sub> crucible was placed in a tungsten boat. The crucible was filled with about 5 g of 99.9995% bismuth (metals basis) and capped with a porous anodized Al<sub>2</sub>O<sub>3</sub> template and a molybdenum plate. The boat was then placed between two resistive heating posts in a vacuum chamber which was then closed and pumped down to about 1.0 x 10<sup>-6</sup> torr, to ensure that no oxidation occurred during the growth process. About 200 amperes were driven through the heating posts, heating the crucible and evaporating the bismuth within it. After about 1.5 minutes the current was gradually decreased, allowing the bismuth to cool within the pores of the alumina template from the top of the system downwards. Once the system was fully cooled, the alumina template was removed and placed in a selective acid etch that dissolved the Al<sub>2</sub>O<sub>3</sub>, ideally leaving behind the bismuth nanowires. A few drops of this solution was then placed on a silicon chip and imaged using an SEM. Insofar, templates are heavily embedded with bismuth, and SEM images have shown 50 micron wires in template. These wires have then been successfully removed with etch and placed on a silicon chip.

#### PHYSICS / ENGINEERING - SESSION B

<u>Sidney Buchbinder</u>, High Technology High School, Lincroft, NJ 07738

## "THE EFFECT OF BLADE DESIGN ON WIND TURBINE EFFICIENCY"

Wind turbines can provide clean energy in a cost efficient manner. Wind turbines are designed to extract as much wind energy as possible. This study's goal was to determine which of two wind turbine designs is most efficient. It was hypothesized that there would be a significant difference in the rotation speed of the wind turbine when comparing a standard blade design with a thick airfoil blade design with a more circular airfoil. CAD models of the two designs were produced based on images and blueprints of actual functioning wind turbines. The KBP-200M wind turbine was used as the basis for the two turbine models. These designs were rapid prototyped at a scaled size. Each design was tested in a wind tunnel constructed by the student researcher. Fifteen one-minute trials were conducted to determine the average RPM of each design at a constant wind speed of 4.5 mph. There was no significant difference in the rotational speed of the wind turbine (P-value = 0.146 using TTEST). suggests that there is no significant difference in the efficiency of the standard blade design compared to the thick airfoil blade design. However, because the results of the first set of trials were inconsistent due to unaccounted friction related to the experimental setup rather than the turbine design, more trials are being performed. The new data suggest a significant difference between the two turbine efficiencies.

Jake Wood, High Technology High School, Lincroft, NJ 07738

## "IS CARDBOARD AN EQUALLY AS EFFECTIVE RESONATOR AS WOOD?"

During this project, the student researcher hoped to provide evidence that there is little difference in the abilities of wood and cardboard to transmit sound. The materials used were single corrugated cardboard and plywood. By testing 12 different pieces of wood and 12 different pieces of cardboard, more accurate and precise data was recorded. To conduct each trial, A speaker was attached to one corner of the medium (Wood or cardboard) and a transducer pickup was placed on the opposite corner and side. A demo version of the application SignalScopePro on the computer was used to output specific frequencies and receive accurate measurements from the pickups. The output and received signal strengths (in dBFS) were then compared to return signal attenuation values. Data was then recorded and analyzed based on the signal attenuation figures using a two-tailed independent ttest.

<u>Nicholas Walters</u>, Sage Day High School, Rochelle Park, NJ 07662

#### "INFRARED LIGHT FENCE"

An invention protecting the building area or the hallway from any unauthorized personal passing was developed. This invention based on thermal action of infrared radiation. By concentrating infrared radiation on the specific area we can heat any living thing (humans, dogs, etc.) or movable electronic devices (robots) up to the temperature when their proper functioning is impossible. (We are not going to burn the approaching object.) The infrared LEDs were chosen as a source of infrared radiation. The main reason for it was the efficiency of light emitting diodes comparing with other light sources. To concentrate the light from light emitting diodes on the protected area we place them on the concave cylindrical surface (ceiling) with each light emitting diode directed to the same area on the floor (protected area). This security

system works as an impenetrable barrier and acts as a warning system for any living thing approaching the protected area by gradually heating the approaching object. The second function is very important as a foolproof security system avoiding the possibilities of lawsuits. The main problem for implementation such system is the price of the required number of light emitting diodes.

#### ECOLOGY / ENVIRONMENTAL SCIENCE

Emily Villa, Marine Academy of Technology & Environmental Science (MATES) Manahawkin NJ 08050 "A STUDY IN PITCH PINE (PINUS RIGIDA) REFORESTATION: USING VARIOUS GROWTH TREATMENTS TO MAXIMIZE EFFICIENCY"

Environmental degradation is a major problem facing today's society. One strategy of counteracting this growing problem is reforestation. The purpose of this study was to investigate various growth treatments with the end goal of maximizing reforestation efficiency. Approximately 500 pitch pine, Pinus rigida, were planted at Jake's Branch County Park in Beachwood, New Jersey. The trees were divided into six plots dispersed around a rain basin; two plots were treated with Bioplex®, two plots were treated with a Mycorrhizal root dip, and two plots were kept as control. Two major parameters were observed throughout the course of this study: plant growth and survivorship. The parameters were consistently taken on randomlychosen representative subsamples of 50 trees per treatment, 25 per plot. A comparison of initial measurements and final measurements after six months revealed Bioplex® showed the most significant increase in height, and the control showed the most significant change in thickness. Mycorrhizal changed the least for both parameters.

Janie Gu, High Technology High School, Lincroft, NJ 07738

## "MODELING ATMOSPHERIC POLLUTION ON SOLAR CELL ELECTRICITY GENERATION"

This work analyzes the impact of atmospheric pollution on solar cell electricity generation. It was hypothesized that there would be a significant difference in power generated when exposed to four different forms of pollution. Ozone was generated by the electrical arcing of a tesla coil and carbon dioxide formed from the dissolving of alka-seltzer tablets in water. Burning paper in a cool, moisturized environment yielded artificial smog. In the last level tested, all three forms were combined. The results of an ANOVA (p = 1.399 x  $10^{-53}$ ,  $\alpha = 0.05$ ) and 10 T-Tests show that all four forms of pollution significantly decreased the solar panel's electricity generation. Combined pollution resulted in the greatest difference, decreasing the power generated by 78.35%. This may serve as a reasonable estimate as to how much modern solar panels are losing to pollution since many areas contain a mixture of several gases such as carbon dioxide, ozone, and smog in the atmosphere.

<u>Andrew Chien</u>, High Technology High School, Lincroft NJ 07738

## "QUANTUM EFFICIENCIES OF DIFFERENT SOLAR CELLS AT DIFFERENT WAVELENGTHS"

The purpose of this experiment was to determine the quantum efficiency of solar cells, which is defined as the percent of photons hitting the photo-reactive surface that will produce an electron-hole pair. Five different colors of lights (Red, Orange, Yellow, Green, Blue) were tested for differences in the quantum efficiencies of three different solar cells (an encapsulated high-output silicon solar cell, an encapsulated multi-volt solar cell, and a thin-film solar cell). These cells were placed in a black box with a 2" x 2" hole at the top, and a 75W full-spectrum flood lamp combined with colored acrylic filters was used as the light source. The output voltage was measured for each color. The quantum efficiency was then calculated using the formula

$$QE(\lambda) = \frac{R(\lambda)hc}{\lambda e}$$

where QE ( $\lambda$ ) is the Quantum efficiency at wavelength  $\lambda$ , R ( $\lambda$ ) is the spectral responsivity, h is Planck's constant, c is speed of light, and e is elementary charge. The data showed that the high-output cell had the highest overall quantum efficiency compared to the other two cells. Also, the two encapsulated solar cells had the highest quantum efficiency under green light (about 510 $\lambda$ ), while the thin-film solar cell was most sensitive under yellow light (about 570 $\lambda$ ). This indicates that different types of solar cells are sensitive to different wavelengths of light due to their design.

## BOTANY OR MICRO/CELL/MOLECULAR BIOLOGY

James Ting, High Technology High School, Lincroft, NJ 07738

#### "EFFECT OF TEMPERATURE ON THE NYCTINASTIC MOVEMENTS OF A BEAN PLANT"

Biological clocks affect the daily routines of many organisms, including plants. The nyctinastic leaf movements of legumes, specifically beans, are visible outputs of their circadian cycles and biological clocks. Since these biological clocks depend mostly on molecular and enzymatic reactions, changing the temperature by 10 degrees Celsius, can greatly affect internal factors. Having examined the visible observations, the experiment was set to find a significant difference between movements of beans grown in different temperatures: 17 and 27 degrees Celsius. By collecting the data with video capture, the physical fluctuations of the circadian cycle were measured. They were then graphed and the periods were analyzed for differences. Through analysis of the periods, derived through relative maxima, a p-value of 1.01062x10<sup>-5</sup> was attained; when derived through relative minima, a p-value of 6.689939x10<sup>-3</sup> was attained. This suggests that temperature truly is a factor in the period of these circadian cycles. Such a study could lead into further work in

determining the molecular basis of the cycles, creating more accurate mathematical models, and forming new applications; this includes using temperature to reduce the effects of jet lag or control hormonal levels.

Smriti Agrawal, Cathryn L. Crego (teacher), Science Department, JFK Memorial High School, Iselin NJ 08830 "POPULATION GENETIC STRUCTURE AND GENETIC DIFFERENTIATION OF Artemia franciscana AMONG VARIOUS POPULATIONS"

The purpose of this study was to analyze the rate of conservation and genetic variability of intronic regions of Hsp26, a highly conserved small heat shock protein, among intraspecific Artemia populations obtained from the Great Salt Lake and the San Francisco Bay. Because this organism is encased in a hard, protective shell, a technique proposed by Montero,et.al, 2008 was employed to extract DNA samples from single individuals. The success of this technique is significant since this DNA extraction is an efficient method for isolating DNA vs. cloning amplified fragments into a TA cloning vector. Results from an individual of the SFB population showed homology to other Artemia sequences obtained from the NCBI database. There was a 92% similarity among a small conserved region, and majority of the sequence showed significant variation, which suggests that this intronic region can be a useful tool for studying variation between populations.

<u>Joshua Chao</u>, High Technology High School, Lincroft, NJ 07738

# "THE EFFECT OF SIMULATED LUNAR AND MARTIAN SOILS ON THE PRODUCTION OF BOTANICAL BIOMASS"

Ever since NASA landed a man on the Moon, humans have been wondering if someday they will colonize on the Moon or even Mars. To decrease enormous costs of this ambitious endeavor, astronomers propose to use natural resources already found on the Moon and Mars, such as their soil for growing a steady supply of food. This study aims to question whether simulated lunar or Martian soils work better in producing biomass and comparing them to soil found on Earth. Due to differences in geological history, hospitableness for life, temperature, and chemical composition, it is hypothesized that there will be a great significant difference between each of the soils. The extraterrestrial soils do not actually come from the planetary bodies but are simulated regoliths prepared by geochemists. In this experiment, sixty Little Marvel pea plants attempted to grow in each type of soil. Using an ANOVA test and three 2-tailed, independent-varied ztests, p-values were obtained and compared with the alpha level of 0.05 to determine any significant differences. It was interesting to see that Martian soil produced much more biomass than lunar soil and as much as the Earth soil. Consequently, it is suggested that astronauts will have not much difficulty in growing crops on Mars as opposed to on the Moon. A further study may be suggested by using different types of plants or other simulated extra-terrestrial soils of other prospective sites for colonization such as Mercury, Venus, or Titan, one of Saturn's moons.

#### NJAS EXECUTIVE COMMITTEE

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Science Program, Annual Meeting

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#### THE **BULLETIN:** CALL **FOR** MANUSCRIPTS

Individuals seeking publication of their work are urged to consider submitting their manuscripts to The Bulletin, The peerreviewed journal of the New Jersey Academy of Science. We are currently on a twicevearly publication schedule, which consists of a spring and a fall issue.

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