ABSTRACTS – HIGH SCHOOL 2006/2007

HS-1

Abuyounes, Deena
Behavioral & Social Sciences 2006/2007

THE EFFECT OF KLINEFELTER'S SYNDROME ON THE SOCIAL APPROACH BEHAVIORS IN MICE (YEAR 2)

The XXY chromosome arrangement is the most common sex chromosome aneuploidy in humans and occurs as frequently as 1 in 500 to 1 in 1,000 male births. Many studies have been performed to find causes of KS, but not very many have been conducted on the social behaviors caused by Klinefelter's Syndrome. An experimental XXY mouse model which exhibits symptoms close to human KS has been developed to use in experiments. The experiment would observe social interactions and gender preferences in XXY mice and may lead to further findings in this field.

Fourteen adult XY and XXY male mice were studied and video recorded. An apparatus of three equal chambers was assembled. The test mouse could choose to enter any of the three chambers. Each testing took place in three 3-10 minute stages. For each of the three types of recordings, the first timed segment was a habituation process. In the second timed segment, either a stranger mouse was introduced to the left chamber and a stranger mouse, of opposite gender, to the right (from camera's perspective), or different male and female odors were introduced. In the last timed segment, either a stranger object replaced the stranger mouse on the left, or a different odor was introduced. Two observers blind to the karyotypes of the test mice observed the tapes and recorded the number of entries into each chamber, the time spent in each chamber, and the sniffing of each stranger object.

XXY mice compared with XY mice spent more time initially in the chamber containing a male mouse but subsequently spent less time in the chamber that contained the female mouse. In addition, the XXY mice spent more time in the chamber containing a male mouse odor than a female mouse odor. The XXY mice also exhibited significantly reduced sniffing behavior to the stranger object. After testosterone implantation, the differences between the behaviors of the XXY mice and XY mice were greatly reduced.

The social interactions of XXY mice with stranger mice are affected by the latter's gender (a difference not seen in XY mice). This data suggest a role for the X chromosome, or X-inactivation, in gender preference. In addition, testosterone has a large affect on the behaviors displayed in the XXY mice.

HS-2

AMIDI, Omid
BEHAVIOR & SOCIAL SCIENCES 2006/2007

REACTION TIME WHEN DISTRACTED

Accident on the road happen every day, most of them happen because of the distraction the driver have to go through while driving. The biggest distraction to a driver these days would be a cell phone conversation while they are driving. While driving, a human has to focus on the

task of driving and scanning the road, because the minute they stop they are vulnerable to an accident.

By using a computer program, it is easy to figure the reaction time of any human being. The program used in this experiment is named Reaction Time V 3.0. Using a basic reaction activity it is able to figure the reaction time of the human subject who is using it. This program will be used to show the reaction time between a person who is taking the test while distracted and while they are not.

After having twenty five participants finish this experiment, it was perfectly clear that there is at least a 0.08 second gap between someone who is distracted and someone who is not distracted. On the road, calculations show that by missing the road for 0.08 seconds while going forty-five miles per hour, a human being misses 100 to 200 feet of the road, making them unable to maneuver their car fast enough if an accident were to happen.

This experiment shows that people should not drive and talk on the cell phone. It is deadly because the driver cannot react fast enough. This subject should be researched more.

HS-3

Kim, Michelle

BEHAVIORAL AND SOCIAL SCIENCES, 2006/2007

CORRELATION BETWEEN GENDER, MUSICAL EXPERIENCE, AND RELATIVE PITCH

This project is its present form is the result the correlation between gender, musical experience, and relative pitch. The initial idea was to determine if girls, regardless of their musical experience, would have better relative pitch than boys do. With lots of practice, musicians can identify intervals between notes that they hear, which is said to having relative pitch. Relative pitch is the skill used by singers to correctly sing a melody, following musical notation. The results would help prove whether there is indeed a correlation between gender, musical experience, and relative pitch. Furthermore, the results would also help prove that non-musicians are capable of obtaining relative pitch too.

A hundred high school students were tests to see if there was indeed a significant association between gender, musical experience, and relative pitch. The individuals were divided into four groups: boys with musical experience, boys with musical experience, girls with musical experience, and girls without musical experience. All subjects had to sing a 4-note sequence (G F# Eb Bb) individually because if the subjects were all tested at once, then the ones that are in the back of the line would have already mastered the pitches due to repetition, so each subject was be tested individually, in a quiet room or area. The subjects were also asked if they had sung on pitch. Results were based on the subject's ability to sing the 4-note sequence correctly or incorrectly.

Interestingly, the boys had performed better on the tests, subjugating the results of the girls. Therefore, the results of the experiment not only refuted the hypothesis, but presented an opposite outcome. However, the consummation of the experiment can certainly conclude that musicians have better pitch than non-musicians.

The explanation of the results could not be justified because more testing is required. The possible explanations of the results were supposed that relative pitch is able to be learned or that it is inherited from parents. With the research and experimenting completed, it seems as though that relative pitch is mostly learned, rather than inherited. Thus, the experiment supported that there was definitely a correlation between gender, musical experience, and relative pitch.

HS-4

LIANG, Elizabeth
BEHAVIORAL & SOCIAL SCIENCES 2006/2007

OBSERVATIONAL LEARNING ABILITIES OF *OCTOPUS BIMACULOIDES* BY PEG-LOCK OBSTACLE

The purpose of this research project was to further understand the learning capacity of an octopus through progressively more complex tasks.

A peg-lock type puzzle was used as the obstacle as the octopus was taught through observational learning how to operate the lock. The lock was attached to a clear, plastic door from which the camera like eyes of the octopus could easily see through. The door did not completely seal off the tank, allowing small openings from which the water could easily pass through. The octopus went through periods of interaction, where modeling was performed. Prawn and crabs were used as a stimulus during each trial. With the small openings between the door and wall, the water was allowed to carry the scent of the stimulus and to the octopus, which is an olfactory hunter.

Twelve trials were committed to this experiment, a few successful but are suspected to be mere flukes. Three of the twelve trials required handicaps to avoid starvation.

This experiment ended with a lot of open variables. If given more time, it could be possible for the octopus to learn how to operate the lock within its lifetime. The possibility for success could be raised if alternate routes of attaining its meal did not occur.

HS-5

WOO, Elizabeth
Behavioral Sciences 2006/2007

SOUTH BAY'S ATTITUDE TOWARD RECLAIMED WATER: THE WATER CRISIS IS REAL. ARE WE PREPARED?

As clean water becomes scarcer in Southern California, cities analyze the different uses for potable water and the priority of each use. Reclaimed water has been introduced as a suitable substitute for native plant irrigation and this study expands on the results of a two-year project analyzing the effects of reclaimed water on *Eriogonum Parvifolium* and *Isomeris arborea*. This project accumulates findings from a previous environmental study and delves into the behavioral aspects of implementing reclaimed water into the South Bay community. This year, validation for the previous experiment was desired, along with observations and discoveries on the affect a freshwater substitute had on the people.

While the environmental studies were completed at the Madrona Marsh Nature Center in Torrance, California, behavioral aspects were analyzed through an anonymous environmental survey. The questions included "true or false", "multiple choice", and "order of importance questions" which could determine both the attitude of the audience towards reclaimed water and the general background knowledge of the public. After having the questionnaire carefully edited for optimally relevant information, it was distributed to hundreds of people from three differing categories: high school students enrolled in Advanced Placement Environmental Studies, Advanced Placement high school students without Environmental course, and adults from universities and throughout the community. The results were then analyzed with support from a knowledgeable university professor.

Overall the results were representative and an accurate reflection of what I had predicted. The graphs represent the different responses to survey questions according to educational background, enrollment in environmental science, and gender. Although some noticeable differences were distinguished among the different groups, the overall the attitude towards reclaimed water was consistent throughout the groups. A primary concern, same across all the groups, was that reclaimed water would not harm the overall health of individuals. Simultaneously, the cost of using reclaimed water when necessary was not as was of lower importance and the amount of bacteria was surprisingly lower than the cost. All three groups had the same percentage of people who answered the survey questions correctly regarding the current uses of reclaimed water. Many people, however, did not know accurately about the current uses of reclaimed water in the South Bay area. Definitely not an optimal number of people were informed.

Ultimately this study provides insight on how informed our community is about reclaimed water and in what areas the people would most likely cooperate when the time comes to conserving freshwater and using reclaimed water as a substitute. Currently a biology professor from CSU Dominguez Hills and University of California-Riverside is studying uses of reclaimed water and along with her students, wants to know about how aware our community is regarding uses of reclaimed water. With her study and this one collectively we hope for an arrangement that the majority of the community will acknowledge.

HS-7

HONG, Jackie
Biochemistry 2006/2007

DIFFERENTIATION OF MOUSE EMBRYONIC STEM CELLS INTO ENDOTHELIAL CELLS FOR TISSUE ENGINEERING

This project in its present form is the result of experimentation on different variable and their effects on differentiation of mouse embryonic stem cells into endothelial cells for tissue engineering. The idea was to determine what variables are needed to maximize differentiation of these embryonic stem cells into endothelial cells using VEGF-A and VEGF-C. Both VEGF-A and VEGF-C, however, led to the developing of blood vessels. No endothelial cells were made. If either protein led to the development of endothelial cells, then further experimentation would have been done to get the most amplified endothelial cells.

The data was examined and collected with the se of the Hanging-Drop method and staining using both VEGF-A and VEGF-C. to compare the effect of VEGF-A and VEGF-C on differentiation into lymphatic lineage, CD31 was used as marker. Using the Hanging-Drop method, mouse embryonic stem cells were aggregated into EB, embryoid bodies. These EB were put into a 12 well plate coated with collagen and put aside for 2 weeks. The outgrowth of the EB cells were all differentiated cells and the outgrowth was determined to be either endothelial or another type of cell.

To assess the role of VEGF-A and VEGF-C on the embryoid body, the results from the microscope were assessed. By qualitative observations, VEGF-A and VEGF-C had longer blood vessel-like structures. By quantitative observations, both VEGF-A and VEGF-C were more abundant in number. Because CD31 is known to be a marker for both lymphatic and blood cells, Prox-1 was used since it is a marker for lymphatic cells and not for blood cells. The C-31 blood vessels were made but did not overlap with Prox-1 for VGEF treatment nor the control. Although

VEGF-A and VEGF-C made better blood vessels, both did not show any promotion of lymphatic lineage in differentiation.

The fact that VEGF-A and VEGF-C makes blood vessels and not lymphatic tissues is a remarkable fact. Understanding the VEGF-A and VEGF-C and its effects on differentiating cells can open many possibilities to the field of stem cell research.

HS-8

Jones, Megan
Chemistry 2006/2007

EFFECTS OF VARYING CONCENTRATIONS OF MAGNESIUM NITRATE ON THE HEART RATE OF DAPHNIA

The purpose of this research was to test how magnesium nitrate will affect the heart rate of daphnia. From this experiment, it was hypothesized that jar # 5 which contained the most Magnesium Nitrate would cause daphnia to have the most heart beats per minute. Six jars were set-up and labeled with one control jar and the others labeled jars one through five. The control jar consisted of a pure marsh water sample with no added Magnesium Nitrate. The other five jars contain the same amount of marsh water with an added amount of Magnesium Nitrate. Jar # 1 consisted of 0.1 grams of Magnesium Nitrate; Jar # 2 consisted of 0.5 grams of Magnesium Nitrate; Jar # 3 consisted of 1.0 grams of Magnesium Nitrate; Jar # 4 consisted of 1.5 grams of Magnesium Nitrate; Jar # 5 consisted of 2.0 grams of Magnesium Nitrate. (Appendix #1) Ten daphnia were added to each jar and the heart rate of one of the daphnia in each jar was tested on days 3, 6, 9, and 12. Contrary to the hypothesis, Jar # 5 which consisted of the most Magnesium Nitrate did not cause the daphnia's heart to beat faster but more slowly. It was observed that the Daphnia in the control jar which contained no magnesium nitrate was the fastest.

HS-9

OJHA, Vijay
Biochemistry 2006/2007

DOES BLOCKING MYOSTATIN EXPRESSION STIMULATE SMOOTH MUSCLE GROWTH

Smooth muscle relaxation is central to erectile function. Loss of smooth muscle due to aging, diabetes, nerve damage, and other conditions is commonly seen. Increasing the number of smooth muscle cells within the corpora cavernosa of the penis could be beneficial and possibly reverse erectile dysfunction. None of the current pharmaceutical drugs to treat erectile dysfunction such as sildenafil, vardenafil, and levitra are designed to increase the number of smooth muscle cells in the penis.

There is an interest in examining whether a small growth factor called myostatin is important in the penis. Myostatin has previously been found to control skeletal muscle cell growth by keeping them in check (1). When myostatin is blocked from functioning, skeletal muscle mass increases (1,2). I hypothesize that myostatin may play a similar role in smooth muscle.

Mice that express myostatin (control) and mice that have been genetically engineered to have a deletion of the myostatin gene (myostatin KO or 'knock-out') were used. Tissue sections from rat penile shafts were previously collected and frozen. mRNA expression for myostatin and smooth muscle markers were evaluated for 3 month old control and myostatin KO mice by quantitative real time polymerase chain reaction (RT-PCR) (n=5/group).

In the study of the four smooth muscle markers tested, three increased in the myostatin KO mice compared to the control mice. ASMA increased by 30%, CSRP1 by over two fold, and SMMHC by nearly 3 fold. Another smooth muscle marker, SMTN, actually decreased by 50%. The SMTN mRNA level was found to be very low, at limit of detectability by the real time RT-PCR assay. This may explain why it appears to decrease.

In conclusion mRNA specifically expressed in smooth muscle tissue was found to increase in the myostatin KO rats. This suggests that myostatin may also control the amount of smooth muscle in addition to its known role in regulating skeletal muscle. In regards to the smooth muscle of the penis, this research suggests that drugs or gene therapy that block the expression of myostatin could be used to increase the number of smooth muscle cells and thereby prevent erectile dysfunction.

HS-10

PARK, Evelyn
Biochemistry 2006/2007

ZINC INHIBITION OF TFIIB AND RAP30 AUTO-ACETYLATION

TFIIB is a necessary protein in eukaryotic RNA polymerase II transcription. In the presence of acetyl-CoA, TFIIB and RAP30, the small subunit of TFIIF, auto-acetylate. It has recently been found that zinc steals the acetyl group from acetyl-CoA. The objective of this project was to investigate the relationship between concentrations of zinc acetate, zinc sulfate, and the amount of auto-acetylation of TFIIB and RAP30.

Two sets of Eppendorf tubes were made, one set using TFIIB and the other using RAP30. All tubes contained protein, buffer, and varying concentrations of zinc sulfate and zinc acetate, except for the control tube that had EDTA instead of zinc. [14-C] acetyl-CoA was added to each tube to begin the reactions, which were later stopped with EDTA. The mixtures were then spotted on a TLC plate. SDS-PAGE and transfer to PVDF membrane were performed with the remaining mixtures. After the TLC and transfer were complete, the plate and membrane were completely dried, placed in a phosphor cassette overnight, and scanned with a STORM scanner.

In the TLC plate, the amount of zinc acetate increased as zinc concentrations increased. In the PVDF membrane, the amount of acetylated protein decreased as zinc concentrations increased. Both trends indicate a greater amount of auto-acetylation inhibition by zinc. Also, the inhibition effect of zinc acetate seems smaller than that of zinc sulfate, most likely due to competition between the acetyl group of acetyl-CoA and acetate ions from zinc acetate itself.

The results clearly indicate that as zinc sulfate and zinc acetate concentrations increase, the level of auto-acetylation decreases. Zinc's inhibition of auto-acetylation may be an important novel transcription regulation mechanism. Also, because of the way zinc inhibits auto-acetylation, zinc may also regulate acetylation in many other biological processes, such as metabolism (since acetyl-CoA is an important molecule in cellular respiration).

HS-11

SUH, Jane
Biochemistry

T-Cell Leukaemia/Lymphoma 1 Oncogene Expression in Germ cells and Cancer Cells

Diseases that are found in the lymphatic system such as AIDS, Non-Hodgkin's Lymphoma, and Seminoma, are of deep concern to many individuals since these diseases deteriorate one's immune system and can cause death. However, high levels of T-cell

Leukaemia/Lymphoma 1 (TCL1) expression have been found in white blood cell tumors and cancers such as AIDS and Non-Hodgkin's lymphoma. In addition, it was found that when TCL1 expression was dysregulated in mice, the mice developed lymphocyte cancers similar to human malignancies. These studies suggest that understanding the TCL1 expression might be keys to treating lymphomas and many types of cancers.

In this study, immunohistochemistry, antibody based staining on slides, was used to determine if TCL1 expression would be found in the testicle from tissues of patients who were diagnosed with seminoma, a testicular cancer. This was compared with immunohistochemistry on normal tonsil tissues. Through many trials, the best optimization conditions for detecting TCL1 were with a 1:4000uL primary antibody dilution and incubation of DAB for 10 minutes. TCL1 was shown to have expected high levels of expression in the mantle zone B cells in the normal tonsil because of the normal differentiation of the B-cells maturing in the mantle zone. However, there was unknown high level expression of TCL1 in seminoma tumor cells. From the high levels of expression in seminoma, it was found that TCL1 could have a role, in promoting not only cancers in the white blood cells of the immune system but also in germ cells.

HS-12

FONG, Jennifer
BOTANY 2006/2007

EFFECTS OF ALOE VERA GEL ON THE PERCENTAGE OF WATER LOSS IN GRAPES AND TOMATOES

My experiment was designed to demonstrate the effects of Aloe Vera gel on the percentage of water loss in grape tomatoes and grapes. Aloe Vera gel has a long history of herbal and medicinal uses (Cultivation and Uses). One recently published use is food preservation (Madsen). Since Aloe Vera has been proven to contain preservation properties, (Serrano M) then it should be able to maintain higher water levels in fresh produce like grapes and tomatoes.

To prove that Aloe Vera maintains higher water levels in fresh produce, twenty grape tomatoes and twenty grapes were weighed in grams and paired with similar weight grape tomatoes and grapes. This created ten pairs of similar grapes and ten pairs of similar grape tomatoes. Ten grapes and ten grape tomatoes were selected from the pairs and coated with Aloe Vera gel. After two weeks, the tomatoes and grapes were weighed. Then the average water loss of both groups of tomatoes (Aloe and No Aloe) was calculated.

The grapes coated with Aloe had a 29.7% water loss versus a 27% water loss from grapes without Aloe. The tomatoes coated with Aloe had a 13.76% water loss while the tomatoes with out Aloe had a 13.69% water loss.

From the data, we can infer that the Aloe Vera did not maintain higher water levels in the tomatoes and grapes. My hypothesis did not prove to be true. The percentage of water loss was higher in grapes than in tomatoes with and without Aloe. This may be related to the skin thickness of tomatoes versus grapes.

HS-13 JOHNSON, George
Environmental Science 2006/2007

THE EFFECT OF FROST ON THE GERMINATION OF *PHASEOLUS VULGARIS*, *AVENA SATIVA*, AND *CHRYSANTHEMUM PALUDOSUM* AT A DORMANT STATE

This project, without supplementary complexity, is intended to further the study of the effects of frost on very common plants when still seeds. The initial idea was to use the information and data collected to possibly predict the outcome of severe temperature drops on different species of plants. Once the complication of determining which type of plants survive lyses under temperature drops, without lyses at temperature and humidity drops, and with temperature drops alone, testing was limited to comparing the most successful and efficient germination.

The procedure consists of three simple steps that were repeated in each plant species: the separation of plant species into subdivisions of lyses and humidity effects, the actual freezing and preservation of each seed, and the nurturing/ germination data collection. Once the procedure was tested on all three plant species the effects of frost were determined over that time period. However, another step was taken to determine the duration of time a seed could handle freezing temperatures before becoming ineffective and completely lysed.

Not surprisingly, the species of *Avena sativa* was affected little if not at all by the freezing process while the two other species had completely different results. The *Phaseolus vulgaris* species, a more complex plant biologically was more affected yet still showed sufficient germination. The *Chrysanthemum paludosum* species was most affected by the temperature drops and showed rapid deterioration once germinated in comparison to each plant's control. Furthermore the experimentation concluded that the longer the seeds are exposed to a drop in temperature the less successful they are in germination.

The findings of this project are beneficiary in two areas. First, the individual species tested prove that frost's effects can be fostered as early as the dormant state of each species. Secondly, the process of freezing and preservation in case of natural disaster worked with specific species of plants and does not work with others, such as *Chrysanthemum paludosum,* thus promoting plant preservation in case of natural disasters that have recently occurred in California such as the severe temperature drops, increase in wildfires, and high earthquake potentials.

HS-14 KWAN, Jessica
BOTANY 2006/2007

Determination of the Ideal Concentration of Hydrogen Peroxide Solution for the Growth of Flowering Plants

Caring for flowering plants can be tedious. Many times, the flowers on the plant tend to lose their brilliant colors and petals in a short time after blossoming, or the plants do not develop well enough to support the growth of flowers. However, rather than using chemical fertilizers to enhance the growth of plants, other more natural solutions can also be used to increase a flowering plant's growth. In this experiment, hydrogen peroxide, an oxidizing and antiseptic solution, was tested on flowering viola and impatien plants. The different concentrations of

hydrogen peroxide were expected to improve the growth of flowering plants watered with the solution.

The research attempted to verify that by watering the flowering plants with a 3% concentration of hydrogen peroxide, the growth of a flowering plant would increase. In experiments, five viola and impatien plants were separated into two different groups by plant type and labeled with the percentage of hydrogen peroxide they received. 1.5%, 3%, 4.5%, and 6% concentrations of hydrogen peroxide were mixed and used to water the flowering plants. Measurements of height and length were recorded every two days for a period of two weeks.

After the experiment was completed, the usage of hydrogen peroxide generally led to an increase in plant growth depending on the concentration of the solution. The result of the experimentation did not support the initial hypothesis, which stated that 3% hydrogen peroxide solution would cause the plant to grow taller and wider. Rather, the plants watered with the 1.5% concentration of hydrogen peroxide grew the tallest and widest, while the other plants watered with concentrations higher than 3% tended to wilt and turn yellow after two weeks.

Generally, the experiment provided useful information which can be used to aid the growth of flowering plants. By using the data collected and applying it to daily life, it is sensible to presume that a dilute concentration of hydrogen peroxide solution can be an inexpensive and easy to obtain substitute to rival expensive and processed chemical plant growths when used to aid a plant's growth.

HS-15

PARK, Brian
Botany 2006-2007

EFFECTS OF DIFFERENT FACTORS UPON ETHYLENE RELEASE RATE IN ORANGES

This project is derived from the idea that different factors such as darkness, coldness, a paper bag, or incense smoke, can make a fruit give off more ethylene. Ethylene, a plant hormone, is responsible for the ripening and eventual spoilage of fruits. The purpose of this experiment was to find out what such factors were most effective in causing the most ethylene release in citrus fruits, specifically in oranges. The most effective method to stimulate ethylene release was found by measuring the pH; the higher the pH of an orange, the riper it was, due to increased ethylene production in that orange.

Green oranges were used, primarily due to the fact that they took longer to ripen than other fruits, and thus were more observable. Oranges were tested with different factors for seven days in a row: darkness, refrigeration, incense smoke, and placement in a paper bag. Factors were tested on the oranges individually or in different combinations. A control group of two oranges was left alone and untouched for the seven-day duration. At the end of this period of time, the juice of the oranges was extracted and the pH of each orange sample's juice measured with a pH meter.

Incense turned out to be the most effective factor in stimulating ethylene release in oranges. Oranges tested with incense by itself or with any other factor had significantly higher pH levels than the other oranges. The least effective method in causing increased ethylene release was placement in a paper bag, since the overall pH levels of the samples placed in paper bags were not as high as the pH levels of the other samples.

In conclusion, all of the factors tested upon the oranges were effective in causing increased ethylene production in oranges. However, some factors were more effective than the

others, such as incense smoke, while another factor, placement in a paper bag, was only moderately effective in causing more ethylene to be released from the oranges. The hypothesis put forward was proved correct, because darkness, refrigeration, incense smoke, and placement in paper bags all stimulated ethylene release in oranges, though in varying degrees.

HS-16

PARK, Youn Woo (Christina)
BOTANY 2006/2007

EFFECT OF GREEN TEA ON THE IRON TOXICITY INFECTED Euryops Virgineus

The iron toxicity is serious problem in places where permanent flooding of water is present specifically, rice planting area. The Iron Toxicity is the result of excess amount of iron in the soil. Large amount of the iron in the soil disrupts the condition and the pH of the soil. Consequently, the low pH (4-7) results deficiency of other metals. The purpose of this research is to find out whether the Green Tea can cure the Iron Toxicity in plants. The Green Tea is know as the most potent natural iron chelator and has many other abilities that are receiving great attention not only from scientists but also from regular people. If the Green Tea can be applied to ameliorate the condition of Iron Toxicity on plant, then it may be more useful than chemically made fertilizers which are the most powerful iron toxicity curer so far.

First, four *Euryops virgineus* were bought and received excess amount of ironite which is iron rich substance that will give them the iron toxicity. As soon as it showed some of the iron toxicity symptoms, certain amount of green tea was applied with small quantity of ironite just to make sure that plants are not recovering by themselves. Different amount and concentration of green tea were given to have varieties in the experiment.

Negative influences were seen; the leaf color, height, and the soil condition got worsened and reached the point where the plant can never be recovered. The leaf color became yellow then light brown, and the height gradually decreased throughout the experiment.

The findings were that unlike in the human body, in the plants the green tea brought opposite result to iron toxicity than it was expected in hypothesis. It made overall condition of *Euryops virgineus* worse. Higher concentration and different quantity of Green Tea could not make any difference.

HS-17

WENSKA, Elliot
BOTANY 2006/2007

THE IMPACT OF SYSTEMIC FUNGICIDES ON THE GROWTH OF ORNAMENTAL PLANTS

Systemic pesticides may have unintended effects on the growth characteristics of the plants they are intended to protect. In this study, petunias (*Petunia x hybrida*) and snapdragons (*Antirrhinum majus*) were treated with systemic fungicides and their growth characteristics were measured and recorded. The hypotheses are that both fungicides will inhibit the growth of both plant types. The experiment was carried out over a period of 90 days, beginning on 1 October 2006 and concluding on 30 December 2006. Samples of each plant type were treated with Green Light Systemic Fungicide with active ingredient 1-(4-chlorophenoxy)-3,3-dimethyl-1-(1H-1,2,4-

triazol-1-yl)-2-butanone (also known as triadimefon) or with Bonide Infuse Systemic Fungicide with active ingredient propiconazole. Control samples were treated with water. At the end of the 90-day growth period, the plant samples in each group were weighed and measured and the number of blossoms was noted. The Green Light and Bonide fungicides had no significant effect on the growth of the petunias, which is inconsistent with results reported in a previous experiment (Wenska, 2006). The likely cause of this inconsistency is the late application of the fungicides or the cold, dry weather experienced during the growth period. Both the Green Light and Bonide fungicides inhibited the growth of the snapdragons slightly, but the differences were small and may not be statistically significant. The results of this experiment were not sufficient to confirm the original hypotheses.

HS-18

Chang, Debra
Chemistry 2006/2007

REDUCTION OF BIOLUMINESCENCE IN *CYPRIDINA HILGENDORFII* BY VARYING PHOSPHATE CONCENTRATIONS

The purpose of this study was to determine the effect of varying phosphate concentrations on the bioluminescence from a marine shrimp, *Cypridina hilgendorfii*. This project targets the chemical reaction of luciferin and luciferase, the reactants that produces light.

Preserved *Cypridina* were introduced in water solution of trisodium phosphate dodecahydrate in 0.005 g/mL, 0.01 g/mL and 0.015 g/mL. The control group solution was pure distilled water. 0.05 g of ground Cyrpidina and 2 mL of phosphate solution were placed in a cuvette. Four trials were done per concentration for a total of 16 trials. Photographs were taken during this entire procedure in a darkoom using a digital camera and exposing the film at 8, 10 and 15 seconds.

Various attempts to accurately quantify the amount of light transmitted did not yield usable results due to the source's dimness. It became necessary to quantify the emitted light by establishing a "standard of brightness" scale. The "standard" was determined by choosing the average brightness from the four cuvettes in the control group. The results were determined by using the number of seconds of exposure needed to reach the light intensity of the standard.

With increasing dosage, the time observed to reach "standard brightness" increased. Numerical analysis suggests that there is a simple, direct ratio between the amount of light emitted and time elapsed after initial mixing of the solution. With the significant diminishment of light caused by the sodium phosphate, this study suggests that Cypridina can be used as a bioluminescent indicator for water quality.

HS-19

HOLGUIN, Shawn
CHEMISTRY 2006/2007

THE BETTER FRENCH FRY METHOD

The purpose of this experiment was to create an optimal method of preparing potatoes to become French fries. French fries are one of the most popular as well as best tasting foods in the country. Yet there high fat content and high calorie content only adds to the growing obesity

problem here in the United States. This experiment sought out to find a method of preparing French fries that would decrease both fat and calorie content. This was to be done by increasing the water content in the potatoes prior to being fried. An increase in water content would allow more water to be evaporated during the frying process. This increase in outward evaporation would fight against the intruding oil on the potato.

To begin a given amount of potatoes were French sliced and fried. The mass of these potatoes was then measured. These potatoes were then placed in an oven to get rid of any excess water, leaving only solid potato and oil. This final mass of potato and oil was then measured also. A second batch of potatoes was then placed in a water bath for one week. The same procedure was also followed. Finally, a third batch of potatoes was soaked in water for two weeks, and the same procedure was followed.

The data showed that the final mass of the French fries after being completely dried out was almost identical with the untreated potatoes and the potatoes soaked in water for a week. This means that the amount of oil absorbed is identical with both trials. It was also found that the potatoes soaked in the water bath for two weeks had a slightly higher mass after being completely dried out.

Though this experiment did not make the exact mass of oil absorbed to decrease, it did decrease the amount of oil that would be consumed per serving of French fries. The water soaking of the potatoes added more mass to the potato. The excess water also stayed in the potato even after the frying process, therefore creating a greater mass of French fries. In these water treated French fries there was a higher percentage of water and lower percentage of oil per serving, than in the untreated potatoes. So if a person were to eat a half of a kilogram of the water treated potatoes, they would be consuming less fat than if they consumed a half a kilogram of the untreated potatoes.

HS-21

WU, Hao (Helena)
CHEMISTRY 2006/2007

EFFECTS OF SURFACTANT TYPE ON THE STABILITY OF ANTIBUBBLES

The purpose of this study was to determine the effects of surfactant type on the stability of antibubbles, liquid globules contained in a thin film of air, by examining the success rate, duration, and size. This project is the result of experimentation of four different types of surfactants— Sodium Lauryl Sulfate, Ammonium Lauryl Sulfate, Cocadominpropyl Betaine, Cetyl Alchohol and Belgian Beer, which contains a protein that gives the beer surfactant properties.

The experiment was conducted by injecting a steady stream of solution into a specified liquid mixture, containing 500mL of water and 5mL of the specified surfactant. The trial was repeated 50 times for each of the five mediums. The stability of the antibubbles was determined by analyzing the outcomes of the three stability factors: success rate, duration, and size.

Results in the experiments revealed that no single surfactant was the most stable in all three factors. Sodium Lauryl Sulfate produced antibubbles with longest lifespan. Likewise, the antibubbles in Ammonium Lauryl Sulfate lasted the longest. Also, the Cocadominpropyl Betaine solution resulted in the highest success rate. Cetyl Alcohol, however, was insoluble in water and was therefore disregarded from the data.

This project indicates that out of three classes of surfactants tested, the cationic group, which contained Sodium Lauryl Sulfate and Ammonium Lauryl Sulfate, is the most ideal type of

surfactant. The cationic class produced the largest and longest duration antibubbles. Furthermore, it was discovered that smaller antibubbles generally have a longer lifespan. The contributions of this project may be utilized for future research in determining a medium that will be optimal for antibubbles formation, leading to more effect uses and practical applications of antibubbles.

HS-22

FONG, Christina
COMPUTER SCIENCE 2006/2007

CLASSIFICATION OF ACUTE MYELOID AND LYMPHOBLASTIC LEUKEMIA

The objective of this research was to determine if analysis of microarray data using the more freely available classification algorithms in WEKA could identify relevant gene markers for disease classification. This project specifically dealt with systematic filtering of acute myeloid leukemia and acute lymphoblastic leukemia data using several different algorithms.

The first list of potentially relevant genes was compiled by filtering two distinct AML_ALL microarray data sets using four algorithms: OneR, Part, JRip, and Ridor. This gene list was subjected to further filtering in the Individual Gene Analysis step, using four different algorithms: Naïve Bayes, SMO, Decision Stump, and J48. The percents of correct classification of each of the individual genes were compared to the control and used to form seven gene sets. These gene sets alone were then used as the basis for the disease classification.

The genes identified initially were used later in this study. The Individual Gene Analysis identified many genes with improved percent accuracies. On average, all seven gene sets formed after three filtering resulted in slightly improved percent accuracies. Most of these sets maintained or improved consistency.

The results of this study indicate that systematic filtering using several WEKA algorithms can identify genes and gene sets that can be used to accurately distinguish between ALL and AML. The results suggest that looking solely at these few genes may improve the abilities of all four algorithms to distinguish between ALL and AML. This project potentially contributed to the development of more accurate and efficient disease diagnoses.

HS-23

KOTSIANAS, Nick
Computer Science, 2006-2007

ALIFE 101 – COMPUTER TIME SIMULATION OF ARTIFICIAL LIFE ORGANISMS

This project in its present form is a simulation of artificial life. The long-term objective of the project is to create a simulation which would accurately predict the best chances for survival and evolution by varying organism and universe parameters. In this first phase, the system can simulate survival and growth of tribes for various nutritional and environmental conditions.
Life is simulated in a configurable Universe populated by Agents, which are organized in Orders. The Universe is defined by a number of Cells, its physical characteristics such as aquatic and land Barriers, and its nutritional resources, both in Distributed (grass and roots) and in Spot (trees and animals) values. Orders consist of any number of Agents with shared characteristics, such as Health, Energy, and Intelligence levels, maximum Life span, Reproduction rates and Food Consumption Efficiency (FCE). Agents are the basic units of life. The Agent's goal is to

find food, reproduce, and stay alive as long as possible. In order to survive, Agents must compete with others for resources and find their way around Barriers. This project was implemented in C#, using Microsoft Visual Studio.
Lower population sizes at stability were observed for Orders with less efficient food metabolism and for higher Reproductive costs. Also, Orders with more efficient metabolism may lead to dominance and cause extinction of less efficient Orders. The A* algorithm was found effective in guiding Agents along the shortest path to food and avoiding collisions.
A major conclusion from this simulation is that an inverse relationship exists between FCE and population size as well as between Reproduction cost and population size.

HS-24

LIN, James
COMPUTER SCIENCE 2006/2007

Localization of Migraine Headache Receptors on the Brain Using Allen Brain Atlas

Much research has been done to try to cure the ailment of migraine headaches. Researchers have successfully mapped out many genes in the brain. This project attempts to find out the placement of the receptors which is involved in the pathogenesis of migraine headaches. It will help migraine researchers to determine how to develop novel medication to treat migraines.

This requires a program which can determine the placement of these genes The Allen Brain Atlas was utilized to do this job. Allen's Brain Explorer 1.2 provided 3D images of mouse brain and the expression levels and densities of the genes. The data collected was compared with the results previously researched.

It was found that there was very sporadic expression for the gene CRLR (calcitonin receptor like-receptor), as expression was only found in blood vessels. There was a lot of expression in Dentate Gyrus and the Ammon's Horn, as well as other places for the RAMP1 (receptor activity-modifying protein 1). The CGRP (calcitonin gene–related peptide) was expressed throughout the brain.

The findings were significant, because they showed that migraine receptors are not in the brain tissue itself. The findings showed that CRLR is not in brain tissue, but rather in the blood vessels. Therefore, any drugs which target migraines must act through the blood vessels and not through the brain tissue.

HS-25

SHARIFIAN, Shahab
Computer Science 2006/2007

MAC VS. WINDOWS: EFFECT OF OPERATING SYSTEM ON SPEED OF ADOBE PHOTOSHOP CS2

This project in its present form is the result of experimentation of the effects operating systems have on the speed of Adobe Photoshop CS2. The initial idea was to determine which operating system enabled faster program usage. With the growing graphic design industry, it made logical sense to test Adobe Photoshop CS2, to see which operating system allows faster performance.

A MacBook Pro that could run both Windows XP and Mac OS X, was obtained with Adobe Photoshop CS2. Various effects were tested on a digital photo on each operating system, and the times taken to complete each effect were recorded.

Windows XP turned out on top, leaving Mac OS X in its dust, as the times were an average 3.5 times faster than those of the Mac OS X.

The contributions of this experiment are twofold. First, the speed of Adobe Photoshop CS2 was found to be much faster on Windows XP rather than Mac OS X (3.5 times faster). Secondly, the myth that Mac OS X is faster than Windows XP at everything was found to be busted, as a faster performance on a leading graphic design program was demonstrated on Windows XP.

HS-26 KWON, Jaein

Earth Science 2006/2007

EFFECTS OF THE DEBRIS FLOWS ON THE PORTUGUESE BEND LANDSLIDE

Portuguese Bend contains an unusual landslide. When dry, the soil is stable, but with the absorption of water it swells and results in ultimate debris flow. Therefore, it was significant to compare the regular backyard soil and the landslide soil's ability to absorb water by comparing their percentage of height. The results would help to prove whether there is indeed a significant relationship between the ability to absorb water and its effects on the landslide.

To discover the relationship, three trials were held for each type of soil with the same ratio. The millimeters of change in height and the original height of two soils were measured. The results were based on the percentage of height in the soil.

Significantly, there was a decrease in the percentage of height in the regular backyard soil while there was an increase in the percentage of height in the landslide soil. In addition, the increase in the amount of landslide soil proved that with the absorption of water, it swells. Thus, it appeared to be the main cause of the landslide.

As a result, it is understood that the landslide soil absorption of water causes the tremendous landslide in the Portuguese Bend Landslide by causing a swell, then the landslide. Therefore, the experiment marked a significant relationship between the ability to absorb water and the causes of the landslide by comparing the percentage of height of the regular backyard soil and the landslide soil.

HS-27 CHEN, Anna

ENGINEERING 2006/2007

PHOTOMETRIC CHARACTERISTICS FOR AUTOMATED SORTING OF DIGITAL IMAGES

The purpose of this research was to discover photometric characteristics to sort out undesirable digital photos from desirable ones. Based on these photometric features, an automated method would offer an alternative to manually sorting through hundreds of digital pictures to find the ones that are worth processing further and printing.

By manually sorting through hundreds of family photos, the luminosity histograms of poor quality images were compared with those of desirable images. Correlations between features such as the "dynamic range", "mean", "median", "standard deviation" and the overall shape of the histograms were taken into consideration. Comparing and recording correlations of characteristics of the pictures identified which features determine an image's quality.

The objects that are distinguishable in an image correlate to the standard deviation of luminosity. For example, most photos with a small standard deviation do not contain sufficient contrast to distinguish image content. After comparing the corresponding characteristics of each undesirable and desirable photo, a non-dimensional metric was constructed based on the standard deviation of the histogram of luminosity and the dynamic range. This photometric measure has a threshold that is adjustable to make the sorting more or less conservative as needed.

As a result of this experiment, it is possible to automatically sort photos using the understanding of these features and the metric formulated. The next step is to construct an image processing computer program that automatically reads, analyzes, and automates the process of sorting large numbers of digital images.

HS-28

CHEN, Tyrone
ENGINEERING 2006/2007

THE EFFECT OF INCREASED ANGLE ELEVATIONS ON NODE TO NODE DISTANCES DURING FILM BOILING

During film boiling, the pockets of vapor are referred to as nodes. Between each of these nodes are smaller pockets of vapor that are referred to as antinodes. In theory, the node to node distances should be equivalent to the antinode to antinode distances. When conducting film boiling on a more point concentrated surface, such as a wire, these distances between nodes can more easily be measured.

Through previous research conducted at the Boiling and Heat Transfer Lab at UCLA, it has been proven that by reducing the distances between nodes while film boiling on a wire, more heat can be expelled from the system during a given amount of time. Because the nodes are pockets of vapor, the vapor acts as heat. As these heat pockets rise out of the system, the heat is also taken out of the system. By reducing the distances between each node, this allows for more nodes to fill the empty spaces, and therefore more heat to be released. Previous research has also shown that for increasing angles of elevation in an enclosed system, there is an exponential relationship between the increasing angles and decreasing node to node distances. Experiments on several elevated angles have been formally conducted, but none have been conducted on the 90-degree angle.

For this experiment, an isolated container was created to induce film boiling along a wire for analyzing the node to node distances at several angles of elevation . Through various trials using different angles of elevation including the 90-degree angle for both a 0.2mm and a 0.5mm diameter wire, film boiling at a 90-degree angle, or vertically, was verified to follow the exponential relationship of decreasing node to node distances for increasing angles.

As a result of these successful experiments showing that the vertical film boiling has smaller node to node distances than any other elevated angle, the idea of vertical film boiling can be applied to several applications for releasing heat more efficiently. Even systems that currently

use film boiling, such as in certain nuclear reactors and heaters, can be improved for greater heat release efficiency if the 90 degree angle of elevation is applied.

HS-30

NEE, James
Engineering 2006/2007

RUNNING, GENERATING MORE THAN GOOD HEALTH

The following research paper deals with the generation of electrical energy during running. In hopes to get more people off the couch and onto the streets, this project has hoped to create an apparatus that would generate electricity while they run. Also, it has an environmental factor, saving people from buying the batteries that are so detrimental to our environment. With this in mind, the project began.

The first steps were of trial and error, trying to determine the best angle for the placement of the generator. Then, it was discovered that an angle of 85 degrees, where the leg is 90 degrees, is best for the leg generator. For the arm generator, it is best placed at 5-degree angle, with the arm being zero. At this point the needed materials were gathered, which include a knee and elbow elastic fabric support, a multimeter, and one roll of duct tape. After this was done, the building of the project took place. In order to counter any unforeseeable problems, duct tape was used to hold the generator and support together. Then came the testing.

After the experimentation, the results were better than expected. The arm generator generated an average of .117 watts and the legs generated an average of .085 watts. Together this came to a total of .202 watts. Considering one AA battery had wattage of .15 and the testers only ran 400 meters, this is a great result. One hopes that this invention will be of great value to present and future runners alike.

HS-31

CHAI, Joyce
ENVIRONMENTAL SCIENCE 2006/2007

MORINGA OLEIFERA: ELUCIDATION OF PHYSICOCHEMICAL PROPERTIES OF THE ACTIVE PROTEIN AND OPTIMIZATION OF WATER PURIFICATION

The seeds of the tropical and subtropical plant, Moringa Oleifera, have undergone studies in environmental science as a primary coagulant for water treatment. This investigation attempts to account for the coagulation abilities of the Moringa Oleifera seed by elucidating the physicochemical properties. Furthermore, using analyses of particle size and zeta potential, optimum environmental conditions were proposed.

The protein was isolated by filtrating a permeate of crushed Moringa Oleifera seeds and deionized water through a 0.45 micrometer membrane. The size of the protein was analyzed by Dynamic Light Scattering, and the same computer program was used to determine the zeta potential of the protein at different levels of pH. Jar testing was used to simulate water coagulation with Moringa Oleifera as the primary coagulant.

From the particle size analyses, the active protein of Moringa Oleifera had an approximate size of 100 to 450 micrometers. This supports the assertion that a larger sized protein increases the ability to agglomerate with other particles. Furthermore, as the pH level

increased, the zeta potential of the protein generally decreased. Consequently, the zeta potential of the protein was zero around a pH of 4.00; thus, jar test simulations of water coagulation were conducted at pH=4.00, the optimum environmental condition. From simulated water coagulation, the investigation concluded that Moringa Oleifera has an influential effect on the color and turbidity of contaminated water, and works at optimum conditions of pH=7.00 and medium dosages of Moringa Oleifera.

The conclusions of this investigation demonstrated three essential concepts. First, the large size of the protein accounts for the ability to agglomerate with other particles. Secondly, though zeta potential analyses demonstrated optimum conditions at a pH of 4.00, simulated water coagulation supported optimum conditions at neutral pH. Finally, optimum dosages of Moringa Oleifera solely depend on the number of colloids present in the water.

HS-32

CHOO, June
ENVIRONMENTAL SCIENCE 2006/2007

PHYTOREMEDIATION OF PHOSPHATES AND NITRATES USING OENANTHE JAVANICA

With the continuous growth of human population, the problems of nutrient excess are surmounting.Many bodies of water are affected by the increasing phosphates and nitrates, resulting in eutrophication that can be harmful to humans. Due to the financial expenses, the cleaning of phosphates and nitrates are often left out, which proves to be significantly dangerous to both humans and the aquatic life.

A recent discovery, phytoremediation, which uses plants to take up harmful substances in the environment, provides an alternative for the expensive chemical and hydraulic activities. This study examines a semi-aquatic plant, *Oenanthe javanica,* and its effectiveness in removing nitrates and phosphates from a nutrient-enriched water solution.

The plant's ability to phytoremediate was measured through the water analysis and the foliar analysis of both shoots and roots. Water analysis was taken every 10 days for 30 days, and the foliar analysis was sent after the thirtieth day. Both water analysis and foliar analysis of *Oenanthe javanica* supported its ability to phytoremediate.

The control group was unsuccessful in removing phosphate and nitrates, thus further supporting that the actual plant performs the phytoremediation. The decrease in levels of phosphates was recognized to be the effect of evaporation.

Also, plants responded to the nutrient excess in different ways, and further research can be conducted on the effects of excess nutrients on aquatic plants.

HS-33

DEAKERS, Christine
ENVIRONMENTAL SCIENCE 2006/2007

RAT BEACH RUNOFF: THE EFFECTS OF WEATHER CONDITIONS

This project substantiates weather being an influence of runoff quality. The water samples were taken upon three occasions of different weather conditions: dry period, day after rain, and day after rain including the factor of “artic winds”.

The water quality was tested upon eight standards: temperature, pH, dissolved oxygen, biochemical oxygen demand, nitrate, phosphate, turbidity, and fecal coliform. To determine qualities, LaMotte kits were used, these tests usually entailing a tablet reacting with the water changing colors.

All three water samples measured 16 degrees Celsius. The general findings in the experiment were no nitrate levels, even with the change of weather; as well, low phosphate levels shown throughout the experimentation. As well, DO levels bounced between 41% and 81% of saturation. Turbidity's quality degraded and in the third sample, there was a positive presence of fecal coliform. BOD levels were mostly 8ppm, and pH levels stayed within the rage of 6.5 through 8.

This experiment emphasized that weather conditions influence water quality. Organic and inorganic materials are more susceptible to be washed into runoff water when precipitation or wind influences the movement of the particles. The effluent in Rat Beach flows directly into the ocean disrupting the marine ecosystem with abnormal water. Because poor water quality can affect oxygen demand, algal bloom may result. This experiment emphasized that weather conditions are a factor that humans cannot control, yet the organic and inorganic matters that are susceptible to entering the water supply is in the public's control. Whether through picking up one's dog's wastes or changing fertilizers, the public can improve runoff quality and therefore influence the health of their community.

HS-34

EVANS, Nicole
ENVIRONMENTAL SCIENCE, 2006/2007

THE EFFECT OF MICROBE-LIFT IND ON CONTAMINATED FRESH WATER AT MADRONA MARSH

At the Madrona Marsh Nature Preserve, there is a portion of urban runoff water (Drain #1) from an adjacent street that occasionally has higher than normal bacterial concentrations. Treatment with Microbe-lift IND, a commercial product, may significantly reduce the bacterial count and thus be helpful to the overall management of the Marsh. Microbe-lift IND is proven to rid urban runoff water of many harmful substances, but it has never been tested at Madrona Marsh in Torrance, California.

For a period of seven weeks, Drain #1 was treated with Microbe-lift IND six times in increments of about a week. Samples of the contaminated water from Drain #1 were taken throughout the week between dosages and the enteric bacterial colonies were counted on McConkey Agar plates.

Prior to adding any Microbe-lift IND, there were approximately 23,000 enteric bacteria per square milliliter in the drain. Four days after treatment number four, the number of bacteria had reduced 91% compared to the initial baseline enteric bacterial count.

The results show that adding Microbe-lift IND to a water source and associated sediment not only decreases bacterial counts, but also creates a more suitable habitat for living organisms by substantially reducing enteric bacterial levels.

HS-35

KILLAM, Kareena
ENVIRONMENTAL SCIENCE 2006/2007

BIOREMEDIATION OF SODIUM PHOSPHATE BY TULES IN THE MADRONA MARSH

Madrona Marsh, a vernal marsh preserve, is surrounded by many potential pollution sources. Obtaining all of its water from runoff and rain, the marsh is overwhelmed with high levels of phosphate. The California Tule (*Scipus Cailfornicus),* one of the most abundant aquatic plants at the marsh, uptakes these nutrients, which naturally cleans the water. However, little is known, as to the rate at which these Tules remove phosphate and too what degree the marsh relies on such plants for obtaining optimal productivity.

Two tubs each contained identical amounts of Tules, water, and sump mud. The plants varied minimally in size. Each tub contained 8 Tules, whose roots were submerged in mud, and 30 Liters of water. Two different doses of Sodium Phosphate were added to each bucket. Once a week, for three weeks, samples were taken and sent to Associated labs, where they were tested for total phosphate(inorganic and organic) and compared.

After three weeks of observation, an unexpected result was discovered. Instead of the phosphate levels decreasing at a steady rate, the phosphate levels were reading in the 100's and drastically increasing as time progressed.

As the results seemed impossible, a newfound discovery was made. Phosphate, from runoff and rain, adsorbs to the sump mud in the preserve. Because the mud was meddled with and relocated, the phosphate detached and became apparent in the test tubs. The more the water was sampled, the more the mud was stirred up. Through the findings of this research the Madrona Marsh is aware that the sump mud contains thousands of pounds of phosphate. The phosphate leaching into the test tub water far exceeded the amount of phosphate uptake; therefore, the initial experiment was unable to be carried out

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HS-36

Wadhwa, Nishwa
ENVIRONMENTAL SCIENCE 2006/2007

THE ABILITY OF *BACCHARIS* ABSORB CADMIUM AS AN EFFLUENT: IMPLICATIONS FOR PHYTOREMEDIATION *SALICIFOLIA* TO

Cleanup of soil pollutants is often expensive and environmentally unsound. Phytoremediation is an area of frontier science that provides a safe and cost-effective alternative to the conventional cleanup methods. This study featured a native California plant, *Baccharis salicifolia*, or mule's fat, and identified the maximum tolerable dose of cadmium that can be administered weekly as well as the implications for a large-scale phytoremediation project.

The approximate maximum cadmium concentrations were determined by planting five groups of eight saplings in various cadmium doses. Cadmium was applied weekly via solutions of water and cadmium acetate.The saplings were observed during the eight-week growth period, and then harvested. Plant tissues were separated and analyzed via ICP-MS (Inductively Coupled Plasma Mass Spectroscopy), and cadmium content was determined in the leaves and shoots of various groups.

Average plant tissue dry masses in addition to leaf counts, shoot length measurements, and actual cadmium content in these tissues confirm that the maximum weekly dose tolerated by *Baccharis salicifolia* is somewhere between twenty-five and fifty parts per million. Beyond this level, the plant is no longer a practical phytoremediation candidate because the decline in overall health drastically increases the mortality rate in the species.

As confirmed by the previous year's study, mule's fat is a plausible candidate for phytoremediation, though not necessarily better suited for cadmium as an effluent. Both a single large dose and multiple smaller doses demonstrate a similarly above-average tolerance for cadmium in *Baccharis salicifolia*.

HS-37

ASHLA, Paul
MEDICINE AND HEALTH 2006/2007

HEAD INJURY SEVERITY DOES NOT PREDICT LONG-TERM COGNITIVE IMPAIRMENT

It is commonly believed that cognitive functioning following traumatic brain injury (TBI) does not improve beyond two years after the injury. Consequently, long-term rehabilitative and other treatments may not be sufficiently pursued or emphasized. The purpose of this research is to determine whether people continue to improve long after a TBI.

This research evaluated the relationship between TBI severity and cognitive tests in 23 U.S. veterans who had remote (>10 years) closed head injuries compared to 23 U.S. veterans who had recent (<5 years) head injuries. None of these veterans received cognitive or rehabilitation therapy following their TBI. The groups were matched for age at time of TBI, years of education, and TBI severity based on the period of coma and post-traumatic amnesia. The cognitive tests included the Mini-Mental State Examination (MMSE) and tests of attention, verbal fluency, memory, and executive functions such as motor sequencing.

In the remote TBI group, severity of the injury did not correlate with performance on the cognitive tests; some veterans had continued to improve even years after their TBI. In the recent TBI group, severity negatively correlated with performance on the MMSE, attention, verbal fluency, and verbal memory. Those with remote TBI performed better than those with recent TBI on MMSE, attention, verbal memory, and executive functions.

In conclusion, the severity of TBI does not predict degree of long-term cognitive impairments because performance may continue to improve years after TBI. This study is important because it implies that rehabilitation is possible even many years following head trauma.

HS-38

AYOUB, Noel
MEDICINE AND HEALTH SCIENCES 2006/2007

HEARING LOSS IN HIGH SCHOOL BAND MEMBERS CAUSED BY BAND MUSIC

The purpose of this study was to conduct hearing tests to determine if high school band members show any hearing loss as a result of their participation in the band. Students in a band

practice their instruments for many hours a week at very high volumes, which may cause severe hearing loss in the future.

There were two groups used in the study, each with fifty-two members: band members and non-band members. Each student was given a questionnaire and underwent a hearing test after signed permission was obtained. The study consisted of standard hearing tests, with the frequency range from 1000 Hertz to 8000 Hertz and the hearing level from 0 to 110 decibels.

The found that high school band members have slightly impaired hearing when compared to people of the same age group who are not in the band. Although the hearing loss is still in the normal to moderate hearing levels, if it continues at this rate the students may become deaf very early on in life. The band members that are not protecting their ears are not only injuring their hearing organs, but also are causing other, more serious harm to their bodies.

This study's findings should persuade band members to wear ear protection while they are playing an instrument or around loud music, or limit exposure altogether. Moreover, because students are already showing signs of hearing at such an early age, drastic measures must be taken to ensure that not only these students protect their ears, but also that future generations find ways to safeguard their ears from music.

HS-40

FONG, Jeanette
MEDICINE & HEALTH 2006/2007

COMPARISON OF DISSOLUTION RATES OF DIFFERENT FORMS OF IBUPROFEN IN VARYING PH SOLUTIONS

The purpose of this experiment was to compare the dissolution of different brands of ibuprofen tablets in 15-minute time periods, using varying pH solutions. The hypothesis, the different types of ibuprofen would dissolve at the same rate, was disproved. In order to conduct this experiment, Pharma TRUST generic ibuprofen, Advil tablets, Nuprin caplets, and Motrin tablets were used. The tablets and individual coffee filters were weighed and the tablets were tested in three pH solutions. After 15 minutes the buffer and the tablet remnants were poured into a coffee filter, left to dry, and weighed. All four tablets had their lowest average percent dissolved at pH 7, which simulated intestinal fluid. The Motrin had its highest average percent dissolved in pH 4. The Pharma TRUST generic ibuprofen tablets, the Advil tablets and the Nuprin caplets had the highest average percents dissolved in the pH 2 solution, which is simulated stomach acid (Biopharmaceuticals, January 6, 2006). This result indicates that these tablets would dissolve the fastest in the stomach, resulting in faster absorption rate (Pharmacology, 2002) and thus bringing faster pain relief. None of the ibuprofen tablets had their highest average percent dissolved in pH 7, simulated intestinal fluid, indicating that dissolution of ibuprofen tablets would depend on the greater acidity of the stomach. Since the Pharma TRUST ibuprofen at 2.5 cents per tablet dissolved faster than the Advil at 16.7 cents per tablet, the higher cost of the brand name Advil is not justified in providing quicker relief than the generic ibuprofen. For the same relief, consumers can spend less money, a difference of 14.2 cents per tablet. These results correspond with the results found in previous research (McKee, 2005).

HS-43

Liu, Monica
Medicine and Health 2006/2007

Selective Amplification of Rare Mutations in Tumor Cells Enriched from Whole Blood

Detection of mutated genomic DNA from cancer cells circulating in blood may improve tumor staging and drug targeting. However, the task of detecting a few mutated cells in the presence of a large excess of wild-type cells requires a sensitive and selective assay. A novel polymerase chain reaction (PCR)-based approach to detect circulating melanoma cells harboring a common point mutation in the *BRAF* kinase was developed in this study.

In the first step, primer binding to wild-type *BRAF* was competitively blocked by a locked nucleic acid (LNA) oligonucleotide. In the second step, the LNA blocking approach was combined with a mutant-specific forward primer. To determine the clinical utility of this method, its ability to detect human blood spiked with a defined number of *BRAF* mutated melanoma cells was tested. Blood was first enriched for melanoma cells using an antibody-mediated negative selection procedure prior to whole genome amplification (WGA). Mutant *BRAF* in the WGA amplified genomic DNA was further amplified by a two-step PCR protocol.

This two-step approach easily detected ten *BRAF* mutated melanoma cells mixed with 10^5 wild-type cells. In addition, this approach could readily identify mutant DNA from as few as ten melanoma cells in one milliliter of human blood.

Since this approach facilitates sensitive detection of *BRAF*-mutated genomic DNA in circulating tumor cells, this assay may reliably predict metastasis, improve tumor staging, and identify candidate patients for therapeutic agents targeting the MAPK pathway.

HS-45

SUH, Carol
Medicine & Health 2006/2007

Integrated Microfluidic Device for the Development of Human Embryonic Stem Cells

Stem cell technology can help pave the way for personalized medicine, but current methodologies prevent from doing so. Human embryonic stem cell cultures are contaminated with animal products, preventing transplantations. Lack of understanding of stem cells in their microenvironments hinders tissue engineering and accurate drug screening. In order to address these problems, an integrated microfluidic device that can sustain the growth and development of human embryonic stem cells (hESCs) was developed. The device was fabricated by soft-lithography. HSF1 hESCs were cultured inside the device with mouse embryonic fibroblasts (MEFs) and cultured media. The "stemness" of the cells was confirmed through immunostaining with AP, DAPI, Oct-4 and SSEA-4. Stem cell growth curves matched conventional methods and were robust. This device is an efficient system for developing human embryonic stem cells. Later it can be used for high-throughput drug screening and the creation of animal free culture systems.

HS-46

TANG-QUAN, Karis
MEDICINE & HEALTH 2006/2007

DETERMINING STROKE CORE USING CT PERFUSION: A FASTER, MORE COST-EFFECTIVE MODALITY THAN MRI

Diffusion-weighted magnetic resonance imaging (dwi mri) is the current imaging modality of choice in the acute evaluation of ischemic stroke. Computed tomography perfusion (ct perfusion) is a newer modality that is cheaper and more readily available in the emergency room. This study compared ct perfusion to dwi in the evaluation of the stroke core in 30 patients with ischemic stroke. It was found that the volume of the infarction core measured by ct perfusion correlated well with that measured by dwi. Moreover, relative cerebral blood volume (cbv) maps had a stronger correlation than absolute cbv maps. Previously, an absolute cbv threshold of 2.0 cc/100 g, rather than relative cbv thresholds, was asserted as the optimal threshold for calculating the volume of the infarction core. However, this study showed that relative cbv thresholds are more accurate in determining stroke core in a heterogeneous population. The correlation between ct perfusion and dwi suggests that ct perfusion, with its wider availability, may be able to complement or even replace dwi in the diagnosis of acute stroke, allowing timely therapeutic intervention. Furthermore, these findings have led to the use of ct perfusion maps in ongoing trials of stroke diagnosis and treatment.

HS-47

HERNANDEZ, Yamila
MICROBIOLOGY 2006/2007

DIFFERENTIALLY ALTERING THE ABILITY OF *HAEMOPHILUS INFLUENZAE* TO FORM BIOFILMS BY USING SUBTHERAPEUTIC DOSES OF MULTIPLE ANTIBIOTICS

When studies began showing the concept of antibiotic resistance, researchers felt that the remedy was to give patients lower dosages of antibiotics, as subtherapeutic dosages lead to the inhibition of initial microbial adherence. However, the flaw in many researchers' thinking was that all antibiotics behaved the same way at subtherapeutic doses. Most researchers also believed the difference between planktonic cells (individual bacterium) and biofilms (many bacteria) was virtually none. Bacteria are actually in biofilms for the duration of their existence. It is only when making the transition from biofilm to biofilm that the bacteria are in a planktonic state. The difference between planktonic cells and biofilms is that the latter are much more resistant to antibiotics than are planktonic cells. Researchers believed that they could treat antibiotic resistance by only examining planktonic cells, when in reality it can only be treated by looking at biofilm formation.

96-well microtiter plates were used throughout the experiment, as they go beyond Petri-dishes which are only able to test for planktonic cell growth and inhibition. Microtiter plates have the ability to test for biofilm growth and inhibition, as they can be introduced to a Victor 3-V Perkin Elmer, 595 nm, plate reader. As biofilms are the predominant state of bacteria, it was fitting to use a plate reader which tested for biofilm growth of *Haemophilus influenzae* after crystal violet had been added, followed by water, and finally the addition of ethanol.

The plate reader showed a significant biofilm spike for Benzylpenicillin. In other words, Benzylpenicillin was shown not only to fail at subtherapeutic doses, but also to cause patient health to drastically worsen as biofilm formation increased at such a low dose. This spike is what contributes to antibiotic resistance in patients.

Often times patients do not fully finish taking their antibiotics or are started on a sub-therapeutic dose. In the case of some antibiotics, such as Benzylpenicillin, this method leads to a rendering of a much more harmful bacterium than would have been present had no antibiotic been administered or had an MIC (Minimal Inhibitory Concentration) dose been put into place immediately.

HS-48

HERRIAGE, Stephanie
Microbiology 2006/2007

BACTERIA CAFETERIA: WHAT ARE YOU EATING WHEN YOU DON'T WASH YOU'RE HANDS?

A study was conducted in order to find out which everyday objects around a high school contain the most harmful bacteria.

Sterile swabs were used to take samples from various surfaces, and were then applied to TSA-LB agar. This is the standard agar that is used to culture samples which have unknown bacteria or fungi. The Petri-dishes were incubated for two days in an incubating oven at 35 degrees Celsius in anaerobic conditions. The oxygen was removed from the incubating oven by placing a lit candle inside which exhausted once the oxygen left in the incubating oven. On the second day, the Petri-dishes were removed from the incubating oven and one of many bacteria or fungal colonies was removed and streaked onto another TSA-LB agar Petri-dish. The second group of Petri-dishes were then incubated for two days in an incubating oven at 35 degrees Celsius, without carbon dioxide. Once these colonies had cultured and had grown into several isolated colonies, a colony was then removed with an inoculating loop and applied to a slide where it was then Gram-stained and later observed under an oil immersion microscope at 100x.

It was found that every surface that was swabbed had several different bacteria and fungi that had cultured. Some of the bacteria discovered are potentially harmful, such as *Escherichia Coli*, *Staphylococcus*, *Streptococcus*, and *Fusobacterium Necrophorum*. It is important to be aware of the bacteria present in the environment, so necessary precautions can be taken to prevent illness caused by bacteria or fungi.

HS-49

Caitlin Kim
Microbiology 2006/2007

INVESTIGATING BACTERIA UNDERNEATH FINGERNAILS

In order to find out if bacteria are different on the hands of a biter and a non-biter of fingernails, a study was conducted.

Sterile q-tips were used to take swabs of the hands and mouth of a fingernail biter and a non-biter. The q-tips were applied to agar Petri-dishes. The samples were incubated for three days at 34 degrees Celsius. After three days, the different colors of the colonies were noted. The bacteria were then gram-stained and observed under an optical microscope.

It was found that the hands of the biter contained a more varied array of bacteria then did the hands of the non-biter.

Every source tested contained bacteria. Some of the bacteria are potentially harmful, such as E. Coli, Staphylococcus, Streptococcus, and the Moraxella. It is important for a fingernail biter to be aware of the potential health hazards in transferring harmful bacteria from the hands to the mouth. Some of these bacteria, like E. Coli, can be fatal, so good hygiene and good health habits are essential for good health.

HS-50

KIM, John
Microbiology 2006/2007

OPTIMAL PHOTOPERIOD FOR THE GROWTH OF RED ALGAE *RHODOMONAS LENS*

Rhodomonas Lens is an important red algae species which plays an important role in many laboratory situations - as the food source of many gastropods, cephalopods, copepods, as well as echinoderm. Aside from being an important marine food source, this Cryptomonad species utilizes the fluorescent red protein phycoerythrin. By understanding the effects of different photoperiods, researchers are able to better utilize this algae species.

The general procedure was allowing several samples to grow for seven days under different photoperiods, and measuring the growth. A sample of algae was counted with the use of a hemacytometer, or an algae counting microscope slide. Then, algae samples were split, or diluted, to start out with a standard concentration of 1000 cells/mL. The timer was set and the samples were allowed to grow for the duration of one week. After one week, the final population was counted and recorded.

The results of the experiment show a great increase in *Rhodomonas Lens* populations as the photoperiods are increased to give more light. However, as the populations increase, the stability of the cultures generally decreases. The results also show a disproportionately large increase between the photoperiods of 12 hours light and 15 hours light.

The results are significant because of the changes in algal populations expected from temporal changes. Also, the large jump between the 12th and 15th hours of photosynthesis in Rhodomonas Lens suggests that there is something occurring between these two photoperiods.

HS-51

KIM, Katherine
MICROBIOLOGY 2006/2007

ISOLATION AND IDENTIFICATION OF MICROBES FROM SPINACH CONCENTRATE

This project's purpose was to isolate and observe the different microbes such as bacteria, yeast, and mold over a period of one week from spinach samples taken from bagged spinach.

Samples from the bagged spinach were obtained by adding water to the bag, then testing that water using sterile swabs to streaking agar plates for isolation. The spinach samples were applied to four different types of agar plates: Blood, CNA, MacConkey, and Sabdex, in order to isolate the bacteria from gram positive, gram negative and fungi. The plates were then incubated

at the microbiology lab in Harbor-UCLA medical center at 35 degrees Celsius except Sabdex plates which were stored in a room temperature incubator of 21 degrees Celsius. On the 24 hr, and 48 hr, the plates were taken out of the incubators so that bacterial growth, and number of different bacteria types that were visible on the plate could be recorded. After one week, the two samples were taken from each plate, gram stained, then later observed under the microscope to be further identified.

It was found that potentially harmful bacteria such as diphtheroids, staphylococcus aureus, Aerobacter Aerogenes, Campylobacter, E. Coli, bacillus, and fungi Penicillium, were possibly present in the bagged spinach. These bacteria can cause infections of the internal organs, suffocations from obstructed airways, urinary tract infections, nerve damage, and Otomycosis.

Every bag, including those that were ready-to-eat and were pre-washed, contained bacteria that could possibly cause illness. The findings from this project amplify the concern consumers have on buying fresh produce that do not undergo proper sanitation measures, and are often eaten without washing.

HS-53 NEJAD,Mona
MICROBIOLOGY 2006/2007

BIOFILM: CONTAMINANTS GROWING IN SCHOOL WATER FOUNTAINS

Biofilm is a haven for bacteria and exists in the pipelines of all water distribution system. The objective of the experiment was to investigate the relationship between the time intervals that a school water fountain was on and the amount of bacteria in the water. It was hypothesized that the highest bacteria levels would exist in the initial water samples taken, while the lowest bacteria levels would be found in the water samples taken 30 seconds after the water fountain has been on.

Water samples were taken while the school water fountain was running at four 10 second time intervals, starting at 0 second and ending at 30 seconds. Three trials at three different water fountains were conducted. The water samples were cultured and the different types of bacteria were observed under an oil-immersion microscope.

The results confirmed that, as expected, the bacteria counts dropped dramatically with each succeeding time interval. In terms of percentages, during the first 10 second interval, in average the bacteria count reduced by 71%. The second 10 second time interval reduced the bacteria count by another 22%. In the third 10 second interval, there was an additional 5% drop.

It is concluded that running the water fountains in schools, or any other facility, prior to drinking the water can greatly reduce the bacterial exposure. Due to the health implications of this conclusion, it is recommended that the government takes steps to protect its citizens from harmful exposure to the bacteria in water fountains.

HS-55

SHIMIZU, Aimee
MICROBIOLOGY 2006-2007

THE EFFECTS OF PHOSPHATE ON THE GROWTH OF ENTERIC BACTERIA

This project stemmed from the research done on phosphates in relation to its effect on the growth of aquatic plants and algae. Instead, however, the study was done to determine the effects of phosphate on the growth of enteric bacteria, which can be isolated from most environments with relative ease.

Water samples were collected from the sump at Madrona Marsh, a vernal marsh located in Torrance. Dilutions were made using the collected sump water and varying amounts of sodium phosphate. Afterwards, 1 ml of each water sample was plated onto separate MacConkey agar plates, and left to grow in an incubator for 24 hours. At the end of the 24 hour duration, the plates were taken out and the number of bacteria colonies counted.

Dilutions of 1000.30 mg/L and 100.30 mg/L increased the populations by 69.4% and 54.8%, effectively stimulating the growth of enteric bacteria. Dilutions at 10.30 mg/L, 1.30 mg/L, 0.60 mg/L, 0.55 mg/L, 0.50 mg/L, 0.45 mg/L, and 0.40 mg/L all effectively inhibited the growth of enteric bacteria, reducing its growth by at most 100%.

The results of this project show that with high concentrations of phosphate, the populations of enteric bacteria expand enormously, while low concentrations seem to considerably inhibit its growth. This growth pattern proves that enteric bacteria rely on phosphate in order to carry on daily functions.

HS-56

Slaught, Christa
MICROBIOLOGY 2006/2007

CHANGES IN BACTERIA ON RED-EARED SLIDERS FROM THE PET STORE ENVIRONMENT TO HOME

Pet store habitats for *Trachemys scripta elegans*, commonly known as red-eared sliders, are especially stressful for the turtles. The overwhelming number of turtles in the aquarium combined with the daily commotion of customers lead to a stressful environment that leaves the turtles prone to bacterial infections. The bacteria that cause these infections are not only harmful to the turtles, but to the pet store employees as well. This project tested whether a less stressful home environment would lessen the presence of harmful bacteria on the turtles.

Two red-eared sliders were purchased and a similar enclosure to that of the pet store was set up for the turtles. The day the turtles were purchased, and again two weeks later, the turtles were swabbed in three regions: the outer shell, the neck, and the cheek. The cultures of bacteria were incubated and identified using the gram staining method and an oil immersion microscope.

The first set of data from the day the turtles were purchased revealed four different types of bacteria. Gram negative rods, most likely E. coli, were predominant. The second set of data from two weeks later only revealed two types of bacteria, and neither was identified as E. coli.

In the two week period that the turtles were first brought home as pets, there was a decrease in the number of different types of bacteria identified under the microscope. The absence of E. coli could be due to the fact that fewer turtles produce less fecal matter to swim

around in, but the more anxious of the two turtles had more variations of bacteria on its body in both trials, which could be related to stress.

HS-57

YOON, Stephanie
MICROBIOLOGY 2006/2007

SUSCEPTIBILITY PATTERNS OF *PSEUDOMONAS AERUGINOSA*

The purpose of the experiment was to determine the susceptibility patterns of type I *Pseudomonas aeruginosa,* an opportunistic bacteria responsible for nosocomial, hospital-related infections, and also found in cystic fibrosis patients. Determining susceptibility patterns is imperative to find new combinations of antibiotics that can combat these bacteria.

In order to determine whether the synergy of the antibiotics were more effective, much preparation had to be taken for all hundred and thirty synergy tests. First, the *Pseudomonas aeruginosa* bacteria had to be sub-cultured on standard agar in a 35ºC incubator with no carbon dioxide present. Once viable after twenty-four hours, a small amount of bacteria were taken and adjusted to a 0.5 McFarland turbidity standard. After being adjusted, they were then spread on Mueller-Hinton agar. It is on these Mueller-Hinton agars that the 5 different classes of antibiotics were placed within five to six millimeters from each other. These antibiotics include imipenem, ciprofloxacin, amikacin, ceftazidime, and cefoperazone. After, the synergy tests were placed in another incubator at 35 ºC with the presence of carbon dioxide. After twenty-four hours, the diameters of the zones of inhibition created from the antibiotics were measured and recorded. Through the diameters, the *Pseudomona aeruginosa* were classified as susceptible, intermediate, or resistant. A two-sample chi-square test was used to analyze the resulting data.

Using the chi-square tests, it was found that *Pseudomonas aeruginosa* were highly resistant to the antibiotics ciprofloxacin and amikacin, representing classes fluoroquinolones and aminoglycosides respectively. In contrast, the same strain was intermediately susceptible to imipenem, ceftazidime, and cefoperazone. However, *Pseudomonas aeruginosa* can easily adapt and will soon resist these classes of antibiotics as well unless if scientists can find newer antibiotics or better understand the structure and functions of some of the bacteria's resistance mechanisms.

HS-58

KAUFMAN, Katherine
PHYSICS 2006/2007

HYSTERESIS OF WATER-BASED MAGNETORHEOLOGICAL FLUID

The purpose of this project is to determine whether the form of wear known as hysteresis is present in water-based magnetorheological fluid. In order to work properly, magnetorheological fluid must be able to change to the proper viscosity instantly, and residual effects from magnetization may hinder that. Magnitude of hysteresis on a basis of different magnetic field strengths was also to be determined.

The fluid's viscosity was measured using a torque viscometer at a set rotation rate. The cup holder was wrapped in copper coil to create a solenoid electromagnet into which voltage

from a DC power supply could be supplied. Voltages of two, three, and four Volts were applied, five rounds of ten-second intervals with forty-second intervals in between, as different tests.

The average initial unexcited viscosities for the three tests were 166759.3, 168958.4, and 68622.54951 mPa*s. For the first test, the unexcited viscosity rose approximately 10,000 mPa*s after each excitation. The same values for the second and third tests were approximately 10,000 and 5,000 mPa*s respectively.

These data show that after excitation the fluid contains hysteresis, as the fluid is reluctant to return to its original viscosity. Any correlation between the magnitude of this hysteresis and the amount of magnetic field created was not found.

HS-59

KIM, Timothy
Physics 2006/2007

CALCULATING PLASMA DENSITY WITH AN INTERFEROMETER

This experiment was conducted to see if the calculation of the plasma's density could be calculated using a microwave interferometer. Plasma is a common form in the universe, and scientists are studying this matter to be put into use. The knowledge of the radial distribution of the plasma density in a column is fundamental to understand much of plasma's properties. The understanding of this phase could help scientists use plasma for more human purposes like energy.

The plasma was contained inside a plasma chamber, and a probe measured the relative densities of the plasma at different radial positions inside the plasma. The interferometer was then used. A microwave beam was split into two beams so that one wave traveled through the plasma and back into the interferometer while the other wave traveled through the air. The two waves were then mixed in a nonlinear crystal and the phase shift was recorded. The fringes, or phase shift, were compared to the relative densities of the plasma taken by the probe to find the actual average density of the plasma. The radial density was found through normalization.

The relative densities of the plasma taken from the probe were found. The phase shift turned out to be 13.94 pi. The phase shift was used to calculate the actual densities of the plasmas at 42 different points. When checking with integration, the phase shift was 13.89 pi. There was a percent error of -.36%.

The data showed that the microwave interferometer can accurately calculate the density of the plasma at different radial positions within the plasma based on the measurement of the phase shift.

HS-60

VAISH, Anshu
Physics 2006/2007

THE SHEAR STRESS OF MAGNETORHEOLOGICAL FLUID AND ITS PRACTICAL APPLICATION IN THE MORPHING OF AIRPLANE WINGS

Magnetorheological fluid is a prime example of today's smart fluids. The fluid is normally hydrocarbon based and contains suspended magnetic particles whose dipoles align with magnetic field exposure.

This project aims to study the shear stress of magnetorheological fluid. Shear stress is defined as stress which is directed parallel to the material's face, in this case the magnetorheological fluid. Furthermore, the project aims to provide a manner in which magnetorheological fluid can be applied to the morphing of airplane wings.

Shear stress measurements were taken as the magnetorheological fluid was exposed to varying voltages of an electromagnet. The stress was measured using a simple pulley system and a glass plate which rested on a thin layer of the magnetorheological fluid. Upon activation of the magnetic field at varying voltages, weights were attached to the end of a string which ran over the pulley and was attached to the glass plate. Upon "shearing" one centimeter, the weight required was recorded and shear stress measurements were completed for the varying voltages. Measurements such as these were taken also at varying thicknesses of magnetorheological fluid.

As voltage of the electromagnet, and therefore magnetic field strength, increased, the viscosity of the magnetorheological fluid also increased. This increase in viscosity correlated closely with an increase in shear stress; therefore, as voltage supplied increased shear stress increased.

Information gained from the sheer stress of magnetorheological fluid can be applied to the morphing of airplane wings. Airplane wings can be made to resemble a bird's wing with individual feathers. These individual "feathers" of a complete bird wing would be translated into several different pieces of a single airplane wing. Each "piece", through magnetorheological fluid shearing, can be shifted in position to morph the airplane wing.

HS−61

WOO, Geoffrey
PHYSICS 2006/2007

DYNAMICS OF PASMON TRANSFER IN NANOPARTICLE ARRAYS

The paper characterizes the behavior of localized surface plasmon polariton (LSPP) propagation in two-dimensional metal nanoparticle arrays. As nanotechnology seeks to decrease the size and increase the efficiency of integrated circuit devices, current methods - based on electronics or optics - for data transmission and processing will reach their intrinsic limits. Plasmonics, based on surface plasmons or excited surface electrons on metals, has been proposed as a new approach that synthesizes the advantages of electronics and optics. Using a quantum scattering theory based on the exciton model for excitations, we develop and use algorithms in Fortran, Matlab and Mathematica to computationally model and analyze the LSPP propagation. Focusing on the "optical" behavior of plasmon propagation, the study simulates plasmon propagation in an array of nanoparticles of two disparate densities. Results describe an analogue to Snell's Law for classical optics for plasmonics and a second order polynomial relation between the magnitude of the initial momentums of the LSPP with the probability of transmittance through the interface between two different nanoparticle arrays. The results add a greater understanding behind the characteristics of surface plasmons and may contribute to the development of new, exotic materials and devices.

HS-62

BONNELL, Nicole
ZOOLOGY 2006/2007

INVESTIGATING THE REAGGREGATION OF DIFFERENT SEA SPONGE SPECIES

Studying the behavior and reaggregation of sea sponge cells can be very beneficial in the medical field and highly valuable to help doctors understand why some patients reject organ

transplants. The interaction and cell-to-cell recognitions systems of sea sponges are like those in human cells, on a much more basic level. Reaggregation can be observed in various ways. For example sea sponge cells can be mechanically dissociated and left in a Petri dish with water and allowed to "reattach" themselves to one another to reform into a single mass. Another way to observe reaggregation is to place two separate pieces of sea sponge together so that they are in physical contact with one another and let them sit undisturbed and attempt to "reattach" together and for a single piece of sea sponge. The highly regenerative properties in sponges allow their cells to reaggregate with one another. These highly regenerative properties are clearly shown in the asexual reproduction of sea sponges.

The three species of sponges used in this experiment were the Bath Sponge (Officinalis Adriatic), the Orange Puffball Sponge (Tethya Aurantia), and the Red Ball Sponge (Cinachyra allocladia). Reaggregation was tested in two different temperatures of water (warm: 21.05 degree Celsius; cold; 13.55 degrees Celsius) and the three different species of sponges were tested against one another. A piece of sponge was cut from each specimen and paired with a piece of sponge of a different species. The two pieces were sandwiched between slides and hung in experiment tanks. The two pieces were allowed 3 weeks to reaggregate.

The results showed that reaggregation occurred in both the warm and cold water samples. The orange vs. yellow and orange1 vs. orange2 sponge combinations displayed successful reaggregation in both water temperatures. The red vs. yellow combination did not reaggregate in either water temperature. Finally the orange vs. red was the only sponge specie combination to show a difference in reaggregation between warm and cold water. The orange and red sponges did not reaggregate in warm water but they did reaggregate in cold water. However reaggregation occurred in trial 1 but not in trial 2.

It was concluded that reaggregation between the Orange Puffball and Red Ball Sponge is only slightly more successful in cold water rather than warm water and reaggregation between the Orange Puffball and Bath Sponge is not affected by water temperature.

HS-63

BOTZONG, Laura
ZOOLOGY 2006/2007

HOW DOES NITATE OR PHOSPHATE POLLUTION AFFECT THE SURVIVORSHIP OF PURPLE SEA URCHINS

The purpose of this experiment was to determine how nitrate pollution and phosphate pollution affect the survivorship of purple sea urchin larvae. It was hypothesized that a mixture of nitrates and phosphates would positively affect the survivorship of purple sea urchins. Since the algae on which the larvae feed thrive in conditions with high nutrient levels, conditions with more nutrient pollution will be beneficial to the larvae. In order to test this, purple sea urchin larvae were raised in four tanks: a control tank, a tank with added nitrates, a tank with added phosphates, and a tank with both nitrates and phosphates added. The number of larvae in each tank was counted after 28 and 32 days. The data did not support the hypothesis, as the control tank had the highest number of larvae, followed by the nitrate tank. All the larvae in the phosphate and nitrate-phosphate tanks perished before the data collections were performed. In conclusion, phosphates and nitrates at the levels tested are detrimental to the survival of purple sea urchin larvae, with phosphates having a stronger negative effect than nitrates. Evidently, the negative effects of the nitrate and phosphate pollutant chemicals on larval development outweighed any additional algae growth they may have caused.

HS-64

DHAWAN, Vikram
ZOOLOGY 2006/2007

SOIL PREFERENCES OF LINEPITHEMA HUMILE IN THEIR NATURAL HABITAT

Many citizens of the United States spend hundreds, even thousands of dollars a year in numerous failed attempts to eliminate these six legged pests from their homes. Individuals have used all kinds of methods to exterminate these ants, but most have never been successful in ridding themselves of these pests for long periods of times. Many of the methods they use are expensive and ineffective and only result in the elimination of the ants for a few weeks. One way to ensure that these ants stay away from one's home is to determine the type of soil they dislike and incorporate that soil into their homes. An experimented was conducted that determined the soil that ants dislike.

The five most basic soils found in an individual's home were gathered, deposited it into five different ant farms, 200 argentine ants were then let loose in the five combined ant farms and observed to determine the soil they favored most and the one they favored the least.

Through this experiment, the soil ants prefer most and the soil they prefer the least was found by allowing the ants to choose from a selection of the five most basic soils found in an American's home.

The conclusions of this experiment were that ants seemed to prefer the mixture of sand and mud the most and seemed to dislike the mixture of clay and silt just as I had hypothesized.

HS-65

GUERIN, Julie
ZOOLOGY 2006/2007

Protocols for *Haliotis rufescens* Egg Cryopreservation and *In Vitro* Fertilization (Year 2)

Gamete cryopreservation can play an important role in conservation strategies for at risk abalone species. The purpose of this study was continue investigating cryopreservation protocols which would yield results for viable red abalone (*Haliotis rufescens*) eggs after thawing. The objectives were to determine whether eggs which exhibit normal phenotype after thawing can be successfully fertilized with live sperm, and to evaluate propylene glycol (PG) as an alternative cryoprotectant agent (CPA) to dimethyl sulfoxide (DMSO).

After induced spawning and egg collection, eggs were frozen using cooled or uncooled DMSO or PG at 8 and 16 mins stepwise cooling at 14, ≤ 4, -40 degrees C, before plunging into liquid nitrogen. A total of 26 stepwise thawing protocols (5 mins at -40, ≤ 4, 14 degrees C with 1.25g or 2.5g non-permeating sucrose/80ml water) and 20 *in vitro* fertilization tests were conducted.

Best results were found in protocols using PG at 8 and 16 mins stepwise cooling and stepwise thawing with 1.25g sucrose yielding 90% to100% (8 mins) and 75% to 80% (16mins) intact round eggs with clear chorion. Both 8 and 16 mins PG protocols with 2.5g sucrose during thawing yielded less than 10% such eggs. Protocols using uncooled or cooled DMSO stepwise cooling and thawing with 1.25g or 2.5g sucrose yielded intact round eggs ranging from 10% to 25% (8 and 16 mins), but such eggs displayed little or missing chorion. Remaining eggs in these protocols were irregular. Sperm orientation towards eggs during *in vitro* fertilization attempts occurred only in PG trials. No cell division occurred in any trial.

PG appears to be more effective as a CPA than DMSO as chemical signaling between sperm and eggs with release of the egg chemoattractant (L- tryptophan) remained bioactive after cryopreservation. However, it appears that fertilization failed due to damage to the egg by CPA toxicity, ice crystallization or other factors during cooling or thawing. Further research will involve refinement of protocols.

HS-66

HADIDJAJA, Kevin
ZOOLOGY 2006/2007

THE EFFECT OF WATER CURRENT ON AURELIA AURITA EPHYRA

The experiment's purpose was to determine the direct relationship between the water current of a jellyfish's (*Aurelia aurita)* environment and the growth of the ephyra. The conclusions stemming from the project is extremely beneficial to the successful breeding of jellyfish in aquariums around the world.

To begin, there were two trials conducted to ensure the validity of the project. During these two projects, five tanks were set up each with a different water flow. Each tank had a flow of 60 mL/min, 120 mL/min, 240 mL/min, 360 mL/min, and 480 mL/min respectively. In the first trial, 10 ephyrae were put into each tank, and in the second trial, 5 ephyrae were placed in each tank. While these ephyrae were growing in the different tanks, they were measured weekly for size and survival.

In the first trial, the 5th tank (480 mL/min) had the best results with one of the higher survival percentages and the highest average size at the end of the trial. The 4th (360 mL/min) and 2nd tanks (120 mL/min) also proved to be successful. In the second trial, the fourth tank reigned supreme with both the highest survival rate and the highest average size by the end of the trial. Because the 4th tank had very good success in both trials, it can be concluded that 360 mL/min is ideal water current for the development of jellyfish ephyrae.

The conclusions coming out of this experiment help marine biologists by giving a specific ideal water current for the breeding of *Aurelia aurita*. The results can provide more rapid and predictable development in ephyra growth.

HS-68

JOO, Ina
ZOOLOGY 2006/2007

Efficacy of Insulin Resistant Herbal Remedies on Drosophila Hydei Fruit Flies

Drosophila Hydei fruit flies are greatly used in research especially on the field of genetics. Due to their short life span, fast reproduction and their low cost, many researchers prefer to conduct their critical experiments on them. Moreover, fruit flies have a similar system of producing molecules and comparable mechanism for regulating blood sugar.

Because of its comparable system to those of human beings of controlling blood sugar levels, the experiment tried to determine the efficiency of herbal remedies on the fruit flies that lived in a high sugar diet. Two insulin resistant herbal remedies were tested: Gluco-Science and DBCARE. There were two control groups: one containing only distilled water and the other containing distilled water and half a teaspoon of sugar. One pill of each herbal remedy was added in the each vial with water and sugar. The four vials were plugged and set in an environment with a temperature varying from 68□ to 77□.

Through a period of a month, it was found that the fruit flies from the vial containing only sugar and water had the most reproducing yet the highest rate of death. Furthermore, the fruit flies in the vial containing the herbal remedy DBCARE had a higher reproduction and a lower rate of death than the fruit flies in the vial with Gluco-Science. From this experiment, the D. Hydei fruit flies were proven to be a useful part in the finding of the efficiency of drugs such as insulin resistant herbal remedies.

HS-69

KWAN, Stephanie
ZOOLOGY 2006/2007

COMPARISON OF VARIOUS SPICES IN REPELLING DROSOPHILA

The fruit fly (*Drosophila melanogaster*) is a frequent annoyance to any who have left fruit uncovered for too long. There are many spray products sold in local stores which can be used to get rid of these flies. Yet these products contain chemicals which may be harmful to the person who ingests the sprayed fruit. In this research, various household spices were tested to determine if any could be effective in repelling Drosophila from fruit.

The research attempted to discover if any of the tested spices could ward off Drosophila. In experiments, banana slices were covered with different spices and placed in beakers. Spices included red pepper, mint, basil, bay leaf, and cinnamon. About 50 Drosophila were placed into each of the beakers. The number of Drosophila located on the spice covered banana slice was recorded at intervals of 15, 30, 45, and 60 minutes with 3 trials for each spice.

After experimentation, it was found that not many Drosophila landed on any of the spice covered banana. On average, red pepper attracted the greatest number of Drosophila, while cinnamon attracted the least.

The results demonstrate that the spices used were effective in repelling a majority of the Drosophila. Evidently, the strongest spice repellent tested would be cinnamon. By using natural substances, such as spices, in place of chemical spray to repel Drosophila, many people will not have to worry about consuming possibly dangerous substances.

HS-70

KWON, Sunwoo
Zoology 2006/2007

Effects of a Biotic Factor of Pyrethrum on theBehavior of *Iridomyrmex humilis*

Many researchers have proposed that ants, and other insects in general, avoid the naturally occurring chemicals found in *Chrysanthemum* flowers. Although many people use insecticides to kill these ants, people find this useless and futile and are philosophically against the use of synthetic chemicals as they have been proven to be harmful to human health and the environment.

To find a credible solution to this issue, the foraging activity and communicating ability of argentine ants, *Iridomyrmex humilis,* were studied under different concentrations of pyrethrum as the insects' surrounding environment. The study was conducted in the human living environment in Palos Verdes, California.

Using argentine ants, it was previously assumed that as the concentration of pyrethrum increases, the number of ants that pass this chemical barrier would decrease. This research experiment was designed to determine how effective pyrethrum can be in repelling argentine ants. Ants were released at the center, which was surrounded by barriers of different pyrethrum concentrations, and food was put around the edges of a platform to lure the ants. Significantly, after researching between 7:00 P.M. and 12:00 P.M., the results of the experiment showed that people had known false information about the potential effects of *Chrysanthemum flowers*; the pure pyrethrum cannot stop ants with huge efficiency.

As a result, now people can understand that pyrethrum is inefficient in preventing argentine ants from invading designated places and that other chemicals are needed to make an effective insecticide. People should look for different means of stopping ants with changes in environment other than pyrethrum.

HS-71

LIM, John
ZOOLOGY 2006/2007

CORRELATION BETWEEN AN INCREASE IN EXTERNAL TEMPERATURE AND THE DIAMETER, DEPTH, AND DECLIVITY OF THE PITS OF *NEUROPTERA MYRMELEONTIDAE*

Notable for its queer appearance and "hunting" tactics, Neuroptera Myrmeleontidae, more commonly known as the ant lion or the doodlebug, is one of the unknown insects in the insect kingdom. Much research has been conducted on the minute creature, however, the correlation between an increase in external temperature and pit construction has yet to be found and the current research was conducted to find the existence of such correlation.

Starting out with an initial temperature of 72°F, each day the external temperature of the experimental group, consisting of twelve test subjects, was increased by one degree Fahrenheit. Two heating lamps were used to reach the desired temperature. To measure the increase in pit sizes, Neuroptera Myrmeleontidae was excavated from its former pit and was dropped into new sand for it to dig into. Until temperatures of 114°F were met, the procedure was followed and soon ensued the conclusion of the research.

In contrast to the control group, the experimental group experienced an increase in pit size, in regards to length of diameter, the length of the depth, and the angle of slope, suggesting a correctly predicted hypothesis. Indeed, as suspected, the lengths of the diameter and the depth were increased while the angle of slope augmented, making the pit more of a sharp decline of slope.

With the fluctuations of growth in the *Neuroptera Myrmeleontidae*'s pits, the effects of the external temperature are magnified thus providing evidence for the significant effect temperature has on ant lion pit construction. Therefore, such correlation between external temperature and pit size does exist.

HS-72

OTTO, Brian & ZENG, Johnny
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THE EFFECT OF LIGHT ON OCEAN CORALS

Most of us know that the world is warming due to global warming. If you don't, then you're probably a conservative republican who fails to see or accept the implications of global warming which is ultimately caused by human activities. Global warming along with human wastes, pollutants and excess sediment run off into the ocean have imbalanced the clean water conditions that corals need to survive. It is these conditions that are estimated to doom 80% to 90% of the coral reefs in parts of the Caribbean. In addition, 85% to 95% coral bleaching has been reported in Puerto Rico. What variable or variables have caused this extensive coral bleaching?

That's where our experiment comes in. Since the ozone layer is disappearing and the earth is warming due to global warming, there is bound to be more sunlight hitting the earth. However near drains which dump human wastes and pollutants, there may be a large growth of algae which blocks out the sun. To address one of the many possible variables that cause coral bleaching, we have decided to see how corals respond to no light, normal lighting, and excessive lighting conditions. These conditions help mimic the light conditions that corals deal with in their natural environments. We planned this experiment in hopes to address whether or not light is a factor in coral bleaching.

Our hypothesis states that we think that the corals in the no light and excessive lighting tanks will experience coral bleaching while healthy conditions will be observed in the corals in the tank with the normal lighting. In our findings, we found that the corals in the "no light" tank experienced about the same results as the corals in the excessive lighting tank. The corals in both tanks lightened in color, shrank, and appear to be at the initial stages of coral bleaching. This allows us to draw the conclusion that light does indeed affect corals and the amount of light can determine whether or not the coral survives. In this case no light or too much light can result in coral bleaching.

HS-74

Ueda, Daniel
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AN OBSERVATIONAL STUDY: ANTLIONS' SURVIVAL RATE IN DIFFERENT ENVIRONMENTS

This project dug down to find out if antlions survive better in different environmental conditions for a period of six weeks.

Myrmeleon crudelis walkers were the species of antlions studied and used in this experiment. Four types of soil were filtered out with different instruments to obtain four different particle sizes to create four different types of environments for a group of eight antlions and in a period of six weeks. The antlions were observed in four man-made environments. Data on survival rate of antlions were recorded as well as any unusual behavior.

The change of particle sizes had no distinct effect on any certain type of surviving antlions, although, if the test was a little bit longer, then maybe more accurate data could have been collected. Increased feeding habits were noted in the finer grained sand, as well as different ways of catching prey were noted. Food was monitored as well.

Since the time frame was very constricting, the study wasn't able to get much into detail. It is suggested that further research should be done on this topic to help clarify whether or not different environments does matter in survival rates of antlions. For an unusual type of animal, this study was able to help provide useful and rare data on such an important type of science that has been neglected for some time.