ABSTRACTS – HIGH SCHOOL 2008/2009

BEHAVIORAL AND SOCIAL SCIENCES

HS-1
ASHAI, Simmone
Behavioral and Social Sciences
2008/2009

CORRELATION BETWEEN ASIAN AND EUROPEAN ETHNICITIES AND PITCH DETERMINATION

This project tested to see whether a student's ethnicity was at all correlated with his or her ability to determine and match pitches, a trait known as relative pitch. Relative pitch is a valuable ability for any musician to possess because it enables him or her to play or sing a piece of music "by ear."

My objective in this experiment was to see whether relative pitch seemed to be a hereditary or learned trait, and whether a person's ethnicity affected his or her ability to detect pitches. I hypothesized that students who had Asian or oriental ethnicities would be more likely to possess relative pitch.

Fifty students from Palos Verdes Peninsula High were tested to see if this correlation existed. The students ranged in age from fourteen years to eighteen years, and they were divided based upon ethnicity. It was also noted whether the subject had extensive musical training. Each subject was taken separately into the Choir room and asked to sing back a 5 note sequence played on the piano. Each subject took around three to five minutes to test, and about four to six students were tested every Wednesday at either lunch or after school. The entire testing took about ten weeks.

The results showed that out of the 25 Asians tested, 16 of them had relative pitch. Of the 25 Caucasians tested, 15 had relative pitch. It seems that the results of this experiment refuted my original hypothesis that Asians would me more likely to have relative pitch, since almost the exact same number and percentage of students from both categories tested positive for relative pitch. This leads me to conclude that perhaps relative pitch is in fact completely a learned trait and not at all genetic.

HS-2
FAUSTO, Celine
Behavioral & Social Sciences
2008/2009

The Improvement of Attention Network Scores as a Result of Visual Training

There is a genetic influence in the development of the executive attention network. My hypothesis is six to seven year old children in the first grade will show an improvement from their initial Attention Network Test (ANT) scores after two sessions of visual attention training. First all 28 children were given the ANT. Two sessions of the visual attention training included three games, two of which were on the computer. The three games were administered to 14 children (experimental) out of 28. The other 14 children (control) were given no training. All three games were designed to increase the child's sustained visual attention. At the end of the training, all 28 children were given a second ANT and it was found that 71% of the students who were in the experimental group scored the same or higher in their ANT while only 50% of the control group scored the same or higher in ANT score. Overall, the average percent change for the experimental group was 3.49 while the average percent change for the control group was −0.21. In the future to further this experiment, different variables, such as age of the students, time between the ANT, and more visual attention games. The different games can be administered differently as well to see if there is a greater increase in scores.

HS-3
JOHNSON, Rita
Behavioral Science
2008/2009

The Relation Between Gender and Brain Dominance on the Effectivness of Multitasking

As more and more pressure to complete several tasks in a limited amount of time builds, people turn to multitasking. When people multitask, is there a specific reason why some are more successful than others in retaining information? Many students find that while studying, others are capable of multitasking while others aren't. Through this project, the factors, brain dominance and gender, are tested to see if there is any relation to effective multitasking. If a factor can be identified, students can pick the best way to achieve in studying.

Human subjects are first asked to take a brain dominance test to identify which sphere is more dominant. Knowing each subject's dominant sphere and gender, subjects are asked to take part two: video selection with reading section. After a timed session with the video and reading selections, students are given a short answer test and asked to fill in as much as they can remember. The third step is the same procedure with instead another reading section and music selection. The performance on the tests will determine the subject's ability to notice important details and retain those details.

Surprisingly, right brain dominant subjects performed the best overall on the reading and video tasks. Even more significantly, the data supported that those who are generally slightly brain dominant to either side are the best at multitasking. It is assumed that because each individual subject that was only slightly brain dominant to either side they were able to more easily switch their focus between tasks, which were designed to depend more heavily one brain dominant side.

From the conclusions made in the study, students who are more likely to multitask with these tasks can change their study habits to better improve their chances of success. If students learn which side of the brain they generally are more dominant and to what extent, they can determine how effective multitasking may be in their success.

HS-4
LEE, Seo Yeon (Anita)
Behavioral and Social Sciences
2008/2009

THE BETTER SHARPENING MECHANISM BETWEEN PIANO AND VIOLIN FOR PITCH PERCEPTION

This project is an experiment on the relative pitch perception between pianists and violinists. The ability to hear the pitch of sound is important, not only for music appreciation but also for listening to speech. However, because people gradually undergo narrowing of pitch perception as they age, the purpose of this experiment is to determine if hearing impairment can be delayed by natural efforts, such as playing an instrument that practices listening of pitch.

My objective was to determine which of the two instruments, piano or violin was the better sharpening mechanism for relative pitch perception, which is assumed to enhance pitch resolution. My hypothesis is that if the same ten notes are played to pianists and violinists, then violinists will have the better pitch perception than that of pianists.

Thirty pianists and thirty violinists from Palos Verdes Peninsula High, South Bay Youth Orchestra, and a church orchestra were tested. The students ranged in age from fourteen to eighteen, and few professionals in the age of thirties and forties who had the experience of playing at least three years of just one of the instruments were tested with the Relative Pitch Test, a program downloaded from the computer to avoid any bias in responses. The same ten pitches were played in the familiar order for all pianists and violinists. For data analysis, two different average scores were calculated by dividing the sum of all number of notes guessed correctly by pianists by the number of pianists tested, and dividing the sum of all number of notes correctly guessed by violinists by the number of violinists tested.

The results of this experiment support my original hypothesis. The violinists guessed an average of 6.367 pitches correct, whereas pianists guessed an average of 6.2. Therefore, the violinists had the better relative pitch perception than pianists, despite the fact that total number of subjects was very small to represent the entire population of pianists and violinists.

HS-5
WU, Steve
Behavioral & Social Sciences
2008/2009

SELF-REFERENCE EFFECT ON COLOR

This project is designed to address the self-reference effect theory and its relationship to color in determining short term memory. Educators are currently striving for the best way to improve their students' learning capabilities, and memory plays a huge part in this process. Testing with subjects eventually led to a conclusion that will highlight the potential of using color in educational environments.

Human subjects were chosen according to age and gender. Short term memory was measured by a specially made video. Subjects would look at the video and then write down as many pictures as they could remember. Data was recorded in terms of # of pictures memorized and average # of pictures memorized. After a three month period, subjects were introduced to a second video, this time with their favorite color as the background. Data was recorded a second time in terms of # of pictures memorized and average # of pictures memorized.

The results of this project were unexpected – the complete opposite of my hypothesis. Overall, there was no improvement by either gender from the first video test to the second video test, although the male performance was significantly worse than the female performance in the two tests.

Data collection provided significant evidence that the self-reference effect did not apply to color in my experiment, hinting that using an individual's favorite color – to underline or highlight notes – could actually hinder his or her memorization skills, rather than improve them.

BIOCHEMISTRY

HS-6
CHEN, Kevin
BIOCHEMISTRY NO ABSTRACT
2008/2009

HS-7
LEE, Seram
BIOCHEMISTRY
2008/2009

Effects of Maternal Food Restriction on Fas-Mediated Placental Apoptosis

The placenta has a major role during pregnancy shuttling nutrients and hormones to the fetus. Maternal food restriction (MFR) during pregnancy results in growth restricted fetuses and newborns. We hypothesized that MFR further compromises fetal growth by decreased placental growth or increased placental apoptosis. We determined the degree and potential pathway (Fas pathway) of placental apoptosis in MFR pregnancies. We assessed the two placental positions (proximal vs. mid-horn) which have differing nutrient supply, and the two morphologically and functionally distinct placental zones (basal, hormone production; labyrinth, feto-maternal exchange).

Pregnant rats were fed an AdLib diet or were 50% MFR starting at E10. At E16, right proximal and mid-horn placentas were fixed (4% paraformaldehyde) and TUNEL stained. The corresponding left horn placentas were separated into basal and labyrinth zones and analyzed for Fas, FasL, caspases 8 and 3 apoptotic markers (Fas pathway) by Western blotting and scanning densitometry.

MFR placentas had significantly increased apoptotic levels in basal and labyrinth zones from the proximal horn with a further increase in placentas from mid-horn. The increased apoptosis was paralleled by significant increases in Fas, FasL, caspase-3 and 8 in all placental regions in MFR proximal horn. Caspase-3 was the solely increased protein in MFR basal zone of the mid horn.

Increased placental apoptosis occurs rapidly following MFR diet, and is mediated in part via Fas pathway. Labyrinth zone apoptosis may contribute to impaired nutrient exchange and fetal growth restriction. Basal zone apoptosis may impact placental hormone production essential for pregnancy maintenance.

HS-8
LIN, James
Biochemistry
2008/2009

EFFECT OF MATERNAL FOOD RESTRICTION ON AMNIOTIC FLUID VOLUME AND PLACENTAL AQP EXPRESSION

Maternal food restriction (MFR) during pregnancy is associated with intrauterine growth restriction (IUGR). IUGR is often associated with oligohydramnios. Transplacental water flow, essential for the maintenance of fetal body water and amniotic fluid (AF), is regulated in part by the aquaporins (AQP). We assessed the effect of MFR during pregnancy on AF volume, osmolality and the placental expression of AQP1, and AQP8 proteins. We focused on the two placental positions (proximal and mid-horn) with the nutrient/oxygen supply extremes, and two distinct placental zones (basal, hormone production; labyrinth, feto-maternal exchange).

Pregnant rats were fed an AdLib diet or were 50% MFR beginning at E10. At E16, rats were euthanized, gestational sacs dissected, AF volume quantified, the placenta and fetus separated and weighed. Placentas (right proximal and mid-horns) were separated into basal and labyrinth zones and analyzed for AQP1 and AQP8 expression.

MFR fetal weights (mid- and proximal horns) were not significantly different from their respective AdLib. MFR basal zone weights from mid-horn placentas were significantly increased while MFR basal zone weights from proximal horn placentas were not. AF volume was significant decreased whereas amniotic fluid osmolality increased in the MFR sac. MFR placentas (proximal-horn) showed decreased AQP1 in both basal and labyrinth zones whereas in MFR mid-horn, AQP1 was only decreased in labyrinth zone. AQP8 was increased in basal and labyrinth (MFR proximal and mid-horn placentas).

Inversely correlated expression of AQP1 and AQP8 proteins in the MFR suggest a role for these channels in maintaining placental water and solutes balance

HS-9
LYBERGER, Kelsey
BIOCHEMISTRY
2008/2009

A NOVEL MECHANISM FOR BLEOMYCIN-INDUCED FIBROSIS: SELECTIVE APOPTOSIS OF BONE MARROW MESENCHYMAL STEM CELL-DERIVED LIPOFIBROBLASTS

Bleomycin is a highly effective treatment for certain types of cancer, however it has the potentially severe side effect of pulmonary fibrosis. In this project, the effect of Bleomycin was tested on Bone Marrow Derived Mesenchymal Stem Cells (BMMSCs) which when converted to adipocytes, play an important role in lung development. Also, BMMSC's were simultaneously treated with the PPAR-γ agonist, Rosiglitazone (RGZ) to determine its potential to allow adipogenic transdifferentiation.

First, three types of stainings were done including Oil Red O (ORO), Von Kossa and α-SMA to prove that the cells obtained were actually BMMSCs proving their multipotent potential. Then a MTS Proliferation Assay was conducted determining the effect of Bleomycin on the BMMSCs with and without the adipogenic induction, and slides were stained with DAPI to show the BMMSCs nuclei, and with Hoechst to show the apoptotic cells. The result of simultaneous treatment of Bleomycin and RGZ was shown by another MTS Proliferation Assay along with ORO staining.

In the first MTS Proliferation Assay, BMMSCs without adipogenic induction were mostly unaffected by Bleomycin whereas those with adipogenic induction were highly affected in a dose dependent manner. The Hoechst staining showed that the apoptosis of the adipogenically induced BMMSCs occurred in a dose independent manner. Both the MTS Proliferation Assay and the ORO staining for the RGZ treatment showed that it blocked Bleomycin mediated decrease in BMMSCs transdifferentiation into adipocytes. These results suggest RGZ's potential to reduce the negative side effects of Bleomycin.

HS-10
NEJAD, Mona
FREIJE, Catherine
BIOCHEMISTRY
2008/2009

ANALYSIS OF GENES CONTRIBUTING TO NEURODEGENERATION OF THE MEDIAL ENTORHINAL CORTEX IN HETEROZYGOUS NAGLU+/- MICE

The objective of this project was to find which genes, expressed to a different degree in a DNA Microarray of the Medial Entorhinal Cortex (MEC) and the Lateral Entorhinal Cortex (LEC) of heterozygous Naglu+/- mice, contribute to further neurodegeneration in the MEC of mice with Sanfilippo Syndrome.

Data from the DNA microarray analysis was narrowed down to 1178 genes which show a greater than two fold change and a "p" value less than 0.01. First the genes were organized into 183 clusters using the DAVID Bioinformatics Database. Genes repeated most frequently and exhibiting relevance to neurodegeneration were further analyzed using the Chilibot Database.

Genes involving amyloid beta, tau, ubiquitin, cyclin-dependent kinase 5 (cdk5), angiotensin, calcium, and dehydrocholesterol were found most frequently in association with neurodegeneration during analysis using DAVID. According to the DNA microarray analysis, cdk5 regulators, tau regulators, and dehydrocholesterol are expressed more in the LEC, while amyloid beta, angiotensin, and calcium are expressed more in the MEC. The degree of expression between MEC and LEC for ubiquitin was dependent on the specific gene.

Neurodegenerative diseases are characterized by amyloid beta and tau protein aggregation in neurofibrillary tangles. Aggregation is marked by high levels of ubiquitin. Also, the lack of dehydrocholesterol allows for the accumulation of calcium ions, an initiating factor of neurodegeneration, due to the amyloid beta protein. Ineffective cdk5 regulation results in increased tau phosphorylization causing aggregation. Lastly, angiotensin is considered a contributing factor of neurodegeneration.

HS-11
Paik, Michelle
Biochemistry
2008/2009

TAMM-HORSFALL PROTEIN AS AN INDICATOR OF HEMATOPOIETIC CELL MIGRATION DURING KIDNEY INJURY

Chronic kidney disease (CKD) is a growing global health problem that affects 26 million American adults today. Although studies show that patients with CKD are predisposed to high mortality from cardiovascular disease (CVD), the biological explanation for this connection is yet unclear. The current study investigated a hypothesis that T lymphocytes activated to recognize certain antigens in the kidney during renal injury may also be activated to recognize these antigens in damaged vascular tissue elsewhere, such as in the coronary endothelium.

To test the shared presence of specific antigens in the kidney and outside the kidney during renal injury, kidney and renal lymph node sections obtained from rats that underwent 5/6 nephrectomy were tested for Tamm-Horsfall Protein (THP), a kidney-specific antigen. All sections were stained by a method of immunohistochemistry then observed under a microscope where a brown staining was considered to be positive for THP.

The presence of THP in the renal lymph nodes demonstrated the trafficking of the antigen from the kidneys to the lymph nodes during renal injury. Kidney sections showed a clear positive staining for THP. Staining in the lymph nodes showed a negative staining in sections from control rats, but a clear positive staining in lymph node sections obtained from surgical rats.

The results of this study suggest that the migrating antigens could possibly be inciting an immune response outside the kidney. Moreover, if specific renal antigens that cross-react with vascular antigens were activated during renal injury, T lymphocytes activated to recognize the antigen in the kidney would also recognize the vascular antigens in coronary arterial tissue. This mechanism could potentially provide the biological link for why CKD patients are at such high risk for cardiac death.

HS-12
Carolyn Sinow
Biochemistry
2008/2009

CONSTRUCTION OF AN IGF-NAGLU FUSION PROTEIN FOR TREATMENT OF SANFILIPPO B SYNDROME YEAR 2

Mucopolysaccharidosis IIIB (MPS-IIIB), also known as Sanfilippo B Syndrome, is a genetic disorder resulting from a deficiency of the enzyme α-N-Acetylglucosaminidase (NAGLU). Synthetic NAGLU has not effectively corrected this deficiency because it has poor cell uptake. Attaching an Insulin-like growth factor II (IGF-II) tag to synthetic NAGLU may allow the enzyme to enter cells using the mannose-6-phosphate receptor. The goal of this project was to use recombinant DNA techniques to create a plasmid coding for the production of a NAGLU-IGF-II fusion protein for preclinical testing as therapy for Sanfilippo B.

Isolated NAGLU cDNA fragments were ligated into plasmid pCI-IGF-II to create pCIGFNag. pCIGFNag underwent transformation and amplification using E.coli cells. Plasmids were extracted from the E.coli colonies, double digested, and screened using gel electrophoresis. DNA sequencing of plasmids verified correct insertion of cDNA fragments. Chinese hamster ovary cells were transfected with pCIGFNag to express the enzyme and characterize its biochemical activity. The medium was assayed for NAGLU activity using a fluorogenic substrate; however, NAGLU activity was minimal. A Western blot was performed to evaluate the enzyme's quality and size, characteristics which influence activity levels.

HS-13
Suh, Jane
Biochemistry
2008/2009

MICROSCALE PLATFORM FOR DETERMINING HUMAN PLURIPOTENT STEM CELL FATE

Millions of individuals suffer every year from devastating diseases such as Parkinson's, Diabetes, and Heart Disease. Promising advances in stem cell research reveal the potential for human pluripotent stem cells (hPSC) to treat many fatal diseases. Current large-scaled conventional culture systems do not accurately reflect the *in vivo* environment and therefore restrict knowledge of hPSC behavior and biology. Common use of animal products (mouse embryonic fibroblasts) for maintaining stem cell growth causes xenogenic contamination, making transplantations unsafe. Lack of understanding between differences among diverse stem cell populations and poor survival upon dissociation also limits the selection of homogeneous populations of specific target cells for regenerative therapy. By understanding factors that improve stem cell growth and affect cell fate in a reliable, robust, and reproducible culture model, hPSC will significantly impact medical applications in the clinical field such as drug screening and tissue engineering.

Human pluripotent stem cells (hPSCs) were successfully cultured in a PDMS microscale chip that reflected a 3D *in vivo* microenvironment. Feeder-free Matrigel coating at a dilution of 1:20 in a microscale chip resulted in optimum growth and high expression of pluripotency factor OCT4, confirming the robustness of the microscale culture platform as in conventional cultures. Differing cell lines (H1, HSF6, IPSA1, IPSB2), were cultured under various stem cell culture media (StemPro, mTeSR, N2B27). Through immunostaining of cell cycle markers (DAPI, pHistone H3 and EdU) and apoptosis (Caspase-3/-7), the fate of the hPSCs at different stages of the cell cycle were efficiently detected. The microscale platform represents a powerful tool for maintaining optimum growth and analyzing stem cell fate among heterogeneous stem cell populations. This platform can determine specific pluripotent stem cell lines that are suitable for therapeutic purposes to advance regenerative medicine.

BOTANY

NOTE : 2 PROJECTS 14(1) AND 14(2) ARE DIFFERENT PROJECTS

HS-14(1) CHOW
CHOW, Nicole
Botany
2008/2009

QUANTITATIVE AND QUALITATIVE PHENOLOGY OF *RHUS INTEGRIFOLIA*

The purpose of this experiment was to determine the most accurate estimation of biomass for *Rhus integrifolia* (Lemonade berry) without destroying the majority of the species. This information is vital to those who need to conduct studies that require biomass measurements to conduct their experiments.

Samples of the *R. integrifolia* were obtained from the Portuguese Bend Conservancy in Rancho Palos Verdes, California. They were measured for length in centimeters and diameter in millimeters. The samples were then taken to University of California at Los Angeles and placed in a drying oven for 48 hours. After, they were separated into shoots, leaves, and flower buds and weighed in grams.

This data was inputted into a computer and main branch diameter and total shoot length was compared to total branch, leaf, and shoot dry weight. These values were graphed, and a linear regression was computed for the variables.

It was concluded that the most accurate estimation of biomass was the correlation between total shoot length and total leaf dry weight.

HS-14(2) GUN
GUNZENHAUZER, Christina
Botany
2008/2009

EFFECTS OF EPISODIC DROUGHTS ON RHUS INTEGRIFOLIA PHENOLOGY

Rhus integrifolia is an extremely common coastal sage in Southern California. It is classified as a drought-resistant, evergreen scrub. These characteristics enable it to thrive on rocky coasts and cliffs. I observed in my previous work that this was not exactly the case. Variations in growth in the *Rhus integrifolia* that I observed was affected by some factor that I could not identify. My initial work suggested that there was a correlation between precipitation and several growth characteristics. In this study, I report on a full two years of observation of growth characteristics and their relationship to monthly precipitation. I decided to incorporate the common yet severe droughts of Southern California in my study to analyze their impact of *R. integrifolia*. The purpose of this study is to observe the extent of varying precipitation on this drought-resistant scrub.

Growth characteristics of several plants of *Rhus integrifolia* were measures over a two-year period. Based on observations in the first year, some additional measures were added during the second year. After analyzing the large mass of data, I found that the resulting trends confirmed my hypothesis. Several of the growth characteristics such as branch length, branch diameter, number of leaves, and number of new shoots all varied in relation to the precipitation levels. This study provides an estimate of the magnitude of this relationship and provides a baseline for measuring the effects of severe drought on plant-life of California. This, in turn, allows us to analyze any consequential risks such as the animal life that live among the plants or the higher chance of brush fire.

HS-15
ITAMURA, Ayane
BOTANY
2008/2009

THE EFFECT OF ETHYLENE, TEMPERATURE, AND LIGHT ON THE RIPENING OF FRUIT

Ethylene, an unusual gas hormone, has been known to promote the ripening of fruits. It stimulates a chemical process inside the fruits which results in stored starch to turn into sugar. This process allows people to enjoy the sweet taste of various fruits that the population is accustomed to.

This research project tested the effect of two variables: temperature and light. These two variables were manipulated in order to see each of its effect on the release of ethylene and therefore on the rate of fruit ripening. A banana was selected as the ripening fruit and apples as its source of ethylene. Each banana was enclosed in a bag with three apples under the appropriate conditions. After a three day ripening period, the bananas were tested for starch with an Iodine solution.

The results show that as the temperature and the intensity of light increases, the amount of starch decreased, indicating a faster rate of ripening. It is apparent that higher temperature and higher sun exposure results in a faster rate of fruit ripening and therefore in sweeter fruits. These results are helpful to society, especially to industries and farmers who grow fruits that reach our local grocery stores. This is because knowing the ideal conditions for the fastest rate of ripening will allow them to have more fruits ripen at a faster rate. As the rate of fruit ripening becomes faster, the rate at which the fruits reach our local grocery stores will be faster, resulting in fresher naturally ripened fruits. Future studies can further strengthen the results by testing other various variables which can have possible effects on the rate of fruit ripening. Thus this experiment will act as a base in finding the ideal conditions that will promote the fastest rate of ripening.

HS-16
KIM, Hyunjean
Botany
2008/2009

THE EFFECTS OF RECYCLED WATER ON NATIVE CALIFORNIAN SHRUBS FROM GERMINATION TO EARLY GROWTH

Since so much water is wasted in a single day by a single person, purifying and recycling that wasted water to be useful again would be practical. But this procedure is not so simple, because there are possible dangers to using recycled water, due to its high levels of salinity. Therefore, this project tests the effects of recycled water on native Californian Shrubs: *Cleome isomeris*, *Encelia californica*, and *Lavatera assurgentiflora*.

This project included two parts: Germination and Early Growth. In the Germination experiment, seeds were germinated in Petri dishes and germinations counts were recorded every week for 3 weeks. During Early Growth, seeds were planted in soil and watered in groups of different treatments: full tap water, a mix of half recycled water and half tap water, and full recycled water. For ten weeks plants were watered regularly and data of the shoots was collected. On the eleventh week, dry masses and measurements were made of the plant shoots and roots.

Each species of plants showed different effects of the recycled water treatment. Recycled water had a positive effect on shoots but a negative on roots of *Cleome isomeris*. *Encelia californica* showed more positive effects of recycled water. *Lavatera assurgentiflora* also benefited from recycled water.

Because each species responded uniquely to recycled water, no universal effect can be concluded about recycled water on shrubs. Recycled water can be used to water *Encelia californica* and *Lavatera assurgentiflora* because these are more opportunistic plants. Recycled water will not be a suitable treatment to *Cleome isomeris* for longer periods of time.

HS-17
LIM, Nicole
Botany
2008/2009

IMPACT OF HUMIDITY AND TEMPERATURE ON PHENOLOGICAL PATTERNS OF ENCELIA CALIFORNICA

To increase the success of restoration efforts of native deciduous coastal sage scrub populations, this project studies the responses of *Encelia californica,* a sunflower species, to its Californian microclimate. Rising humidity and falling temperatures are predicted to increase the emergence of leaves and the blooming of flowers over the span of four months.

Six data loggers were deployed for six sample specimens. These data loggers recorded the humidity and temperature of the experimental site. In one reserve, the first three data loggers were tagged to three specimens from the lowest to the highest elevation. This procedure was repeated in the second reserve. The number of nodes, the lengths of branches and the presence of flowers were used to document quantitative phenological changes while photographs were taken to capture visual qualitative phenological changes.

A significant increase in the emergence of leaves but little to no change in the branch lengths and the blooming of flowers depicted *Encelia*'s phenological reaction to the inverse relationship of increasing humidity and decreasing temperatures over the span of four months.

These results indicated that *Encelia* required a longer period of time to activate its phenological activity to its full potential. To depict more accurate phenological responses, this project can be extended beyond four months.

HS-18
McGUINESS, Lauren
Botany
2008/2009

HOW DIFFERING LIGHT WAVELENGTHS AFFECT THE RATE OF FRUIT RIPENING.

If fruit ripening can be altered in a natural way, such as exposure to only certain light wavelengths, then harmful ripening techniques, such as the use of chemicals, will become less useful. How certain wavelengths affect fruits and the rate at which they ripen was tested.

To test how specific wavelengths alter ripening rates, fruit was left to ripen under red light, blue light, purple light, and no light. A refractometer was used to more accurately determine the degree of ripeness for each fruit. A refractometer measure Brix or sugar weight – the reading help monitor the progress of ripening.

Refractometer measurements were taken every 3 days. By the end of a 12 day period the red light proved to ripen tested fruit the fastest while no light proved to ripen tested fruit the slowest.

The purpose of this project proved beneficial. Manipulation of light wavelengths can be used to naturally alter fruit ripening.

HS-19
Ololade Saliu
Botany
2008/2009

THE AFFECT OF HUMIDITY ON THE GROWTH OF *OPUNTIA LITTORALIS*

The goal of this research was to discover if *Opuntia littoralis* responded most readily to high relative humidity. The *Opuntia*, a vigorously growing succulent with a large root system, grows in response to seasonal rains that peak in the winter months.

To measure the relative humidity in each of the six plant sites used for this study, USB-502 data loggers were attached to sturdy plants nearby a cactus patch. The units were programmed to take relative humidity, temperature, and dew point every 30 minutes. To interpret the differences in each area's humidity, five branches at each cactus site were measured once a month to make comparisons of growth rate. Temperature differences were also considered in data collection.

It was discovered that, for the most part, the relative humidity at each of the plant sites aligned; the most notable difference was the site marked by Unit 2. Unit 2 recorded on 8 separate occasions a relative humidity that differed greatly from that of the other areas. On 6 of those occasions, the relative humidity fell far below those of the other sites. Temperature was within the same range for the separate units. Unit 16 was excluded from the temperature and relative humidity comparisons because water damage to the data logger made it impossible to retrieve the data.

Unfortunately, measurement errors and difficulties making a useful number of measurements made a decisive conclusion on the affect of humidity on the *Opuntia* difficult to decipher.

HS-20
Song, Sheena
Botany
2008/2009

THE EFFECTS OF RECYCLED WATER ON THE GERMINATION AND GROWTH OF *LEYMUS TRITICOIDES*, *NASSELLA CERNUA*, AND *POA SECUNDA*

With the growing demand on a limited water supply, the use of recycled water for irrigation offers both a possible long term sustainable approach as well as a cost effective plan. However, the effects of recycled water on the growth and germination of native plant species are virtually unknown and may therefore pose a risk to the well being of plants. It was hypothesized that those plants treated with recycled water would exhibit the most detrimental effects and low germination, while those treated with tap water would exhibit optimal growth and high germination.

In this experiment, three water treatments were used to evaluate the responses of the three native grass plant species, *Leymus triticoides, Nassella cernua,* and *Poa secunda*. These treatments included recycled water, tap water, and a 50/50 mixture of both. The plants were irrigated regularly and stem counts and height measurements were taken. At the end of an approximately 90 day period, wet and dry masses were obtained. Several analyses were then taken, which included net water absorption and stem: root ratio. In addition, separate germination seed tests were conducted in Petri dishes, and seed germination percentages were determined.

It was concluded that though recycled water may have given all of the plants an initial boost in height and stem abundance, the gradual accumulation of heavy metals and salts may have ultimately proved detrimental to the plants' health. Recycled water caused the plants' shoot system to outgrow the root systems, hindering the plants' ability to absorb the necessary nutrients and to support itself. Seed germination tests provided that seeds treated with tap water showed optimal growth.

The experiment provided useful information regarding the usage of recycled water on grass growth. Though recycled water may be a sustainable solution to the world's growing water crisis, it was determined that its usage on plants was harmful.

HS-22
TANG, Jocelyn
BOTANY
2008/2009

EFFECTS OF ELEVATED CARBON DIOXIDE ON SALINITY TOLERANCE OF AZOLLA FALICULOIDES

This project tested whether elevated levels of atmospheric carbon dioxide had any effect on the salinity tolerance of the freshwater fern *Azolla filiculoides*. Since *Azolla* was known to have covered the Arctic Ocean in the Eocene period, either a low concentration of salt water, or an increased toleration of salt water, or both, must have contributed to this phenomenon.

To test whether carbon dioxide levels affected the *Azolla* growth, 5 gram samples of the plant were placed in 18 beakers with 400 ml solutions: 6 with 0% salt, 6 with 1.5% salt, and 6 with 3.0% salt. Half of the beakers from each salt concentration were placed in a chamber with elevated atmospheric carbon dioxide (created by adding sodium bicarbonate to hydrochloric acid in a beaker and then sealing the entire container). The other half was loosely sealed to maintain atmospheric concentrations of carbon dioxide while preventing unwanted substances from falling in.

After 2 weeks, the living *Azolla* was taken from the beakers, dried, and weighed. Using the statistical procedure 2-way ANOVA, the results indicated that carbon dioxide levels had no effect on *Azolla* growth in any kind of water.

These findings indicate that *Azolla* was able to live in the Arctic Ocean either because there was a layer of freshwater at the top, which is likely because the high temperatures at the time may have caused polar ice caps to melt, or because of another factor. Carbon dioxide, however, is not the reason for this phenomenon.

HS-24
WEN, Zeyu
Biology
2008/2009

DRY WEIGHT OF SALVIA LEUCOPHYLLA AND ARTEMISIA CALIFORNICA

This experiment was designed to exemplify the dry weight of different plants that are common in Southern California, more specifically Rancho Palos Verdes. The plants used in the experiment are *Salvia leucophylla*, Purple Sage Brush, and *Artemisia californica*, California Sage Brush. The information gathered from this experiment is designated to be a table for future research that involves using dry weight of these plants to determine their amount of carbon sequestration

Salvia leucophylla and *Artemisia californica* were gathered at the Palos Verdes Land Conservancy. 10 of each plant were taken with permission from the conservancy to be used as sacrifice. The plants were separated into separate portions. For California Sage Brush, its separate components was 2005-2006 old branch growth, 2006-2007 old branch growth, 2007-2008 new leaves, and 2008-2009 new flowers growth. Then, the Purple Sage Brush was separated into 06-08 old branch growth, and 08-09 new leaves growth. Afterwards, each portion of the plant's dry weight was accumulated and then totaled. Then, a best line graph was drawn to distinguish the length and diameter versus dry weight comparison to show which plant contained more dry weight.

The purpose for gathering data for these two plants is because they are common and native to Southern California. As a result, when these plants are proven to be efficient, they can be recreated and multiplied within a short time span. Another variable that possibly affected the plants was its canopy size. Since these plants can range from small canopy to large canopy, it was necessary to gather samples from all three sizes. As a result, the plant's data can be cross referenced with the size of the canopy and whether dry weight was affected at all.

The results of this experiment were important for future research. Foremost, *Artemisia californica* proved to produce a higher dry weight than *Salvia leucophylla*. Therefore, *Artemisia californica* should have higher carbon sequestration and will be efficient when society needs to reduce carbon monoxide in the climate.

HS-25
WOO, Suh Young (Sharon)
Botany
2008/2009

EFFECTS OF WATER POTENTIAL AND PHOTOSYNTHETIC CO_2 UPTAKE FOR INVASIVE AND NATIVE PLANTS DURING DROUGHT CONDITIONS OF CALIFORNIA

Plant invasions are widely recognized as significant threats to biodiversity conservation worldwide. They change the structure and function of ecosystems, most importantly, causing extinctions of native species. This study looked at how invasive and native plants deal with the drought conditions by studying assimilation, transpiration, plant water use, water-use efficiency, and water potential.

A portable gas exchange system (LI-6400, LI-COR Inc., Lincoln, Nebraska, USA) and a steady state porometer were used to measure the maximum rates of net photosynthesis, stomatal conductance to water vapor, and water-use efficiency in two different shrub species. To measure water potential, a pressure chamber was used.

It was found that a California native plant, that is known to thrive in dry conditions, has lower water-use efficiency than an invasive plant. Therefore, the reason for invasive plants to drive out the native plant is because of the wise use of water. Even though the native plant has a greater rate of assimilation and transpiration, they grow faster and they show late senescence. Their higher water potential also indicates that that they have more water available in their leaves. A better understanding of the invasive plant can allow for better management and control of these invasions.

This study showed that when invasive plants and native plants live side by side each other, water would not be a limiting factor for the invasive species. In addition, invasive species can possible increase our need for water because they do not take up as much water as a native plant, but the risks beyond keeping an exotic plant is far too great.

CHEMISTRY

HS-26
HO, Wesley
Computer Science
2008/2009

ANALYSIS OF BROWNIAN MOTION USING IMAGE CORRELATION TECHNIQUE

This project presents an improved method to observe and analyze the random motion of particles undergoing two dimensional Brownian motion.

This technique utilizes computer image processing which is used quickly and efficiently to analyze videos of the randomly moving particles. It is much more efficient than previous similar studies which required manual processing of the video that was not only time consuming but also inaccurate. This experiment attempted to prove the hypothesis that the average drift of milk fats cells increases with temperature to verify that the image processing technique is efficient.

After utilizing the new improved technique, the slopes of the averaged drift of milk fats cells was compared. It was found that the average drift of milk fasts cells behaved as predicted in the hypothesis.

This technique can be a valuable tool for the study of this fundamental process. Future research could be conducted on writing a more sophisticated program that analyzes three dimensional Brownian motion.

HS-27
HSIEH, Emmelyn
Chemistry
2008/2009

COMPARISONS OF D-GLUCOSE AND D-FRUCTOSE LEVELS IN CONSUMER PRODUCTS

This project is investigating the correlation between fructose and glucose levels and the listed carbohydrate levels in various consumer products. The experiment was constructed to measure the levels of fructose and glucose in frequently consumed products, and was aimed at discovering the true carbohydrate levels in products claiming to be "sugar free" or to withhold "zero calories". This project was ultimately designed to give the population an idea of how daily diets should be regulated and to help people realize the ways they are impacting their body and health through their eating habits.

Several samples of consumer products such as juices and energy drinks were analyzed with tandem gas chromatography-mass spectrometry (GC/MS). Assays were conducted for samples with and without prior hydrolysis treatment. Assuming that all glucose and fructose in the samples originated from sucrose and/or high fructose corn syrup, the hydrolysis reaction promoted dissociation of the disaccharides and/or oligosaccharides into the two monosaccharides of interest, allowing quantification of all available glucose and fructose in the sample. A linear standard curve was prepared and utilized to determine the quantity of glucose and fructose based on the GC/MS intensity ratio of the monosaccharide and its respective internal standard.

This report presents the glucose and fructose concentration of various consumer products. When the hydrolysis step was omitted prior to analysis, the sugar levels were in the range of the listed values in the nutrition label of each product. All samples showed significantly higher fructose and glucose content when all sucrose was completely hydrolyzed prior to analysis.

HS-28
LEE, Justin J.
Chemistry
2008/2009

PROTECTING *APIUM GRAVEOLENS* FROM FROST USING PROPYLENE GLYCOL SOLUTIONS

All farmers and gardeners, professionals and hobbyists alike, face one common fear-- the coming of the frost. With the ability to induce catastrophic consequences on farms and gardens, people have developed common ways to protect their plants by using physical coverings. This project attempts to take the protection method further by developing a chemical solution using propylene glycol, an environmentally-safe antifreeze, which will be sprayed onto celery plants (apium graveolens) prior to being freezed.

The project requires the chemical propylene glycol and distilled water, as well as the celery in form of 15 potted plants. The project was done in three trials, with five plants used in each trial. Using graduated cylinders, 0%, 5%, 10%, 20%, and 50% solutions of propylene glycol were made. Each solution was then sprayed onto each potted plant using a spray bottle. The five potted plants were then placed into a fridge with a temperature gauge; in the first trial, the temperature was set to 30 degrees Fahrenheit; in the second trial, 20 degrees; in the third trial, 10 degrees.

It was found that the propylene glycol solutions offered frost protection to some degree, with the higher concentration (by mass) solutions offering better protection. The first trial resulted in all five plants surviving the 30 degree temperature. The second trial resulted in only two plants surviving the 20 degree temperature; the two plants were sprayed with 20% and 50% solutions, respectively. The third trial resulted in only the plant sprayed with 50% solution surviving the 10 degree temperature.

The findings in the experiment showed that the 50% solution of propylene glycol offered the best protection for celery in freezing temperatures.

HS-29
LIN, Kristopher J.
Chemistry
2008/2009

TOWARDS THE OPTICAL DETECTION OF FLU VIRUSES USING NANOISLAND FILMS

The purpose of this study was to demonstrate the sensor properties of gold nanoisland films and their capabilities in detecting various biomolecular interactions. The molecular interaction studied in this project was between biotin and avidin. The bonding between these two molecules is known to be a strong protein-ligand interaction. Successful detection of this interaction would be a promising advancement towards the detection of *Influenza*.

The gold nanoisland films were constructed using plain glass slides, where the –OH functional groups were first replaced with thiol (-SH) groups followed by subsequent attachment of gold nanoparticles (~ 2.0 nm). The slides underwent a layer-by-layer assembly using a polymer carrying amino groups sandwiched between coatings of gold nanoparticles. The multilayered slides were then heated at 625ºC, which caused the surface layers of functionalized gold nanoparticles to soften and disperse into hemispherical clusters called nanoislands. The nanoisland films were then submerged in a biotin solution, enabling biotin molecules to attach to the surfaces of the films. The biotin-coated films then became a sensor for avidin, and were placed in avidin solution for the detection process.

UV-vis spectroscopy was used to measure the absorbance of the nanoisland films before and after the treatment of avidin for comparison. The absorbance values were plotted on a graph versus the wavelength range of 400 – 900 nm, which served as a gauge of the electron resonance acting upon the nanoisland surface. The results showed that significant increases in the absorbances of the films took place after their immersion in the avidin solution, concluding that the optical properties of the films changed after interaction with avidin. Therefore, the detection of the biotin-avidin interaction was concluded successful at a concentration as low as 1000 ppm.

Gold nanoisland films prepared in this work are especially versatile in that the various molecules exposed to them are able to attach to the surface of the films, by means of selecting the functional groups extending from the nanoislands. These films can be constructed with specificity to allow interaction with the target molecules for detection. This study depicted the enormous potential as to offer straightforward, effective, clean and industry-friendly detectors in the future.

HS-30
TABATABAIEPUR, Sogole
Chemistry
2008/2009

DETECTION OF RADON GAS LEVELS THROUGHOUT PALOS VERDES PENINSULA HIGH SCHOOL

This science research project was constructed to determine radon gas levels at Palos Verdes Peninsula High School. Radon gas is the second leading cause of lung cancer and also increases the risks of other related health issues such as lymphoma, respiratory diseases, coronary heart disease, and cerebral vascular disease, etc. The fact remains that radon concentrations in areas of Palos Verdes are above average. If radon levels at Peninsula High School too high, many people in the community would risk their well being by coming to school. This specific study was completed to ensure that radon concentrations at Palos Verdes Peninsula High School were safe for students and staff.

Short-term activated charcoal radon detectors were placed in 43 various rooms around Palos Verdes Peninsula High School at 3:30 on Friday, February 20th, 2009 and the starting time, date, and location were recorded. The measurements were conducted according to the *Indoor Radon and Radon Decay Product Measurement Device Protocols* published by the EPA. After approximately 48 hours, the end time and date was recorded and the detectors were collected, placed in airtight aluminum bags, and mailed to Alpha Energy Laboratories in Texas for analysis.

After receiving the data report from the lab via e-mail, it was found that all locations tested had levels safely below 4.0 pCi/L, between 0.0 pCi/L and 2.0 pCi/L, and that the mode of concentrations was below 0.5 pCi/L, or undetectable.

Although all radon levels were below 4.0 pCi/L, it can be concluded that the M-buildings have much lower radon levels than those of the H- and S-buildings. It can also be concluded that rooms on the first floor generally have greater radon levels that those on the second floor.

HS-31
Yuen, Ella
CHEMISTRY
2008/2009

LEAD DETERMINATION IN SUNSCREEN

Products containing zinc oxide have been shown to also contain lead. The objective of this experiment was to test for lead in commercially available sunscreen samples containing zinc oxide. If lead was detectable, the concentration of it was to be detected. This experiment also entailed finding an adequate procedure to test for lead in sunscreen.

Three different brands of sunscreen were used in this experiment. Nitric acid was used to put the samples through a vigorous acid digestion. This process separated insoluble organic substances that would have been bound to lead and would have interfered with the graphite furnace reading. The samples were filtered after going through the acid digestion. An atomic absorption with a graphite furnace was used to determine the concentration of lead in the samples.

The results of the experiment showed that there was lead in sunscreen. This level, however, was quite minimal compared to other products containing lead. It was found that the sunscreen sample with a greater amount of zinc oxide also had more lead.

It was proved that zinc oxide sunscreen does in fact contain lead. Since lead is known to be harmful to humans and other living systems, some might want to avoid sunscreens that contain zinc oxide.

COMPUTER SCIENCE

HS-32
Shuhee Kim
Computer Science
2008/2009

COMPUTER SIMULATION OF MIGRATION PATH OF ANCIENT NATIVE AMERICANS INTO NORTH AMERICA

The migration path of the ancient Native Americans has long been a much sought for, yet abstract concept. The present method of determining the ancient Native Americans' migration route into North America relies heavily upon the discoveries of fossils and other ancient artifacts that scientists can use to locate the assumed settlements of ancient Native American tribes. The object of this project is to create an accurate and realistic computer simulation of the migration path of the ancient Native Americans to aide researchers in determining the location of ancient Native American settlements and tribes, and to possibly use the data acquired from this program to draw evolutionary assumptions of ancient humans.

The migration path is simulated using inputted data, which are the factors of living conditions, such as land formations and climate, which must have played a significant role in the migration of ancient Native Americans. The inputted data are then translated in the program into configurable values which are used to set the parameters of the harshness of living conditions. The migration is realistically portrayed, significantly affected by the migration hindrances (mountain ranges, etc), which further enhances the accuracy of the simulated migration path.

The accuracy of the resulting simulated migration path was determined by comparing the computer generated migration path with the migration path determined by professional researchers using paleontological and archaeological information. The simulation proved highly compatible, and it could ultimately become a major source of data and reference for researchers in the future.

HS-33
LOW Melvin
Computer Science
2008/2009

HUMAN DETECTION IN THERMOGRAPHIC IMAGES

Human detection is a recent topic in science that is rapidly getting the interest of many researchers. Currently, human detection is accurate but needs improvement. For example, it has not been applied extensively to images taken with thermographic cameras, and cannot work smoothly on moving film. This engineering goal of this project was to help improve human detection in thermographic images by creating a program able to detect human figures in such images.

The program currently uses only color gradients to help determine where a human might be in a picture. It scans the image and looks for pixels which meet specific requirements. For example, pixels that are around other pixels of similar color are noted down. Pixels which have a color darker than the picture's average color are also noted down. To test the program, the program was executed on several images, some of which I created and others from the internet. The majority of the images selected had a single, clear target figure for the program to detect.

In the images where there was a single target figure, the program was able to detect the figure without a problem. However, the program had trouble detecting figures in images where multiple target figures existed. In addition, the program, because it currently works only by examining color gradients, does not have a way to tell the difference between a human and another object.

This project is a work in progress. Based on previous studies, analyzing color alone is a start in human detection, but may not be adequate. However, with continued work and revising, the program should become more accurate.

HS-34
Nguyen, Perry
Computer Science
2008/2009

OPTIMAL INPUT METHODS FOR ACCURACY AND PRECISION THROUGH TRAINING

This project took five different computer input devices and compared them in accuracy, precision, and speed out of these five peripheral devices: graphics pen tablet, optical mouse, keyboard, Wii® Remote, and the Wii® Remote's “nunchuk” analog stick. The project concluded with the end result being the optical mouse. The goal of this research project was to determine which of the five devices listed was the optimal device to use based off of the three measurements previously mentioned.

A testing script was written in Python to collect raw input data from the input devices. 400 sets of data were collected from 20 high school students during this experiment. The test process consisted of centering the cursor, having the target appear randomly, and clicking the center of the circle. The script recorded the distance from the user's click to the center of the target, as well as the time it took for the user to click.

The data showed that the mouse was faster and more accurate than any of the other devices. The keyboard was accurate but the slowest, the Wii® Remote and the pen tablet are similar, and the joystick was average.

The original hypothesis was that devices with the most direct control would be most easily influenced by the user. The graphics pen tablet was the device which the test subject was believed to have the most control; because it was overshadowed by the mouse, it is believed that the lack of experience is a key factor.

HS-35
ZHANG, Andrew
Computer Science
2008/2009

AN EXTERNAL SORT PROGRAM USING A COMBINATION OF MAGNETIC STORAGE AND SOLID STATE STORAGE

The world's information is stored into many large databases, which increase inside as more information is gained. To make the information in databases easy to access, the information must be sorted. When new information is entered into the database, the database must be sorted again. External sorting is used for sorting files containing a large amount of information. Therefore, a faster external sorting program is needed.

The new technology of a solid state drive would help in making a faster external sort program. The solid state drive stores material electronically, so it is faster than the hard drive. However, it cannot store as much. The hard drive would send information to the solid state storage and the main memory would receive information from the solid state drive. This would enhance the speed of the sorting, because accessing information from the hard disk is very slow.

Two external sort programs were created, one program using solid state storage and one program without it. When the amount of information needed to be sorted was a low amount, the solid state storage would not prove to be efficient. However, as the amount of information increased from twenty five million numbers to sixty two point five million numbers, the solid state storage proved to be more efficient; the sort program with the solid state storage was fifty seconds faster than the sort program without solid state.

If the amount of information was increased to a normal scale used in computer databases, the amount of time saved would enormous. Therefore, solid state storage should be used in external sort programs.

EARTH AND SPACE SCIENCE

HS-36
Kelly-Slatten, Kayla
Environmental Science
2008/2009

HOW HUMAN POPULATION GROWTH AFFECTS HUMIDITY LEVELS IN SOUTHERN CALIFORNIA

To better understand how the human population affects the desert region, I enlarged last year's project to include many common Southern Californian cities. The reason I only incorporated Southern California and not the entire "Sunshine State" is simply because the desert is identified to be in the southern region. However, the main motive for completing this type of research study remains the same as the previous year: I wish to bring the consequences of human actions into easy grasp for everyone. Climate change and global warming are not someone's problems, they are everyone's problems and they need to be taken seriously and dealt with on a global level.

For this type of data collection, there were no set procedures or methods followed. The order taken to compile and analyze the data was purely for organization purposes and commenced with choosing the cities of research and collecting population numbers. Air temperatures and dew point figures were then found and the relative humidity calculated from an online source. While doing most of this on the Internet, charts were completed by hand to hold the information collected. This, in the end, made it easier to compare human population to relative humidity and form a conclusion based on the data.

The cities that I tested—Thermal, Los Angeles, Needles, Bakersfield, San Luis Obispo, and Fresno—generally had an increase in population over the testing period, 1975 to 2005. With this, came a rise in relative humidity levels in all cities except for S.L.O. and Fresno. At first, the calculations seemed wrong, but as I did a bit more research, I concluded that both cities are among the top most environmentally aware in the Southern Californian region. As for the other four test cites, they have a ways to go before they reach a sustainable and environmentally friendly lifestyle that will satisfy the desert region in which we live and provide comfort to the ever-growing human population.

ENGINEERING

HS-38
FISCHER, Eric
ENGINEERING
2008/2009

MECHANICAL EXFOLIATION AND CHARACTERIZATION OF GRAPHENE VIA RAMAN SPECTROSCOPY

Graphene, a one-atom-thick planar sheet of carbon atoms arranged in a honeycomb crystal lattice, has the ideal properties to be an excellent component of integrated circuits, but must be mechanically exfoliated onto a substrate and characterized using Raman spectroscopy prior to any implementation into future devices. By reliably identifying certain mechanically exfoliated graphene samples as single layer or bilayer, the samples can be utilized in the fabrication of novel quantum devices.

To mechanically exfoliate graphene onto a silicon dioxide substrate, layers of graphite were cleaved onto the full length of a piece of tape, which was then applied to a substrate and removed slowly to maximize graphite/graphene deposition. A raster scan was performed with an optical microscope to find graphene flakes, and pictures were taken to record the location of the graphene flakes. Graphene flakes were then characterized with a Renishaw Ramascope.

The full width at half-maximum of the single layer suspect sample was recorded to be 24.3 cm^{-1}, confirming it was indeed single layer graphene. The full width at half-maximum of the bilayer suspect sample was recorded to be 50.9 cm^{-1}, confirming it was indeed bilayer graphene. The full width at half-maximum of the multilayer suspect sample was recorded to be 69.7 cm^{-1}, confirming it was indeed multilayer graphene.

The photon-phonon interactions during Raman spectroscopy resulted in energy shifts (in units of cm^{-1} of the photons from the laser) that can be used as "fingerprints" for the particular material investigated. Characterized graphene samples can now be used to engineer new devices in nanotechnology, such as graphene-based transistors. Carbon electronics will hopefully become the successor to silicon electronics and the solution to Moore's law, which has predicted a bottleneck effect for the continued scaling of transistors.

HS-40
PARK, Woo Jin (Kevin)
Engineering
2008/2009

ISOLATION SOLUTION

The purpose of this research was to find a new design of base isolator. A roller and a set of springs were combined to serve as a new isolator. The performance of spring-roller isolator was to be compared to that of spring isolator. The experiment is significant because favorable results can contribute to saving the lives and reduce the property damage done by earthquakes.

The performance of each isolator was determined by measuring the lateral displacements. As the earthquake simulation was conducted for ten second per trial, the pen attached to each building marked the displacements on the graph papers. Also the times in which the buildings took to stop moving after the simulation were measured to determine their ability to recover.

The average left side lateral displacements for the spring-roller isolator and spring isolator were 4.32cm and 5.52cm respectively. The spring-roller isolator averaged 2.18cm and the spring isolator averaged 5.78cm for the right side lateral displacement. Finally, the spring-roller isolator and the spring isolator respectively recorded the average of 31.332 seconds and 69.142 seconds for the recovery time.

The results showed that the spring-roller isolator could dissipate seismic waves better than the spring isolator. The new isolator allowed the building to sway with stability and control unlike the spring isolator. It also provided the ability to recover fast.

HS-41
Bunnag, Brandea
Hong, Kimberly
Environmental Science
2008/2009

ANALYSIS OF LOCAL WATER FOR TRIHALOMETHANES

This project was conducted in order to discover if a high number of trihalomethanes was found in drinking water and swimming pool water in local areas. The initial idea was to determine if high levels of chloroform, bromoform, and bromodichloromethane appeared in the local water areas. This was further determined by the close analysis of the differing trihalomethanes using a Gas Chromatography/Mass Spectrometry (GC/MS).

A variety of fourteen water samples was collected from various locations throughout the neighborhood, which included drinking fountains from parks and school swimming pools. Each swimming pool was tested with an "Aquacheck Pool and Spa Test Strip" to test the pH, alkalinity, and free chlorine. Then, water samples were collected with capped 20mL amber glass vials. The samples were then taken to the Urban Water Research Center at UCI. Calculation standards were then made to see how much of each water sample and how much pentane was needed for each Ultra-Scientific Lot CE-0434 5mL vial. A computer connected to the gas chromatography/mass spectrometry was then used to program all the samples into the machine. The vials for each sample were then inserted to a wide ring called the injection port. The GC/MS then took control by taking automatic injections of each sample and analyzing the different compounds found in the samples. The results then appeared on a computer.

It was found that there were no detectable results of trihalomethanes in any of the samples. The only high level of any compound was the pentane that was used previously to prepare the standards. All the levels of chloroform, bromoform, and bromodichloromethane were low, or not there at all.

The contribution of this experimentation is beneficial. It is seen from the results of the local water samples that the local areas are safe without any harmful trihalomethanes. Therefore, it has been demonstrated that the highlights in which the water was taken from is in healthy condition.

HS-42
CHAN, Michele
Environmental Science
Year 2008/2009

THE EFFECTS OF NATURAL RESOURCES ON WATER PHOSPHATE REDUCTION TO MINIMIZE EUTROPHICATION

Eutrophication, a severe water pollution problem affecting marshes, lakes, and reservoirs, is a worldwide challenge in many areas. It results in algal blooms clogging water intakes, growth of slims, unsightly shorelines, and deoxygenation causing the diminution and fatality of public waters habitats. Eutrophication can be minimized by limiting phosphorous and nitrogen in the water through costly chemical procedure. The purpose of this study is to demonstrate the comparative effectiveness of removal of inorganic phosphate from water by natural resources such as seashells, and/or plants to reduce the rate of Eutrophication.

The procedure used in this research include the addition of crushed seashells (phosphate precipitates) and the addition of 1-inch cuttings of mule fat (Barcharis salicifolia) to bottles of distilled water dosed with 0.6mg/L part of phosphate. The hypothesis of this research is that the natural materials applied to the dosed water will be effective in the removal of dissolved phosphate in the water.

The results of this study demonstrate that the addition of crushed seashells to phosphate dosed distilled water significantly reduce the amount of dissolved sodium orthophosphate after on month of containment. Surprisingly, the results of adding mule fat cuttings to distilled water for the same amount of time increased the quantity of inorganic phosphate by a factor of 3 rather than decreased as indicated in the literatures. Therefore, the methodology of this experiment needs reexamination. The results of the experiment that were determined by the use of colorimeter, were in close agreement with the samples professional analyzed by Associated Laboratories, in Orange, California.

In conclusion, the hypothesis is supported by research literatures that dissolving of seashells is complex due to an organic matrix, called conchiolin, binds the layers of calcium carbonate crystals that make up the shell. It is reasonable to predict that the use of a turbidemeter would reveal the presence (by percent loss of light transmission) of a small amount of

suspended precipitate (calcium phosphate) in the seashell experiment. The hypothesis has been confirmed, but correction of methodology for the mule fat cuttings may require revision.

HS-43
CHEN, Lawrence
ENVIRONMENTAL SCIENCE
2008/2008

WINTER SEASON NET PRIMARY PRODUCTIVITY IN MADRONA MARSH CREEK AND EAST SUMP WATER

In today's exponentially increasing population, there has yet to be a permanent solution for maintaining a balance between human expansion and environmental harmony. With knowledge of the primary productivity, the efficiency by which plants generate nutrients from inorganic sources, of an ecosystem, naturalists can assess the relative biodiversity of the environment, and thus, address the necessary measures to be carried out. Many leading causes have been discovered to have impacts on the primary productivity; however, the effects of pollutants, such as detergent and car exhaust, on primary productivity have not yet been analyzed.

For the reason of convenience, a small-scale experiment at the Madrona Marsh Preserve was conducted to reflect on other possible polluted environments with similar conditions. In order to measure primary productivity, the standard Winkler method for dissolved oxygen was used on two sites in the Madrona Marsh: the Creek and East Sump, where sewage and urban runoff flows through. The Gram stain procedure was also carried out.

Low collected dissolved oxygen results imply the photosynthetic rate, production of oxygen gas, fell far below the rate of cellular respiration, which was due to numbers of bacteria detected in both the Creek and E. Sump. The trophic state was found to be hypereutrophic, a state in which little or no organisms can survive.

On a larger scale, the results of the experiment show how small pollutants can make primary productivity. Under such conditions, an environment proves virtually uninhabitable and a pool for disease.

ENVIRONMENTAL SCIENCE

HS-44
CHEN, Monica
Environmental Science
2008/2009

ELUCIDATION OF BACTERICIDAL EFFECTS INCURRED BY *MORINGA OLEIFERA* AND CHITOSAN

Water contamination, which plagues the human race with 80% of all diseases, remains a recurring hazard worldwide. Although a myriad of advanced water treatment techniques are rapidly developing, many of these systems require immense financial support and occasionally harm the environment with polluting effluent. The aim of this investigation is to elucidate the potential of two natural and nontoxic antimicrobial agents, *Moringa oleifera* and chitosan, for use in rural areas chronically plagued with polluted water.

The first part of this study involved ascertaining optimum conditions for bactericidal activity incurred by both *Moringa oleifera* and chitosan. Several *Moringa oleifera* and chitosan solutions were prepared in a range of pH and ionic strength that modeled actual aquatic environment conditions. Additionally, two bacterial strains were tested, the Gram-negative *Pseudomonas putida*, and the Gram-positive *Bacillus subtilis*. A high-throughput bactericidal assay was then developed and optimal conditions were obtained.

In Part II of this investigation, a high-throughput bactericidal assay of a combined solution of both *Moringa oleifera* and chitosan was carried out. A novel disinfectant, the combination of both antibacterial agents was evaluated for antimicrobial efficacy in comparison to bactericidal activity of the antibacterial agents separately. Solutions of *Moringa oleifera* and chitosan were dissolved together at ratio of 10:1, respectively. The treated water was conditioned to mimic realistic water conditions.

This study resulted in the following significant findings. First, an increase in concentration of disinfectants appeared to promote antibacterial activity especially with the *Pseudomonas putida* Gram-negative bacterial strain. Secondly, an increase in ionic strength decreased bactericidal activity attributable to the lower solubility of the antimicrobial agents in solution. Additionally, solutions at extreme pH levels were shown to result in low ratios of live to dead bacteria due to the acidic or basic

nature of the solution, not from the bactericidal effects of the antimicrobial agents. Finally, the novel disinfectant consisting of both *Moringa oleifera* and chitosan, despite demonstrating consistent bactericidal activity, was not significantly greater in efficacy compared to the *Moringa oleifera* and chitosan solutions on their own.

HS-46
McCLOUD, Sierra
ENVIRONMENTAL SCIENCE
2008/2009

CONSERVATION OF ELECTRICITY EMISSION IN THE HOUSEHOLD

The average family spends about 2,000 dollars a year on electricity, which definitely puts stress on millions of families. For this reason, many don't realize the effects of electrical conservation. The objective of this experiment was to determine how much money can be saved through simple procedure of daily controlling the amount of light used. Over a time period of three months during the fall/winter seasons, it resulted that a family of five has tremendous impact on how much electricity can be preserved even after multiple violations. It was hypothesized that a large amount of money would be saved just through simple technique.

Last year's electricity emission data charts were collected from Edison International as the control group. Precautions were taken every day from December until the month of February. Each member of the family was told to use as little light as possible. They were instructed to keep lights off when not in use and to stray away from electrical overuse. Every night the computers were turned off and only the outside lights remained on for residential safety. The monthly electricity bills were collected and charted in order to determine the money saved from the conservation months compared to last year's months at the same time. Even during strict monitor, violations were still made.

The results confirmed the hypothesis made; the monthly electrical bills dropped drastically every month as well as the wattage emission. More than 10% of electricity emitted every day and each month was conserved. Violations made were evident in conclusion; however, the conservation significantly lowered bill costs compared to previous years' data

It was concluded that by simply reducing the amount of light used every day, not only is electricity being preserved, but money as well, even after several violations.

HS-47
McCULLOH, Casey
Environmental Sciences
2008/2009

DETERMINING THE TRANSFER OF ARSENIC FROM CHROMATED COPPER ARSENATE-TREATED WOOD TO SURROUNDING SOIL

The purpose of this experiment was to find the relationship by means of transport between the arsenic concentrations in a CCA-treated post and in the soil surrounding the post. Internal and surface samples were taken from the post to find where on the post the arsenic was being leeched from, if it was being leeched at all.

Internal samples were taken by drilling into the post at a distant, proximal, and intermediate point above the insertion point of the post into the soil. External samples were wood shavings from the surface of the wood and were taken from the same locations the internal samples were taken from. Three soil samples were taken close to the post, all at different depths. Father from the post two more were taken, and a soil constant sample was taken as well to determine the background levels in the area. Then all 12 samples were subjected to a Hach Arsenic Test Kit and their arsenic (As) concentrations were determined.

Treated samples showed arsenic levels in the post to be highest at the top and lowest in the middle, internally and on the surface as well. For the soil samples, as distance and depth decreased, the arsenic concentration increased.

Since the arsenic concentration of the post was higher at the top than at the bottom, it is possible to conclude that the arsenic is leeched from the base of the post, from the surface and from the inside as well.

HS-48
PALOSAARI, Andrew
Environmental Engineering
2008/2009

ULTRAFILTRATION MEMBRANE COAGULANT OPTIMIZATION AND FLUX REDUCTION

Urban vernal marshes are "islands of wilderness within a city." Due to the fact that urban vernal marshes dry up in late summer and are located in populated areas, contaminants such as pesticides, pharmaceuticals, personal care products, bacteria, and viruses are a significant problem. When pollution levels are particularly high, membrane-based water treatment processes could be applied. This study investigated flux (flow rate) decline and the effect of various aluminum sulfate coagulation dosages on two ultrafiltration membranes (UF-200kDa and UF-70kDa) as a pretreatment for a standby nanofiltration (NF) water treatment system.

Flux was determined by collecting weight measurements of the permeate at constant intervals, using a new experimental pressurization procedure. Flux was normalized by temperature, pressure, and clean membrane flux with distilled water. In addition, a new application of pore blocking laws with cleaning over multiple runs was used to identify periods of cake filtration.

Results show that aluminum sulfate is a suitable primary coagulant for UF membranes. The optimal 50-mg/L coagulant dosage should be decreased to 15-mg/L over the rainy season. However, coagulation is not needed as a pretreatment of UF membranes since, even without coagulation, final permeate flux is within industry standards. In addition, the higher resistant UF-70kDa membrane is less affected by fouling due to its easily reversible cake filtration blocking mechanism.

This bench-scale study shows that a membrane-based water treatment system for urban vernal marsh ecosystems could incorporate UF-70kDa membranes as a pretreatment for a NF system.

HS-49
Portiz, Trevor
Environmental Science
2008/2009

DETERMINING THE QUALITY OF RECYCLED WATER IN GOLF COURSES

Today, water quality has become a high priority in large part because the issues are more complex and money set aside for water quality monitoring is becoming scarce. Although tests are made for public water quality, very rarely is the water in golf course ponds and lakes tested. Especially since golf courses use irrigation systems to reuse the water they import from local water districts.This poses a threat to the safety of avid golfers and the surrounding communities worldwide. The goal of this project was to determine the levels of Coliform Bacteria, Ammonia, Nitrates, Nitrites, and the pH of four golf courses in Southern California and to see whether the presence or absence of an irrigation system had an effect on the water quality as well. The courses were Los Verdes Golf Course, Harbor Park Golf Course, Heartwell Golf Course, and Palos Verdes Country Club.

To test for the pH, Ammonia, Nitrates, and Nitrites, a water test kit was used. However, to test for Coliform, a laboratory test was used in order to assure accuracy and proper handling of the equipment and samples. When collecting the water samples, proper precautions were used to ensure the safety of the individual with the use of sterile plastic gloves and sample bottles. After water collection, a five mL water sample was poured into test tubes, and the specified amounts of test solution for Ammonia, Nitrates, Nitrites and pH were added to each test tube. The testing for Coliform was conducted by professionally trained scientists in their laboratories.

After testing, the results showed that all of the water samples had very similar levels of Ammonia, Nitrates, Nitrites and pH. All of the samples contained much less that the limit proposed by the Environmental Protection Agency. The results from Coliform showed that Heartwell Golf Course and Harbor Golf Course contained levels of Coliform way above the limit set by the EPA of 10000 mg/L, with 24000 and 13000, respectively. Palos Verdes Country Club had 5200 Coliforms and Los Verdes had 85 Coliforms per 100mL of sample water.

The outcome of this experiment produced results that were not expected. Although the presence of irrigation systems did have an effect on the Coliform count in the courses with irrigation systems (Heartwell, Harbor, Palos Verdes), the levels of the other substances were comparatively indifferent from each other. With the increased numbers of Coliform bacteria in the reused water of golf courses, golfers and residents alike have an increased risk of receive potentially deadly strains of viruses and bacteria.

HS-50
SAVANT, Neha
Environmental Science
2008/2009

GALLONS OF H_2O AND MONEY SAVED BY IMPLEMENTING SIMPLE H_2O CONSERVING METHODS

Water is one of the most important substances for human life. The human population will keep on increasing, yet the amount of water on Earth will always stay constant. California, specifically Southern California, is famous for having water problems because of its large and growing population and lack of precipitation. Therefore to get more water, the citizens of California must conserve water. The goal in this experiment was to see how much water and money one family in Rolling Hills could save if simple water saving habits were incorporated into their daily routines and to apply it to different populations.

The family of three was told to save water whenever they could during the four month experimental period : when washing dishes, hair, vegetables, etc. the water was to be turned off when not in use, the sprinklers was to be off whenever possible, and when water is turned on, it was to be on the lowest pressure. Each month, the water meter was read, and was reported by the water bill from the California Service Water Service Company.

After the results were received, the number of gallons of water and money spent from the four months was added and divided by three and four to find the amounts per person per month. These results supported the initial hypothesis which stated that at least seven hundred gallons and two dollars a month would be saved. These monthly totals were then applied to the population of Rolling Hills Estates, Los Angeles County and California to see how much money and water could be saved in one year.

With these outcomes and applications, California alone can save more than a trillion gallons of water and more than a million gallons of water each year. Therefore, a large amount of water can be saved if populations take a conscious effort to save water. If these results are presented to the public, such an impact can be made that they would want to conserve water for the future.

HS-51
SHARIFIAN, Shahab
Environmental Science
2008/2009

THE EFFECTIVENESS OF BIODEGRADABLE SURFACTANTS ON PETROLEUM MICELLE MICROEMULSIONS

This project in its present form is the result of bioassay experimentation on the effects of biodegradable surfactants on light crude oil. The initial idea was to determine if biodegradable surfactants could reduce the detrimental effects of oil in the case of an oil spill. Some success with dispersants and burning eventually led to the use of chemicals in disintegrating light crude oil, which, in turn, led to the use of biodegradable surfactants as the test substance.

Effectiveness was determined by means of observing the test tubes daily for any light crude oil remains over the span of seven days, and then subsequently putting the test tubes through an organics analysis to view the composition at a particulate level. Ski Wax, Fabric Softener, All-Purpose Cleaner, and Detergent, all of which were biodegradable, were used as the test agents. Disintegration was measured in terms of a decrease in the amount of light crude oil left in the test tube, and later through the organics analysis. Salinity, temperature and four biodegradable surfactants were tested. The effective salinity was found last year to be 0.03544 grams of salt per milliliter of water. The effective biodegradable surfactant was found to be Ski Wax, which disintegrated 99.7% of the light crude oil in the test tube.

Anomalies in the results raised the suspicion that the temperature was affecting the results. In addition, the lack of results from the Detergent brought to attention the dynamic results during the first days of testing that slowed to minimal changes throughout the rest of the experiment. Fabric Softener dissolved 86% of the light crude oil, while All-Purpose Cleaner disintegrated 67%. Lastly, Detergent disintegrated 45%. The contributions of this project are three-fold. First, oil spills can now be treated with biodegradable surfactants, as all tested surfactants showed progress in disintegrating light crude oil. Secondly, recovery and response times will be more efficient if treatment involves the usage of biodegradable surfactants. Thirdly, the benefits of the disintegration of light crude oil by biodegradable surfactants were demonstrated.

HS-52
TSAI, Michael
Environmental Science
2008/2009

THE EFFECT OF NITRIFYING BACTERIA ON *GLAUCOCYSTIS SPP.* DURING EUTROPHICATION

A method to prevent cyanobacterial blooms can protect a freshwater environment from the toxicity that cyanobacteria produce. Many methods of killing algae and cyanobacteria have been formulated. However, algae killers contain a complex dichloride chemical, which is harmful to plants and animals. Therefore, a more natural method of preventing cyanobacterial growth during a period of eutriphication is necessary to protect a freshwater environment.

The experiment was conducting by mimicking a freshwater environment with cyanobacteria and nitrate and phosphate nutrients to simulate eutrophication. Glaucocystis was used as the cyanobacteria and was placed in freshwater containers containing nitrate and phosphate nutrients. Plant bulbs were used to imitate sunlight periods. Samples were tested for nitrate/nitrogen levels and for chlorophyll absorbance. Chlorophyll absorbance was used as an indirect measurement for the amount of cyanobacteria through biomass. After one week of growth, nitrifying bacteria in the form of Biozyme was added. It was hypothesized that the nitrifying bacteria would lower nitrate/nitrogen levels, and with no nitrate nutrients the amount of *Glaucocystis spp.* would also decrease.

The results disproved the hypothesis. The lowering of nitrate/nitrogen levels did not affect the amounts of cyanobacteria. Instead, chlorophyll absorbance steadily increased even though nitrate/nitrogen levels had reached 0 parts per million.

In conclusion, the decrease in nitrate/nitrogen levels using nitrifying bacteria did not inhibit the growth of *Glaucocystis spp.* during a period of eutrophication. Other factors of growth, such as phosphate, carbon dioxide, and light, are enough to cause the cyanobacteria to continue growing.

HS-53
WATTS, Nicole
Environmental Science
2008/2009

MACROCYSTIS PYRIFERA AND EGREGIA LAEVIGATA; METAL DETOXIFICATION AGENTS

Seaweed has been the subject of study for hundreds of years. This ocean algea has many medicinal uses and this experiment tested its ability to absorb copper. A stock solution was prepared using copper (II) chloride and distilled water. The percent transmittance of dilutions of the stock solution was measured on a spectrophotometer and then flasks of the stock solution were made with two seaweeds, *Macrocystis pyrifera* and *Egregia laevigata*. After two days the percent transmittance was measured again and seaweed in powder form was found to absorb the largest amount of copper. Five more flasks were set up for both of the seaweeds containing different measurements of the powdered seaweed. There was a direct correlation between the increased amount of seaweed and the increased amount of copper absorption.

MEDICINE AND HEALTH

HS-55
Batacchi, Lucrezia
Medicine & Health
2008/2009

Fingerprint Patterns Inheritance

Fingerprints of 15 different families were taken with black ink on index cards. Index cards were labeled and organized into folders. All the fingerprints were then analyzed to find a pattern of inheritance between family members. The fingerprint pattern appears to be determined by 3 genes, which, combined together, cover all the possible fingerprint patterns. Epistasis also occurs to determine the fingerprint pattern.

HS-56
CHOO, Hyun Woo (June)
Medicine & Health
2008/2009

INFRARED HEAT TREATMENT REDUCES FOOD INTAKE AND INCREASES PRO-OPIOMELANOCORTIN EXPRESSION IN THE MEDIAL NUCLEUS TRACTUS SOLITARIUS OF OBESE PRONE RATS

In this study, we examined the effects of infrared heat treatment on food intake, blood glucose, body weight, and the expression of Pro-opiomelanocortin (POMC) in the brainstem of male Obese Prone (OP-CD) rats compared to age-matched (7 weeks) Obese Resistant (OR-CD) rats. Heat was performed twice (separated by an 80 min interval) each day for 5-6 days by exposing the whole body of the rat to an infrared lamp at 40-42°C. Food intake was monitored daily in conscious rats before and after the treatment. At the end of treatment, the rats were transcardially perfused with 4% paraformaldehyde. Sections of rat medulla were cut, and the brain nuclei were visualized by immunolabeling with a polyclonal antibody directed against POMC. Micrographs were quantified using a microscope with reticule grid to measure the number of positive cells in the medulla nuclei.

Though no effects were noted on body weight or blood glucose level, the food intake of OP-CD treated rats was attenuated and eventually matched that of the OR-CD rats at the end of 5 days. The food intake of OP-CD treated rats showed progressive The number of POMC immunostaining neurons were significantly increased in the medial nucleus tractus solitarius (mNTS) regions of rats that received the treatment. The results show that food intake is decreased while POMC expression is increased in the mNTS by infrared heat in OP-CD rats. We conclude that infrared heat treatment produces an increased expression of POMC in the dorsal medulla nuclei, which repressed the feeding behavior induced by the therapy.

HS-57
Daniel Doo
Medicine and Health Sciences
2008/2009

The Difference Between the Diastolic and Systolic Volumes of the Heart

This project is the result of comparing two different myocardial volumes of the diastolic and systolic phases of the heart. These two values of the volumes were compared to see if there were any significant differences between them. Also, if there was a wide gap between the ranges of the values, an average percent difference of the volumes was to be found.

The diastolic and systolic volumes were found through a program called TeraRecon, which recognized the phases of the heart. The majority of the subjects that were analyzed were males. Approximately 5 of the 20 human subjects were female and the rest were male. Each phase of the heart was analyzed and data was recorded.

Unlike hypothesized, it was found that there were no differences between the myocardial volumes of the systolic and diastolic phases of the heart. The ratio of these two volumes was close to a 1:1 ratio. When plotted, the resulting plots were

fairly close to one another indicating that the values were similar. When the data for male and female subjects was compared, the trend was similar: the diastolic volume equated the systolic volume.

Through this project two things were discovered. First, the volumes of the diastolic and systolic volumes of the heart were alike to one another, contradicting what was predicted. Secondly, it was observed that there was no particular difference between the male and female subjects. Both genders exhibited similar trends within the values of the volumes.

HS-58
Fausto, Charles
Medicine and Health
2008/2009

Vision Therapy (VT): Measuring Prescription Percent Improvement Among Visually Impaired Patients Undergoing VT

While there are many quick fix procedures open to the general public, such as Lasik Eye Surgery, Visual Therapy is an available branch of alternative medicine for the visually impaired. My hypothesis proposes that vision therapy will increase eyesight performance and specifically decrease impairment by at least 30% in less than four months. Data was collected from fourteen visual therapy patients of three local licensed visual therapists. The status of the patient was determined by his or her certified visual therapist, while I analyzed the data obtained. The research is limited, for the data does not account for certain variables, such as age variations or different types of eye diseases a patient might have (such as glaucoma). General analyses of percent eyesight improvement can still be drawn from the fourteen subjects. Based on my calculations, the visual impairments of the subjects averaged a prescription decrease of 41.38% over a span of three months.

HS-59
FONG, Jennifer
MEDICINE & HEALTH
2008/2009

CONTINUATION RATES OF IUDS IN FAMILY PLANNING CLINIC SERVING INDIGENT WOMEN: A RETROSPECTIVE CHART REVIEW

The intrauterine device (IUD) is used by approximately 176 million women worldwide (1) and is the most common form of reversible contraception. In the United States, two highly effective types of IUDs are available: the Copper T380A (ParaGuard, Duramed Pharmaceuticals, Inc., Cincinnati, Ohio) and the levonorgestrel intrauterine system (Mirena, Berlex Inc., Montbille, New Jersey). Both IUDs work primarily by preventing sperm from fertilizing ova (4). The copperT380A causes an increase in copper ions, enzymes, prostaglandins, and white blood cells (macrophages) in uterine and tubal fluids which impair sperm function and prevent fertilization. The levonorgestrel intrauterine system may have an array of contraceptive actions, including thickening the cervical mucus, inhibiting sperm function and survival, and suppressing the endometrium (4).

Both of the intrauterine contraceptives available in the United States rank in the top tier of contraceptive effectiveness (4). Even more, IUDs are long-lasting, convenient, cost-effective and protective against ectopic pregnancy compared to other forms of birth control. Several previous studies of continuation rates of IUD patients have resulted in high continuation rates ranging from 55.3%-96% (7). However, these studies may be limited in application to the Harbor UCLA Family Planning Clinic population due to several factors including population ethnicity and free services. These free services are not restricted in method in that patients can request any type of contraceptive method free of charge. At a clinic where all services and contraceptive methods are offered free of charge, what is the continuation rate of IUD patients?

To investigate this question, a retrospective chart review of all women who had IUDs placed at the Women's Health Care Clinic at the Los Angeles Biomedical Research Institute at Harbor-UCLA Medical Center was done. The 764 charts included patients whose IUD's were placed between January 1, 2005 to December 31, 2007. Most women were in the age group 25-35 years old. 28% of the study population had prior IUD use. The most common reason for request of removal was bleeding in the first six months and the same after the first year. Twelve months after the patients had an IUD placed, the overall continuation rate was 69.6%.

Similar studies for this same population have been done using other types of contraception: condoms, hormones and Depot Medroxyprogestrone Acetate (DMPA). However, the IUD continuation rate proves significantly more effective. This information is extremely applicable especially in today's society where pregnancy prevention is a key public health issue.

HS-61
Kim, Katherine
Medicine 7 Health
2008/2009

CTHU DIFFERENCE IN PATIENTS VARYING BODY SIZE BY THE MEASUREMENT OF THE PHANTOM

The objective is to determine the importance of body size relative to the spine Phantom in Computed Tomography (CT) scans for the diagnosing of diseases. This study focused on the use the software program N-VIVO to provide quantifiable data of the Phantom in CT scans in Hounsfield Units (HU), a measurement of the attenuated x-ray. Previous studies involving CT scans to diagnose spine diseases neglected body size of the patients when analyzing data. The analysis of this study attempted to verify that there is a positive correlation between Spine Phantom CTHU and body size.

For this study, Spine CT scans of 203 patients were collected. The Phantom CTHU was collected from T1-L5 for each patient along with each patient's weight, height, and Body Surface Area (BSA). The three types of body measurements were then each compared to the phantom measurements. Each comparison was graphed on a scatter plot to determine the r value for correlation.

By using the data collected, the r value was determined to be 0.4419 for BSA versus mean CTHU, 0.3171 for Height versus mean CTHU, and 0.7088 for weight versus mean CTHU. These results indicated that there was a strong correlation for BSA and weight with mean spine HU but not a significantly strong correlation between mean spine HU and height. The results of this study support the initial hypothesis that a positive r value exists between the mean HU and all three types of body size measurements. The results of this study indicate the importance of the Phantom for diagnosing diseases when analyzing CT images. The contributions of this study can be utilized for future research in improving CT image analysis and better diagnosis by doctors by taking into consideration the patient's body weight and BSA.

HS-62
KWAN, Jessica Ya-Yun
Medicine and Health
2008/2009

ANALYSIS OF THE DIAMETER OF THE ASCENDING AORTA (AAOD) AND THE CORRELATION OF CORONARY CALCIFICATION IN PATIENTS OF 50 TO 59 YEARS OF AGE

Most cardiovascular diseases occur because of atherosclerosis, or the blockage of coronary arteries through calcification. The conventional method of revealing cardiovascular disease is by calculating the amount of coronary calcification. Another method is measuring the AAOD and comparing it to a standardized value for a particular age. In this project, it was determined whether or not there is a direct correlation between the size of the AAOD and the amount of coronary calcification in the cardiovascular system.

The project attempted to verify that there would be a correlation between the AAOD and amount of coronary calcification. Moreover, there would be a significant difference between patients with abnormal and normal levels of calcification. For this project, the Cardiac Computerized Tomography (CT) scans of 997 patients (282 female and 715 male) were collected. The patients had to be between the ages of 50 to 59 years of age. The scans were selected only if the ascending aorta could be clearly identified. Each patient's AAOD was measured, and the amount of coronary calcification was also calculated. After both numbers were recorded, the data was first stultified by gender, then by age.

From the analysis, it was determined that there is a correlation between the AAOD and amount of calcification. However, the results of the study weakly supported the initial hypothesis. The correlation was not constant throughout the 50 to 59 years of age range. Moreover, gender was an apparent factor in determining correlation because females had a higher correlation rate than the males did.

Since a significant correlation was found, the AAOD may be directly used as an indicator of cardiovascular disease. The analysis provided useful information that could help to maximize the information provided by CT scans, and the AAOD can provide another test for cardiovascular disease when coronary calcification fails.

HS-63
KWAN, Stephanie
Medicine & Health
2008/2009

Development of a Cell-Based Assay for *Diabetes Mellitus* Drug Discovery

8% of the American population has diabetes. These 23.6 million people must constantly monitor their blood sugar level to insure that they will not suffer from high blood sugar (hyperglycemia) because their bodies either lack insulin or do not respond to insulin.

A majority of diabetes patients must inject themselves with insulin to moderate blood sugar. However, this treatment is inadequate because of the wide range of factors affecting blood sugar levels.

Thus, it has been proposed to use human embryonic stem cells (hESCs) differentiated into pancreatic endocrine beta like cells as a platform for diabetes drug screening.

An ideal 20 embryoid body (EB) plating density for primary screening was determined by scaling down the 6-well culture format to 24 and 48-well format. Also, a 2.4 kb fragment of the insulin promoter gene was successfully isolated by Polymerase Chain Reaction (PCR) and will be subcloned into a red fluorescent protein (RFP)-containing vector to generate the necessary hESC reporter line.

Aims include:

1) Generating a hESC reporter line transgenic for insulin promoter driven red fluorescent protein expression
2) Adapting hESCs to pancreatic lineage culture and primary screening of small molecules for increased insulin signals
3) Secondary screening of positive "hit" compounds for specific properties

HS-64
Levenson, Joseph
Medicine and Health
2008-2009

Perception Response Evaluation Test as a Gauge to the Sensitivity in Decline in Cognitive Function in Alzheimer's Patients

Is the perception Response Evaluation test (PRE) more sensitive to decline in cognitive function in Alzheimer's patients than the traditional Alzheimer's Disease Assessment Scale test (ADAS)? The data to be analyzed in the current project will include participants' scores on the computerized Alzheimer's Disease Assessment Scale (ADAS) and the reaction time (RT) measures from the Perception Response Evaluation (PRE) on CMINDS. These data will be compared for longitudinal trends across a study period of roughly 12 months in duration. Specifically, the experimental hypothesis that RT-based test variables *will* provide more sensitive measures of decline in overall cognitive functions than will the ADAS will be tested by comparing the slopes of these respective measures across time. In order to reject the null hypothesis that the two measures *do not* actually differ in terms of sensitivity to decline, it will be necessary to identify whether there are indeed statistically significant ($p<0.05$) differences in the change in these measures across time. Data compared across the 12 months of the study period will include total ADAS scores and the following variables from the PRE: mean, median, and standard deviation of the RT from the three task conditions (Simple Nonverbal, Simple Verbal, and Reversed Verbal). The tables containing these data will be extracted from the CMINDS SQL database in which they were originally stored and exported to a Microsoft Access database for ease of collation. The relevant data variables will then be combined on a single spreadsheet using a query from the various test tables and then saved in Excel. Statistical analyses will be conducted using SPSS (Version 15). Statistical tests will include a 2 X 4 (test X time) repeated-measures analysis of variance (ANOVA) to compare overall changes across the duration of the study between the ADAS scores and each variable from the PRE (separately for each). Comparisons between the variables will also be conducted using the Pearson's products-moment coefficient to examine whether the variables are correlated. Additional analyses may also include paired-samples t-tests using the data collected at assessment sessions 2, 3, and 4, relative to baseline (percent change) in order to further a=examine differences between the ADAS and the RT-based variables.

HS-65
LODHIE Kaval
Medicine & Health
2008/2009

EFFECTS OF LIGHT-EMITTING DIODES ON HAIR GROWTH

This study compares the effects of light-emitting diodes on hair growth on a 22-year old, as well as on a 65-year old. Products such as Rogaine which are sold in stores can cost up to thirty dollars a bottle which can last only a month at most, while light-emitting diodes can last for years without replacement, with a one time cost. Different frequencies of light determine each color in the spectrum, so there are only certain colors of light which are effective in stimulating cells for healing or growth in the body. Light-emitting diodes break down the frequencies into only the ones that are necessary. The results of this experiment can determine whether saving time, energy, and money will just as effectively increase hair growth and stimulation.

A panel was plated with red light-emitting diodes, to create a hairbrush. There were two different subjects, a 22-year old, and a 65-year old, and both were told to use the brush. The subjects used the hairbrush approximately two times a week, for five minutes a day, for about three months. Throughout the process, pictures were taken monthly to see the progress in hair growth, as well as qualitative data such as texture of the hair.

It was found that the hair growth of subject number 1 showed a very small but still significant amount of hair growth over a period of three months. The texture slightly improved, becoming softer and healthier-looking. The hair of subject number 2, however, showed no improvement whatsoever, providing no change in texture as well.

In conclusion, the light-emitting diode hairbrush proved to be an effective method for subject 1, a 22-year old, for growing back hair and improving its condition and health. This provides an alternate method for hair growth in young men, while avoiding spending large sums of money on products that may or may not be effective. These results showed that choosing light-emitting diodes would be a smarter choice to grow healthier hair and save money all at once.

HS-66
MARSHALL, Frank
Medicine and Health
2008/2009

ACCESSING THE CORRELATION BETWEEN SLEEP AND BLOOD PRESSURE LEVELS

This experiment sought to determine whether or not people who routinely receive fewer then seven hours of sleep per night have a higher chance of having hypertension. My hypothesis stated that those subjects that receive 6 or fewer hours of sleep per night will have a significantly higher chance of having hypertension or prehypertension if these sleep habits have occurred for five continuous years or more.

The experiment consisted of 15 adults between the ages of 25 and 55. The subjects were told to take 2 blood pressure (BP) tests within 8 AM-10 AM and to take two more tests within 72 hours, again between 8-10. The test subjects were then instructed to answer about 22 questions related to their sleep habits and BP levels. The 4 BP tests were averaged and the average was considered to be the closest number to that person's usual blood pressure level. This information, along with the questionnaire determined whether the subject showed a relationship between sleep habits and BP levels.

Line graphs for systolic BP and diastolic BP determined whether the data supported the hypothesis. Hours of sleep were the x-coordinate.

The results didn't support the hypothesis, as there was no definitive relationship between BP and sleep deprivation. The lack of a definitive relationship is most likely due to individual lifestyle differences between subjects and/or the time the blood pressure test were taken. Prior medical conditions were another possible factor and a small sample size made all of these variables more apparent.

HS-69
OKUDA, Reina
Medicine and Health Science
2008-2009

WORSENING OF DIABETIC RETINOPATHY ON EUGLYCEMIC CONTROL IN TYPE 2 DIABETES

The objective of this research was to determine the effects of a dramatic improvement of glycemic control on retinal disease in patients with poorly controlled type 2 diabetes. In patients with established type 2 diabetes, the early effects of tightening glucose control on macrovascular and microvascular disease are still uncertain.

This was performed with a retrospective study of patients with type 2 diabetes in a public hospital setting, who had undergone annual retinal imaging as part of a case management program or standard care. Patients in both groups were included if they met criteria of at least two retinal images more than one year apart, and at least three A1C measurements, two of which were within $\pm$ 3-month window surrounding each image. Retinal images were reviewed by an independent reader and graded according to a modified Scottish Diabetic Retinopathy grading scheme. Patients who participated in case management with a decrease in A1C>1% (n=34) were compared with a group of randomly chosen patients (n=34, out of 160 who met criteria) whose A1C changed $\leq$ 1.5% during the follow-up period.

The results indicated that patients were followed for a man of approximately 25 months in each group. The results of retinal grading revealed a + 0.7 $\pm$ 0.25 unit mean change from baseline in retinal grade in the intensive group (p=0.015), a 22.6% worsening (p=0.02 vs. control group), with no significant change in the standard-control group over the same time period (0.03 $\pm$ 0.14 units, p=NS).

Significant worsening in diabetic retinopathy occurred in very poorly controlled patients with type 2 diabetes who had an intensification of their blood glucose control that resulted in dramatic change in A1C. Marked reduction in blood glucose levels should be considered carefully in patients with high starting A1C and long duration of diabetes.

HS-70
TU, Ang
Medicine & Health
2008/2009

FINDING THE BASELINE HUMAN ANTI-RALS3P-N IGG AND IGG SUBCLASS ANTIBODY TITERS BY ELISA

The high mortality rate and frequency of disseminated candidiasis has garnered attention and support to developing a vaccine against the bloodstream infection. Current effort on the vaccine has focused on the proteins of the ALS family, namely Als3p (rAls3p-N), from *Candida albicans*. The purpose of this investigation is to develop ELISA assays that can be used to track vaccine-induced immune response to the rAls3p-N protein in future clinical trials, to determine the normal, pre-existing antibody titers against the protein in humans, and to determine if the titers of total IgG and IgG subclasses correlate with one another.

In this study, ELISA assays were conducted to determine the anti-rAls3-N antibodies titers of the IgG and IgG subclass isotypes in 13 healthy donors. Different anti-human secondary antibodies were used to detect different antibody types. The Mann Whitney test was used to determine the distribution difference of different antibody assays.

High antibody titers against rAls3p-N were found in the human donors. The most prominent IgG subtype was IgG3. IgG3 titer also makes up the largest portion of total IgG titer in general. However, high variability was observed among the donors. There is no evidence of correlation between the titers of different antibody type.

According to the results, baseline antibody titers against the rAls3p-N exist in humans. Future assays should be calibrated to accommodate the high and variable titers. There is no correlation among the titers of IgG subclasses and overall IgG titers.

HS-71
WU, Helena (Hao)
Health Science
2008/2009

EFFECTS OF ALCOHOL CONSUMPTION ON LEFT VENTRICULAR FUNCTION AND CALCIFICATION

The purpose of this research was to obtain an accurate comparison of cardiac functions of patients who consume alcohol and those who do not. Alcohol is a highly toxic substance and when ingested frequently, can cause health complications that are characterized by changes in volume, mass, and ejection fraction of the left ventricle. Previous techniques for achieving measurements of the heart relied on echocardiography (ultrasound). This study focuses on the use of Computed Tomography (CT) for precisely determining differences between non-alcoholic and alcoholic hearts.

340 patients (79% Males, 61% consume 1-3 alcoholic drinks per day) who underwent thoracic CT protocol were selected for analysis. Patients with previous history of cardiovascular disease were excluded from the study. Images were analyzed on the GE Advantage Workstation 4.4 and 4.6. The ejection fraction, volume and mass of the left ventricle were calculated with the software program titled Reformat. Calcification of the coronary arteries was measured using the Calcium Score function. *T*-tests were performed and histograms were constructed for statistical analysis.

The data collected from the patient population revealed differences between non-alcoholic and alcoholic hearts. Results indicated that the left ventricles of alcoholic patients were larger in volume, higher in mass, and lower in ejection fraction, compared to non-alcoholic patients. Calcification was also higher in patients who regularly consume alcohol.

It was concluded that CT scans validated the results from echocardiography and provide a more in-depth understanding of the exact correlation between alcohol and heart health. The measurements can be utilized as a standard of comparison to detect abnormalities in volume, mass, ejection fraction, and calcification of the heart, which can be the first signs of alcohol related diseases such as cardiomyopathy and myocardial infarction. These guidelines can assist doctors in making early and noninvasive diagnosis of heart disease.

HS-72
YU, Kyeong-Ri (Katherine)
Medicine & Health Sciences
2008/2009

Correlation between Coronary Artery Calcification and Bone Mineral Density

Everyone ages, no matter how much people want to deny it. And as they age, their body slowly deteriorates. It has been long confirmed that advancement of age is associated with increasing values of CAC, or Coronary Artery Calcification, and with BMD, Bone Mineral Density. Osteoporosis and atherosclerosis, two of the most common diseases seen in elderly, are caused by low BMD and high CAC, respectively. It is not too uncommon to observe patients suffering from both diseases at same time.

In this study, patients' CAC and BMD were analyzed to find any possible correlation to one another, as they both share a common factor: age. 1436 females and 2379 males were involved in this research. Each patient was recorded age, gender, race and their total Coronary Artery Calcium score and Bone Mineral Density value of the thoracic cavities 8 through 11. Statistical analysis was performed to find the correlation between age and CAC, between age and BMD, and between CAC and BMD.

The results showed that there were definite correlations between age and CAC, between age and BMD, and between CAC and BMD. Although it is entirely possible that the CAC was not directly associated with BMD but indirectly by the common factor of aging, the statistical analysis showed that there is certainly a correlation between the two conditions.

The analysis not only reaffirmed that aging does play an important role in atherosclerosis and osteoporosis, but also shone a light on the possibility of how low BMD can contribute to high CAC.

MICROBIOLOGY

HS-73
NGUYEN, Lauren
MICROBIOLOGY
2008/2009

LEAF AGE AS A RISK FACTOR IN CONTAMINATION OF SPINACH WITH ESCHERICHIA COLI

Food contamination and public health safety are major issues in America today. Each year, thousands of people suffer diagnosed food poisoning; many more suffer minor symptoms that go undiagnosed. Although some strains of Escherichia coli are natural to the human body, certain strains such as E. coli O175:H7 cause serious illness and even death. In 2006, a major outbreak of E. coli food poisoning was attributed to contaminated spinach. If the factors that contribute to the E. coli growth on spinach can be isolated, then it may be possible to minimize the possibility of E. coli growth in the subsequent potential food poisoning hazard. Previous research has indicated that E. coli growth is correlated with leaf age of broad leaf vegetables. If this mechanism can be understood, it may be harnessed to reduce the public's exposure to food-borne bacteria.

In this experiment, spinach leaves were categorized by age: young, middle, and old. The leaves were inoculated in an E. coli solution. Then, one leaf from each age group was cultured onto a MacConkey plate and a Hektoen Enteric plate. The plates were then examined to determine the presence and relative population of E. coli bacteria.

The results supported the hypothesis that the younger leaves have higher levels of E. coli activity than that of the older leaves. There was a general trend that as leaf age decreases, E. coli conduciveness increases. However, not all data supported this trend.

The experiment provided evidence for the ability of E. coli to multiply more on young spinach leaves more than on older spinach leaves. By knowing that younger leaves have a higher risk of hosting a deadly pathogen, better fertilizers can be made, and widespread outbreaks can be prevented.

HS-75
JAFRI, Sabeen
MICROBIOLOGY
2008/2009

THE EFFECTS OF AGING ON SYNAPTIC TRANSMISSION IN CAENORHABDITIS ELEGANS

This project was constructed to study the effect that aldicarb, a fast-acting cholinesterase inhibitor, and cholesterol had on the synaptic transmission response in three stages in the life cycle of C. Elegans. Aldicarb was used to study the rate at which it would have its paralyzing affects on C. elegans, and cholesterol was used to test whether it increased the rate of paralysis in the C. Elegans.

The first experimentation involved the experimental group of L4, Young adult, and Adult worms that had been introduced to the aldicarb. The second experiment involved a control group of C. elegans that had been introduced to aldicarb, and a second experimental group that had been introduced to both aldicarb and cholesterol. The two worm stages involved were Adults and Young adults. All the worms were periodically checked to affirm the stage of paralysis.

It was hypothesized that the younger the worms the faster they would paralyze, due to a faster synaptic response. The hypothesis yielded true when the results showed that there was a sharp increase of more paralyzed L4 worms; followed by, Young adult worms and Adult worms. In the second experiment, the cholesterol was hypothesized to increase the rate of paralysis inhibited by the aldicarb. The results yielded that there was no significant correlation in the results of worms introduced to cholesterol paralyzing faster than the worms without.This experiment has determined that age is important factor in determining the rate of the synaptic transmission response in C. elegans. The experiment has also shown that cholesterol does not have a significant affect on the rate of the synaptic transmission response in worms.

HS-76
Park, Brian
Microbiology
2008/2009

CONCENTRATION OF *ESCHERICHIA COLI* AT VARYING DEPTHS OF MADRONA MARSH SOIL

The purpose of this experiment was to detect and find the concentration of *Escherichia coli* at varying depths of soil in Madrona Marsh; this was to determine if the *E. coli* discovered originated from the fecal matter of warm-blooded organisms inhabiting the marsh or if the *E. coli* was living independently beneath the surface without a fecal envelope. In other words, the objective was to find out the durability of *E. coli* in harsher, drier conditions.

To do this task, two separate tests were utilized: a presumptive coliform test, and a test which specifically detected and enumerated *E. coli* within the soil. Soil was taken from three areas of the marsh: the finger bay, south bay, and east creek. At each of the three sites, soil was drawn, using a probe, at depths of 0-3 inches, and 3-6 inches down into the ground. A LaMotte test kit was utilized for the coliform test; this test kit comprised of test tubes containing tablets, which contained nutrients, gas-producing gel, and a pH color indicator. From each of the 6 total soil sampling areas, soil was put into a test tube and mixed with water. The tablets were added, and the test tubes were closed tight and left upright in a dark area for 24 hours. If a test tube was yellow and effervescent, then it indicated a presence of coliform; if a test tube was pink and non-effervescent, then it indicated a lack of coliform. For the specific tests, the procedures outlined in the Food and Drug Administration's Bacterial Analytical Manual (BAM) were used. The soil samples were placed in nutrient agars and incubated, to foster growth. Afterwards, the samples were diluted, placed in another agar, and incubated. The agar plates were examined under a UV light, and the most probable number (MPN) of *E. coli* was calculated using the BAM's MPN index.

The presumptive coliform tests were positive for all 6 soil samples. All 6 test tubes contained a yellow, gas-producing solution, indicating that coliform bacteria were present in the soil. The specific tests for *Escherichia coli*, however, indicated that the amount of *E. coli* in the soil was minimal; for each of the 6 samples, the MPN of *E. coli* was less than 2. Thus, *Escherichia coli* were present in the 6 soil samples, albeit in tiny amounts.

In conclusion, the findings indicate that *E. coli* is not able to manifest itself well in the soil, both at and below the surface. The minimal amounts found at the surface were most likely from fecal origin, while the trace amounts found beneath the surface layer were most likely the dead remains from *E. coli* originating from groundwater contamination; unfortunately, most of the moisture had evaporated from the soil at all depths, leaving behind only a tiny amount of surviving *Escherichia coli.*

HS-77
TANG-QUAN, David
Microbiology
2008/2009

Isolation of Kinase Mutant Genes Governing Stress Response of *Candida albicans*

In immuno-compromised patients, the fungus *Candida albicans* can enter the bloodstream, which carries it to most organs of the body. This results in disseminated candidiasis, which has a 40% mortality rate even with treatment. One reason that normal individuals do not get candidiasis is that their white blood cells and the cells that line the gastrointestinal tract secrete antimicrobial peptides. For *Candida* to colonize patients and cause disease, it must be able to withstand these antimicrobial peptides.

Building upon the previous year's research, approximately 100 strains were screened and results were further verified through additional experimentation. Besides testing strains according to standard stress test protocols, strains discovered to be hyper-susceptible were retested with a second, independent clone. Additionally, gene deletion mutants and complemented strains were acquired and tested. Finally, the kinase insertion mutants were transformed with the HIS1 gene and retested in the absence of histadine. All of these stages aided in further providing the validity of results.

Results from the screen and retesting further confirmed the validity of results as well as eliminated the probability of false positives. While PBS2 and YCK2 from the previous year's research were confirmed, HST7 was found to be a false positive by testing a second clone.

It was concluded that kinases are required for *C. albicans* to grow in the presence of antimicrobial peptides. Three members of the HOG1 kinase pathway, Ssk2, Pbs2, and Hog1, are required for antimicrobial peptide resistance in *C. albicans*.

Further research would be to explore the role of other necessary kinases, such as Yck2 and Vps34. Pharmacologists and others can use this research to develop medication that can inhibit the HOG1 kinase pathway and thereby prevent *Candida* infections.

PHYSICS

HS-78
Vikram Dhawan
Physics
2008/2009

DETECTING INAUDIBLE FREQUENCIES IN THE CLASSROOM

Cheating is a major problem in schools and colleges across America. The mosquito ring tone initially invented to repel teenagers has been transformed into a device that students can use t cheat in the classroom. This ring tone, which functions on frequencies that are inaudible to most adults over the age of 24, is used by students to send text messages during class without the teacher knowing. In order to alleviate the number of students cheating with the use of this ring tone, a device was required that could pick up the ring tone and alert an adult when it is in use. In this project a device that can pick up this ring tone and alert adults of its use has been constructed.

In order to construct such a complex device, all other frequencies except the desired frequencies must be filtered out. This is achieved by using a basic bandpass filter that must be tuned by a series of resistor and capacitors. After the frequency is filtered, a detector circuit must be built. In this case, the detector is comprised of a Light Emitting Diode that turns on when a certain number of volts is passed through it.

By triggering the LED in the presence of the mosquito ring tone, this reception device will be able to alert adults to the ring tone's use. If this device is introduced into a classroom or any academic institution for that matter, it will be very proactive in reducing the number of students using their cell phones when they are not supposed to.

HS-79
KIM, Jonathan
PHYSICS
2008-2009

DESIGN OF HIGH-FREQUENCY ULTRASOUND SYSTEM TO MANIPULATE MICROPARTICLES

The project currently is a theoretical exploration of the possibilities of microparticle manipulation by means of two or more ultrasonic transducers. The aim of this project was to design a dual-transducer system, a kind of "ultrasonic tweezers" that would be able to manipulate microparticles of size 30 μm or smaller. The project in its current stages involves two transducers facing each other and propagating two acoustic beams, which create a focal zone, or a region of heightened intensity. The focal zone created can trap small particles, which can then be moved by moving the focal zone. Applying counter forces between the two transducers would be able to move effectively the focal zone.

The project was based on computer simulations obtained through the use of the computing programs MATLAB and Field II. The files used in this project simulated the intensity of an acoustic beam at a given distance away from the transducer that emitted that beam. Therefore, the beams of two transducers facing each other in opposite directions were simulated, and the resulting intensities of the two transducers were summed up.

By simulating the two opposite-facing transducers, a small focal zone of about 40 μm was indeed obtained. The result can also be applied to more than one dimension. The current status of the system is in the first dimension, but by applying more dual-transducer systems in the z- and x- axes, a 3-D manipulation system could be attained.

ZOOLOGY

HS-80
AU, Kristin
ZOOLOGY
2008/2009

DETERMINATION OF THE OPTIMAL SUBSTRATE FOR THE *Corynactis californica*

The objective of this project was to determine the optimal substrate for the *Corynactis californica*. Three different mediums were tested in order to find what type of medium would best be suited as the optimal substrate. Discovering the optimal substrate for the *Corynactis californica* would allow greater understanding to the health of this particular organism and its relatives including the coral and the anemone.

Corynactis californica were placed in separate tanks of different substrates. These substrates included sand, gravel, and mussel shells. The optimal substrate was determined by the tank with the healthiest organisms which was defined as largest, brightest in color, and most abundant in number. In order to determine with tank held the healthiest *Corynactis californcica*, the volumes, general color and overall number were found and recorded.

The sand tank yielded the lowest final average volume with an increase of zero *Corynactis californica.* The gravel and mussel shell tank yielded approximately the same final average volumes. The gravel tank increased in four *Corynactis californica* while the mussel tank increased in three. The final color of the *Corynactis californica* in the sand tank was an almost white red, the gravel tank maroon, and the mussel shell tank bright red.

The optimal substrate for the *Corynactis californica* was determined to be mussel shells. Each tank was limited due to its sustainability rate. Sand seemed to be the most inefficient substrate due to its tendency to hinder the ability of the *Corynactis californica* to obtain food and grab hold of a stable base.

HS-82
Hanui Choi
Animal Sciences
2008 / 2009

THE EFFECT OF SUPERSATURATED OXYGEN ON THE BIOLUMINESCENCE OF *RENILLA KOELLIKERI*

The discovery of the green fluorescent protein, which is an integral part of bioluminescence, has induced much advancement in genetics and a heightened interest in bioluminescent species. This project examined the effects of supersaturated oxygen levels on the bioluminescence of *renilla koellikeri*. Since oxygen is used in the chemical reaction for bioluminescence, it can potentially increase glow levels during bioluminescence.

Specimens were divided into two groups. One group experienced normal dissolved oxygen levels prior to being stimulated, and the other group experienced significantly increased dissolved oxygen levels prior to being stimulated. Each specimen was placed in a darkroom, stimulated with a battery probe, and then photographed once with a 30 second exposure. Two batches of specimens with 12 individuals in total were tested.

Although the use of the electrical probes prompted glow from the specimens, no statistically significant differences in brightness were observed from the two groups of oxygen levels in both batches of specimens. The hypothesis was not proved because the differences in luminosity were statistically insignificant at $\alpha = 0.05$.

The inconclusive results could be due to insufficiently increased oxygen levels, insufficient exposure to increased oxygen levels prior to stimulation, or a threshold level on how much oxygen *renilla koellikeri* can take in at a time in order to bioluminesce. Another study with more samples can potentially yield more conclusive evidence and data.

HS-83
HADIDJAJA, Kevin
ZOOLOGY
2008/2009

THE EFFECTS OF IRON PARTICLES ON THE GROWTH OF NANNOCHLOROPSIS

This experiment's purpose was to determine the direct relationship between the concentration of iron in the water and the growth curve of the microalgae Nannochloropsis. The conclusions stemming from this project are extremely beneficial to aquariums who are using the algae for aquaculture because ideal concentrations of micronutrients and iron will lead to more efficient growths of the green algae.

To begin, there were a total of 8 trials conducted to ensure the validity of the projects' results. The eight trials were, however, divided into groups of two for more efficient counting and set-up. For each trial, six flasks were set up with gradually increasing concentrations of iron. The concentrations ranged from 0 (the control), 0.5, 1, 1.5, 2.0, and 2.5 mg/L. These concentrations were mixed with approximately 1 million cells of algae (approximate count using a hemacytometer).

The results at the end of the trials were inconclusive and it could not be determined that one concentration was better than the rest. Using the Anova: Single Factor test, it was found that there was not enough statistical difference between the concentrations to signal that one concentration of iron was the most beneficial.

The conclusions stemming from this experiment will aid marine biologists by acting as a basis to other experiments regarding this subject. While the results from this particular experiment were inconclusive, a similar project with different variables could unlock the key to accelerated and stable Nannochloropsis growth.

HS-84
Kim, Jung Soo
ZOOLOGY
2008/2009

ANT SURVEY ON THE PALOS VERDES REGION FOR THE POSSIBLE REINTRODUCTION OF THE PALOS VERES BLUE BUTTERFLY

The mutual interactions between ants and honeydew-producing insects (which include the Palos Verdes Butterfly, widely acknowledged as one of the world's rarest butterfly species) have been a popular subject of investigation for over 100 years; mutual interactions between lycaenid larvae and ants have a variety of benefits for larvae. In this relationship, the larva secretes honeydew from glands on the abdomen, which is consumed by attending ants.

At the focus of this situation is the Argentine Ant, a tiny dark ant native to northern Argentina, Uruguay, Paraguay, and southern Brazil. The aforementioned mutualism is assumed to involve highly co-evolved behaviors and chemical signals, and therefore may be in danger when Argentine ants replace native ants. Simply put, the presence of Argentine Ants has a negative effect on the survival possibility of the Palos Verdes Blue Butterfly and the land sites had to be carefully searched for their existence.

The two land sites that I surveyed (from the period of Dec. 2008 to Feb.2009) , both Point Vicente and Three Sisters Land Conservancy sites, had already been infested with Argentine ants. The dominance of Argentine ants reveals how drastically the ant-composition in the Palos Verdes Peninsula region has changed over the years. It also implies that the Conservancy's plan to reintroduce the Palos Verdes Blue Butterfly has now become a much more difficult mission.

HS-85
McCulloh, Kelly
ZOOLOGY
2008/2009

DETERMINING A RELATIONSHIP BETWEEN A DECAYING HAIR ROOT AND THE POSTMORTEM INTERVAL USING DIGITAL IMAGING

The current investigation is the result of the need for a more reliable technique to establish the postmortem interval of an individual. This investigation attempts to determine if the area and perimeter of a mouse's decomposing hair root is related to its time since death. Furthermore, using the hair roots photographed under the light microscope, a micrometer to pixel relationship was derived using an experimental setup.

One trial was used to get an accurate idea of how a hair root changes in size postmortem. During the trial, hairs were pulled from certain parts of the body every 2 hours for the first 24 hours after death to determine if any significant changes occur. Hairs were photographed under a light microscope and were placed in the ImageJ software. The program was calibrated using the derived μm/pixel relationship and was able to find the area and perimeter using the wand tool.

From the experiment, the hair root grew in size around the 24-hour mark. This supports the idea that after 24 hours, the outer layer of the follicle loosens and decays before the inner layer of the follicle, were the keratin has just hardened. Furthermore, a knob at the proximal end of the roots was found to appear at hour 20. Root banding was found to occur at hour 22, similar to what was found last year.

The conclusions from this experiment established two important concepts. First, the area and perimeter of a decomposing hair root were not statistically significant in determining a mouse's postmortem interval. An accurate time of death may not be able to be calculated using the data collected, only roughly estimated. Secondly, a more accurate way of determining postmortem interval would be to look at the characteristics of the root, such as root banding and proximal end clumping.

HS-86
NAKATA, Nicole
Zoology
2008/2009

THE EFFECT OF MILD DISTURBANCES ON THE GROWTH OF HYDROID *E. RAMOSUM*

This paper examines the effect that mild disturbances in environmental factors have on the growth of the hydroid *Eudendrium ramosum*. This experiment was conducted in hopes of finding the most effective way to culture the hydroid in a lab environment. It is the sole food source of the nudibranch *Flabellina iodinea*, and great supplies are needed to sustain the nudibranchs in captivity. *E. ramosum* grows slowly because it stays in its asexual polyp form and reproduces by budding. The environmental factors of flow, lighting, and temperature were manipulated here in the hopes that the hydroids would become stressed enough by the altered (or incorrect for their needs) environment that they would move into their sexual medusa phase and reproduce more quickly that way.

It appears that environmental stressors do play a part in the development of different polyps (medusal and other) on the hydroid. However, greater than stressors, particular environmental conditions dictated the development of different kinds of polyps and the growth and production of feeding polyps. It appears that the hydroid favors cold water, high flow, and darkness (as defined in this experiment) of the tested conditions.

HS-87
TAKAYANAGI, Ariel
Zoology
2008/2009

ANTS AS SYMBIOTIC PARTNERS AND HABITAT QUALITY INDICATORS FOR *GLAUCOPSYCHE LYGDAMUS PALOSVERDESENSIS*, THE PALOS VERDES BLUE BUTTERFLY

Glaucopsyche lygdamus palosverdesensis, the Palos Verdes blue butterfly, was assumed extinct for eleven years. However, since it was rediscovered in 1994 at the Defense Fuel Supply Depot, San Pedro, California, numerous studies have been done to identify the optimal habitat for the butterfly's survival. Presence or lack of ants can be used as an indicator of habitat quality. The purpose of this investigation was to find out whether a level of diversity of ant species similar to that of DFSP would be found at four potential butterfly reintroduction sites. The preserves surveyed included George F. Canyon Nature Preserve and Linden H. Chandler Preserve, two *G. L. palosverdensis* re-introduction sites and Three Sisters and Alta Vicente Reserves. The hypothesis was that the number of ant species would be significantly fewer at the four reserves that at DFSP. The presence of native species could indicate that the habitat is healthy for the *G. L. palosverdensis*, while the domination of invasive exotic species would indicate instability in the habitat. In addition, ants are known to have a symbiotic relationship with lycaenidae butterflies mainly through larvae tending by the ants. While six species, including one invasive exotic, *Linepithema humile*, and five native species, *Pogonomyrmex californicus. Messor andrei, Solenopsis xyloni, Prenolepis imparis* and *Camponotus semitestaceus*, were found at DFSP; only *L. humile* was found at Chandler, Three Sisters, Alta Vicente, and George F. Preserves. Further study should be done to determine which ant species can be good partners to help the *G. L. palosverdensis* survive.

HS-88
VAISH, Manu
ZOOLOGY
2008/2009

EFFECTS OF DDT ON THE CALCIUM CARBONATE SHELLS OF TEGULA FUNEBRALIS

The purpose of this research was to identify the impact of the pesticide Dichloro-diphenyl-trichloroethane or DDT on the shells of the Tegula Funebralis. The Tegula Funebralis are a common sea snail species that are found mostly along our coastline. They live in the intertidal zone and feed mainly off of algae. DDT was a commercial pesticide used commonly until it was found that it had adverse effects on the environment and was then outlawed in 1972.

In order to do this study, about 20 shells from three different sites were observed. The first site from which shells were collected from was White Point, a known DDT superfund. The second site was the Cabrillo Beach tide pools. This area is considered to be a safe zone. Finally the third site were the beaches along Ocean Trails, another safe spot. Once collected all of these shells were taken to Cabrillo Marine Aquarium for identification and measurements. Using a microscope and calipers, the shells were measured for their length, height, width, weight, and porosity.

From the data collected the average length of the shells from Cabrillo, White Point, and Ocean Trails respectively was: 10.53 mm, 11.35mm, and 11.58 mm. The average length of the shells was: 16.92 mm, 17.06 mm, and 16.17 mm. The average width of the inner diameter was: 1.97 mm, 2.25 mm, and 2.03 mm. The average width of the outer diameter was: 1.71 mm, 1.97 mm, and 1.97 mm. The average weight of shells was: 2.02 g, 1.18 g, and 2.53 g. In order to determine the porosity of the shells, three shells were measured from each site. From Cabrillo Beach the average amount of pores counted in a 1 mm square was: 1, .34, and .67. From Ocean Trails the average amount of pores counted in a 1 mm square was: .67, 1.67, and .67. Finally from White Point the average amount of pores counted in a 1 mm square was: 33, 15.67, and 19.34.

The conclusions that were made from this data were that DDT is increasing the porosity of these shells and decreasing the weight of these shells.