BEHAVIORAL & SOCIAL SCIENCES

1
Maziar Amini
Behavioral & Social Science

The Effects of Long Term Exposure of Color on Performance Attainment

Andrew J. Elliot performed an experiment in which 71 college students were given a test. All the tests were the same, except that some students had a test number printed in either red, green, or black. The results showed that the students who had a test number in red had a significantly lower score that those who had a test number in either of the other 2 colors. This result is quite important because some students may be given a disadvantage if they are given a test in one color rather than another. It creates an unequal learning environment. This test, however, only tests the effects of short term exposure to the color. My experiment tests the effects of long term exposure, as the entire test is printed in the color, not just the test.

25 high school students were give 3 basic multiple choice math tests. They were given 2 minutes to complete each test. Each test was printed in either red, black, or green ink. After all 25 students have taken their tests, the data was then analyzed by taking the mean of all the tests taken of that specific color.

The results showed that a significant number of the high school students tested had lower scores with the red tests compared to the black and green tests by almost 3 or 4 points. On an individual basis, every student showed roughly the same difference in their results, by nearly the same margin.

Therefore, students who take tests in the color red could be given a significant disadvantage compared to students who take tests in other colors.

2
BAI, Ruipeng
BEHAVIORAL AND SOCIAL SCIENCES
2012

Different Ants? Different Route?

There are many different kinds of ants, such as Harvester and Argentine Ants. Ants always leave a phenomenon trail no matter where they go (Moody). If two kinds of ants, Harvester and Argentine Ants both leave a phenomenon trail would they follow the other species' trail or will they only follow their own?

` A maze with only one way to the finish line and four to five dead ends is used to test this idea. A paper outline is used to see if each group of ants will follow the other ant's trail and a stop watch is used to examine the time difference between one group of ants that have a phenomenon trial to follow and one that does not.

After four days of running each group of ants, there were no major difference between the times nor did the two groups of ants follow the other group. However, while the two groups of ants were in their ant farm, Harvester ants took the sand from the bottom of the farm to the top because the food where too big to fix in the ant farm's hole. During the experiment, Argentine ants were much faster in finishing the maze. This was not due to the phenomenon trail the Harvester left behind but due to the fact that Argentine ants are much quicker and faster than Harvester ants.

With the time and the different marks on the outline, this clearly displayed that ants does not follow other ant's phenomenon trail.

3
KERKHOF, Delaney
BEHAVIORAL AND SOCIAL SCIENCE2012

The Effect of TRPV1 Stimulation on Academic Performance

The purpose of this research is to determine how stimulation of Transient Receptor Potential Cation Channel Subfamily V Member 1 affects academic performance.

First, the participants completed a timed math pre-test. Shortly afterwards, they ate a mild hot sauce containing a small amount of capsaicin, which binds to TRPV1. Then a timed math post-test containing similar questions was administered to the participants. The control group of participants drank water instead of hot sauce. Ultimately, the individual changes between pre-test and post-test scores were recorded and the changes in score were averaged for each group.

On average, the post-test scores of participants who ate hot sauce lowered 2.97% compared to their pre-test scores. On the other hand, the control group's post-test scores rose an average of 4.97% from their pre-test scores.

The academic performance of participants who ate hot sauce decreased because those participants were experiencing a slight amount of pain while taking their post-tests. This pain hindered their test-taking abilities, and therefore negatively affected their post-test scores. The academic performance of participants in the control group did not experience this distraction and they were able to take their tests unaffected.

4
KIM, Sarah
Behavioral and Social Sciences
2012

Correlation Between Pattern Detection and Artistic Abilities

The purpose of this experiment was to determine whether or not those involved in art, dance, or music would affect pattern detection in some sort of way. An objective of this project was to find whether or not artistic students scored higher on a pattern detection test over those who are not involved in the arts.

To begin experimentation, students were gathered to be the test subjects. Each participant and his or her parents signed a consent form to allow this. Next, the students voluntarily took a survey and then a pattern detection test. The survey was to determine artistic abilities and question intelligence levels so that the results would be based purely on pattern detection rather than how smart the student is. The volunteers were Peninsula High students from all grades.

Ultimately from this experiment, it was discovered that having artistic abilities slightly affected pattern detection in a positive way. While those with higher GPAs definitely scored higher than those with lower GPAs, artistic abilities barely gave students a better score.

With these findings, the hypothesis is rejected. Even though there was a slight increase of scores from the students who are involved in dance, music, or art, there was not enough data to prove that artistic ability increased pattern detection. The correlation was not strong enough to show that the hypothesis is true.

5
LIN, Jenna
BEHAVORIAL AND SOCIAL SCIENCES

Correlation of Visual Search and Reflexes

The project tests the reflexes of students and their performance in a visual search test to discover whether visual search and reflexes have some type of correlation. The idea was tested to find whether a person who has faster reflexes also happens to be faster at finding hidden items or words because of a quickened ability to react to stimuli. A word search and screen-changing timer were used to test students.

A word search puzzle was made, incorporating words that started with every letter of the alphabet with a total of twenty-six words to be found in the puzzle. A reflex screen color changer test was acquired and given to thirty high school students to take, along with the puzzle, which each person was given one minute to complete. The reflex test was given ten times to each student in one sitting, and all ten reaction times were averaged.

Principal findings from the experiment data demonstrated that students tended not to find more than four words from the word search, with a mode of two words. The reflex times ranged from 0.369 to 0.556 seconds. Reaction times were centered mainly at 0.400 seconds with few outliers.

The data, when analyzed, showed that there is a peculiar sort of correlation because the correlation is only present between certain data points. The data for four, three, and zero words found shows one correlation, while the data shows a separate correlation between two and one words found in relation to reflex times.

6
Darius Martins
Sean Bonyadlou
Behavioral & Social Sciences

Does Smell Affect Taste?

We conducted our experiment on the effect that smell has on taste. After researching for several weeks we hypothesized that smell would affect taste due to it being a more dominant sensory organ. We then conducted a blind taste and smell test using fifteen test subjects. We asked our subjects to taste and identify several household foods while blindfolded and deprived of their sense of smell. The subjects were able to correctly identify the item they were eating a fractional amount of the time. They were predominantly incorrect when choosing the fruit and we concluded that our hypothesis was correct. We were then curious as to why the scent of a food affected taste and decided to research further. Through our research we found that taste buds allow us to perceive only bitter, salty, sweet, and sour flavors. It's the odor molecules from food that give us most of our taste sensation. Our research confirmed our conclusion thus validating our experiment.

7
MASHAYEKH, Mahnush
BEHAVIORAL & SOCIAL SCIENCES

Cultural Ideals of Beauty through Plastic Surgery

The study discovered whether cosmetic reconstruction was creating identical drones for society, or preserving individuality by enhancing the ethnic features of a patient. Despite the continuous rise in plastic surgery, society is not in danger of a uniform population. With the rise in ethnic plastic surgery, surgeons have had to adapt to new methods in order to satisfy patient's specific ideals of beauty. Surgeons have had to shift away from traditional Eurocentric features to accommodate a more diverse clientele. Perseverance of ethnic identity has been an important motif throughout findings; requested from patients and well known by plastic surgeons. The findings supported my hypothesis that due to the different ideals of beauty, individuality may be preserved in the face of plastic surgery.

8
PAIK, Erin
BEHAVIORAL & SOCIAL SCIENCES

Academic Melody
Effects of Different Music Conditions with Standardized Tests

Music is a big part of a student's life, especially while studying. This experiment tested under what conditions students were able to perform and concentrate best. The musical environments were tailored to the student. There were three different conditions; no music, favorite music, and hated music. They chose what music they wanted to listen to as they took the test. The students came from Palos Verdes Peninsula High School, South Torrance High School, and California Academy of Math and Science, all 10th graders. Each student was given 3 SAT reading comprehension tests taking 15 minutes each. First with no music, then with the favorite music, and then with music he or she disliked. The highest scores were the tests with their favorite type of music. The data collection showed that the tests that were taken with music the students disliked had a negative effect on the test scores therefore the lowest.

9
PARK, Robin
BEHAVIORAL & SOCIAL SCIENCE

EFFECTS OF COHABITATION IN BEHAVIORS OF LINEPITHEMA HUILE AND PRENOLEPIS IMPARIS

Effects of Cohabitation in Behaviors of *Linepithema humile* and *Prenolepis imparis*
Ants live in highly structuralized and exclusive colonies maintained by a strict nestmate recognition system. It is known that cuticular hydrocarbons (CHCs), derived both genetically from intracolony breeding and environmentally from food and habitat, provide the main chemical cues used for discrimination between nestmates and intruders. Aggressive behavior is common among conspecific ants with vastly different cuticular chemical compositions. In this research, the possibility of environmental factors influencing inherent discriminatory patterns between two ant species was tested. Members from the species *Linepithema humile*, the Argentine ant, and *Prenolepis imparis*, the winter honey ant, were intermixed in a controlled environment. Initially the ants displayed aggressive behaviors toward the members of the other species and remained territorially segregated, avoiding contact with the other species as much as possible. Over a period of three days however, the two species began spreading out from their segregated communities and approached one another without aggressive behavior though interspecies interaction was still largely limited. Results support the idea that cohabitation in a controlled environment, influencing the cuticular chemical composition of ants, can override genetic cues and reduce aggression among members of different ant species,

but only to a certain extent in that integration is largely achieved by increased indifference rather than cooperation.

10

Shim, Ashley
Behavioral and Social Sciences

The Effect of Urban Noise Pollution on Memory

The objective of this project was to analyze the effects of urban noise pollution on the memory of 16-17 year olds. The data would represent how severely noise pollution could impact the concentration of these teenage students. The results would also help determine what type of environment is best for high school students to learn in.

In this experiment, 10 subjects participated, all between 16-17 years old and all with a GPA between 3.0-4.0. The 10 students were presented with 20 words to memorize for two minutes. The experimental trial had a simulated urban noise pollution sound track that the subjects would listen to. Short term and long term memory were tested in the experiment.

The major finding of this experiment, was that short term memory between both control and experimental trials differed by 0.05%, but long term memory differed by 54.9%. The averages did overall show decrease with the urban noise pollution sound effects.

Bases on the results, a conclusion can be made that urban noise pollution has a greater negative impact on long term memory than on short term memory. Short term memory seems to be relatively unaffected by noise.

11

SHIM, Kaitlyn

THE STROOP EFFECT

The objective of this project was to analyze the Stroop Effect on 13-15 year old females and 13-15 year old males. The main purpose of this experimentation was to determine if the females could perform the Stroop Effect dominantly than the males or vice versa. This test is used to measure an individual's selective attention, cognitive flexibility, and processing speed. The participants would be able to learn that the Stroop Effect could be used to improve the abilities of individuals and increase the changes of good judgment and decisions in actual life situations.

In order to test the Stroop Effect on genders, 10 females and 10 males from Palos Verdes Peninsula High School were needed. The individuals were given the test and were timed. Precautions were taken into account and made sure that no participant was color blind. The results were anonymous and recorded in seconds. After, the average of the time was taken for each gender to read the Stroop Effect and compared.

The data collected showed that the males had an average of 12.39 seconds to read the Stroop Effect and the females had an average of 13.67. Therefore, the 13-15 year old males performed the Stroop Effect faster than the 13-15 year old females with only a 1.28 second difference.

The results show that 13-15 year old males have sharper selective attention and speed than their female counterparts. These teenagers of both genders can still be analyzed together and can generally conclude that teenager's minds can deal with interference if an effort is made.

12
TAVAKOL, Delana
Behavioral Science,
2011/2012

THE EFFECT OF SHADOWS ON THE HUMAN MIND

Shadows are everywhere, and though most people encounter them daily, they are usually acknowledged by only the subconscious level of the mind. Investigating how different people react to these shadows could give insight into how external factors, especially those as omnipresent as shadows, affect the human psyche. Although knowledge on the effects of shadows on humans could be used in an extensive number of ways, no previous published studies have been done on this subject. Therefore, this study, as an extension of a previous year's work, attempted to determine the effects that darker and lighter shadows have on the moods of humans.

Experimentation took place using two Biology I Honors classes during two different times of the day: morning and afternoon. Each class was given a questionnaire asking them to respond to ten brief questions regarding their moods, specifically restlessness, drowsiness, energy, anxiety, calmness, focus, optimism, irritability, nervousness, and general sadness. Next to these questions was an image of a building. For some students, this building was shaded more darkly, while for others more lightly. While responding to the questions provided, the subjects were, according to the initial hypothesis, being affected subconsciously by these images and their shadows.

The data produced during this experiment showed that, though there was a somewhat notable increase in drowsiness and irritability in subjects affected by the darker shadows, overall there was no dramatic difference in the responses of students who took the questionnaire with the darker shadows versus the one with lighter shadows.

At its conclusion, this experiment found that one's mood is not dramatically altered by nuances such as shadows. However, signs that there may be discreet affects of these shadows are evident, and require further experimentation to be substantiated or invalidated.

13
WOO, Dongun
BEHAVIORAL & SOCIAL SCIENCES
WOO, David
Behavioral and Social Sciences

Effectiveness of Subliminal Messages While the Conscious Mind is Occupied

Subliminal messaging is based on the theory that subconscious mind perceives messages conscious mind cannot perceive. The theory suggests that people are influenced by the messages and messages change one's behavior. Purpose of this experiment was to determine the effectiveness of subliminal messaging and changes in effectiveness while the conscious mind is occupied.

Subliminal message was created using MindFlasherImage. First group in the first stage will not receive subliminal messaging, second group in first stage will perceive subliminal messaging, first group in second stage will not get subliminal messaging but will be asked a series of mathematic questions, and second group in second stage will perceive subliminal messaging and will be asked a series of mathematic questions. They will all be asked if they feel A: content or happy, B: sad, nervous, or C: no change.

In the first group of the first stage, 6 out of 20 chose B, in the second group of the first stage, 12 out of 20 chose B, in the first group in the second stage, 4 out of 20 people chose B, and in the second group in the second stage, 8 out of 20 people chose B.

Based on the results, it was concluded that subliminal messaging does not produce a significant effect. However, since the number of people who answered B decreased during the second stage, it can be concluded that the mathematics questions decreased one's ability to perceive and that the conscious mind and the subconscious mind work together.

BIOCHEMISTRY

14
FUJIWARA, Wakana
Biochemistry
2011/2012

Development of Cassette Vector for Gene Copy Number Standard in Transgenic Mini-Gene

During microinjection, genetically manipulated gene segments are inserted into the pronucleus of the host animal in a random and unpredictable manner. Therefore, it has been reported that the only method to quantify the copy number of DNA is by the time consuming and radioactive procedure called Southern Blot method. The purpose of this project is to utilize available molecular biology technology to design a universal cassette vector that eliminates the necessity to create target-specific primers to assess the copy number of the transgenic mini-gene construct.

D12Mit201 primer set was designed and a 1.3kb fragment of BALB/c genomic DNA that contains this target was amplified using polymerase chain reaction (PCR). This DNA segment served as an insert that allows non target-specific polymerization. Real-time quantitative PCR (qPCR) was used to detect florescent signals emitted by the probe based Taqman assay and to produce a graph of DNA amplification that is proportional to the amount of light it receives.

The resulting graph of qPCR confirmed efficacy of this new idea of designing a primer set to accurately quantify the copy number of DNA inserts in transgenic animals. The data obtained from this experiment led to the conclusion that as long as the target and the mouse strain remain unchanged, the same primer can be used for any gene construct to analyze the copy number of genes.

The discovery of this method of creating a universal genomic DNA segment that contains a specific microsatellite target leads to application on actual transgenic animals in the future research. Utilizing this technique will expedite the process of copy number assessment and eliminate the need to use radioactive hybridization probes.

15
LEE, Kenny
BIOCHEMISTRY

The Role of Testosterone in Hepatocyte Apoptosis in High Fat Diet-Induced Non-alcoholic Fatty Liver Disease: Year 2

In the past 20 years, the Western world has been subject to a dramatic increase in obesity. One common manifestation of obesity is non-alcoholic fatty liver disease (NAFLD). Last year's study found that NAFLD results in increased hepatocyte apoptosis, while testosterone replacement could reduce these apoptotic effects. However, the mechanisms behind testosterone's protective role in high fat diet (HFD)-induced hepatic steatosis have not been well studied. It has been previously reported that Smac/DIABLO plays an integral role in promoting cell apoptosis by antagonizing Inhibitor of Apoptosis (IAP) proteins. In order to further develop the HFD-induced NAFLD rat model, testosterone's potential role in reducing mitochondrial release of DIABLO was studied via Western blot.

Male rats were randomly placed into four groups: castrated rats on HFD, castrated rats with testosterone replacement on HFD, intact rats on HFD, and intact rats on regular chow diet (RCD). The rats were fed ad libitum for 15 weeks, sacrificed, and liver tissue was collected for detection of apoptosis. Western blot was used to evaluate concentrations of Smac/DIABLO (25 kDa) in hepatocyte cytosol.

The results showed that HFD-induced NAFLD increased mitochondrial release of DIABLO compared with RCD in intact rats, while testosterone replacement reduced DIABLO release in castrated rats.

It was concluded that one main mechanism behind testosterone's protective effect in the liver is inhibiting release of DIABLO into hepatocyte cytosol. This study thus further develops the HFD-induced NAFLD model, and may forge a path toward developing methods to eventually attenuate NAFLD.

16
WATHUGALA, Samantha
BIOCHEMISTRY

VARIATIONS IN PH CURVE AND BACTERIAL CONCENTRATION IN HOMEMADE KEFIR (YEAR 2)

Kefir is a probiotic drink currently brewed only in homes. Working toward making kefir as standard as yogurt, this study measures the effect of two parameters, grain-to-milk ratio and milkfat, on the duration of fermentation, pH vs. time curve, and bacterial content.

A full factorial design of experiments with center points was used. Samples representing all permutations of a low and high grain ratio and 0% and 3.5% milk and center points with the median ratio and 2% milk were fermented and pH read periodically throughout. Each sample was then run through a spectrometer set to 600 nm.

Combining pH data from both these and last year's tests, a polynomial model was found to determine fermentation time from the parameters. 2011's linear model was limited due to less variation of parameters, and the combined data was enough to prefer a quadratic model. This new model gives home brewers more control; should they want, say, 200 mL of 2% milkfat kefir in 20 hours, they know how much grain to use.

The pH v. time curve was normalized both for both years' and this year's data. The former's curve was hazily linear, with a 0.75 pH band. The latter was well-defined and clearly quadratic; better control of temperature may have effected this precision. This model can aid kefir's path to industrialization.

From spectrophotometry, the clearest trend was fat content and absorption's direct correlation. Because attempted controls showed this may indicate increased fat rather than bacterial content, more research is needed.

BOTANY

17
Chang, Shulin
Botany

Effect Of Calcium on Biomass of Bean Plants

An experiment has been conducted to measure the biomass of bean plants that have been given various levels of calcium chloride. This project has been designed to find the optimum calcium levels needed to produce the highest biomass.

Four seeds were planted into individual pots and each pot was given 0 ppm, 250 ppm, 500 ppm, or 1000 ppm calcium chloride. All pots were placed in a temperature-controlled greenhouse and they were all given the same conditions. They were given five weeks to grow and afterwards, they were pulled from the soil and they were put into an oven for 48 hours to dry. The weight was measured and biomass was obtained.

The experiment yielded interesting results. The plant with no calcium grew the longest but it only had the third highest biomass—the plants with 500 ppm and 1000 ppm weighing more. The 500 ppm plant had the most desirable results with its long stem and the most biomass. The plant with 1000 ppm was the shortest but it had the second highest biomass. The 250 ppm plant had the least success with a medium length stem and the lowest biomass.

In the end, 500 ppm of calcium chloride seemed to be the optimum level of calcium for the most success in plants; however, an unexpected discovery was made as well. The more calcium you add after 500 ppm, the shorter the plant will be but the more biomass it will have in relation to its size. These findings are significant because biomass is an important developmental fuel for a progressing world and the data from this study can optimize our gains.

18
ILUORE, CHARISSA
BOTANY

THE EFFECT OF QUERCETIN AND BROMELAIN ENZYME ON OXIDATION IN *MALUS DOMESTICUS*

The damaging effect of free radicals is well documented, including browning in produce and aging in humans. However, antioxidants like quercetin and bromelain have been shown to slow free radical release. Quercetin is a flavonoid that neutralizes free radicals. Bromelain also inhibits free radicals and may enhance the absorption of quercetin. This experiment demonstrates quercetin and bromelain's effectiveness in slowing browning in apples. The study also shows the synergistic relationship between the two compounds.

The impact of the quercetin and bromelain solutions was gauged by measuring the levels of carbon dioxide and ethanol in the apples over time. The apples were placed in water baths containing seven different concentrations. RAE Colorimetric Gas Detection Tubes were then used to measure the emissions of ethanol and carbon dioxide.

The 1000 mg bromelain and quercetin setup was most successful in reducing oxidation, with ethanol levels of less than 100 ppmv and carbon dioxide (CO_2) levels of about 393 ppmv . The 500 mg bromelain - quercetin and the 1000 mg bromelain setup had low ethanol and CO_2 levels. The 1000 mg quercetin had moderate levels of both gases. The 500 mg quercetin and 500 mg bromelain had high levels of both gases. Lastly, the 0 mg bromelain-quercetin had 165 ppmv ethanol and 430 ppmv CO_2.

Thus, bromelain and quercetin prevent free radical release and oxidation. Furthermore, bromelain and quercetin work better together. These findings not only have grand implications for fruit preservation, but also could lead to treatments for human ailments like psoriasis.

19
JUNG, Seung Hea
BOTANY

Effects of Combinations of Copper Sulfate and Citric Acid on the Necrosis of Spirogyra Algae

Due to phosphate waste discarded into the water, the algae has been exhibiting uncontrollable growth at the Madrona marsh, where the research was conducted. Although Copper sulfate is commonly used for algal control, it is toxic to other aquatic organisms. To protect the fish, Citric acid is added along with Copper sulfate. Through this study, the proper ratio and concentrations of these two substances were determined.

First, the concentration of Copper sulfate was determined. Concentrations 0.4mg/L, 1.0mg/L, 5.0mg/L, 10mg/L, and 20mg/L were tested on equal amounts of algae. Then, the suitable ratio of Copper sulfate and Citric acid was determined. Ratios 1:1 and 2:1 by weight were tested. Temperatures were measured and observations were made to see the necrosis of the algae.

10mg/L of Copper sulfate was concluded to be the best concentration for immediate effect, and the ratio of 1 Copper sulfate: 1 Citric acid by weight was concluded to be more suitable.

This experiment demonstrated that concentration of 10mg/L for both Copper sulfate and Citric acid is the best combination to control the algae without harming the fish or affecting the results.

20
LEE, Matthew
BOTANY

THE EFFECTS OF CO_2 ON THE CALIFORNIA NATIVE, NASSELLA LEPIDA, IN A GREENHOUSE EFFECT

The world is consisted of many different climate zones with many different plants. With many various climates, the question of, how these climates affect the plants, remain. Environmental conditions such as CO_2 play a key role in defining the function and growth of plants. The purpose of this experiment was to determine the effects of CO_2 on the Nassella Lepida, a California native grass, on its growth while being placed in a greenhouse effect. Ultimately, a microcosm of the earth was created forming a general hypothesis on the future statuses of grass.

Three containers of Nassella Lepida were placed with distinguished concentrations of CO2 (390 PPM, 6000 PPM, and 12000 PPM) by exhaling the CO_2 gas, and the concentration tracking was controlled using a CO_2 sensor connected to the laptop. A Greenhouse Effect was set up by compressing all gas inside the container while given 10 hours of direct UV light from grolamps. Without a set end date, observations were recorded each week concerning the health of plants, growth, and change of CO_2 concentration.

All three containers of Nassella Lepida had fungus formed causing the death of the plants. However the grasses of different set of concentrations demonstrated a separate rate of mortality represented by the order of the concentration of CO_2. The container with the larger amount of CO_2 represented a lower mortality, prolonging the lives of the Nassella Lepida. When plants were taken out of the container, measurements showed a slight longer length for grass with higher concentrations. Data had shown that photosynthesis had dominated over respiration in this experiment.

Results of this experiment concluded that California native grass creates fungus when moved from a cool climate zone to a fog zone. This is due to the moisturization caused by the Greenhouse Effect. However, the increased concentrations of CO_2 are able to prolong the lives of the dying grass demonstrating the ability to help sustain its health and regulating growth.

21
LEE, Sangheon
BOTANY

Effects of Binders on the Toxicity of Water and Madrona Environment

With the emergence of technological advances and the urban culture in today's world, many natural environments are susceptible to pollution, destruction, and in several cases, removal. Similar to other natural environments, the Madrona marsh water especially has a problem with eutrophication, a state where a freshwater ecosystem in polluted with excess levels of nitrates and phosphates. The excessive formation of the spirogyra algae has marked the problem for the marsh waters at Madrona, and the high levels of phosphates and nitrates are to blame.

Toxicity was determined by colorimetric processes measuring nitrates, phosphates, nitrites, and ammonia. Three tanks were set up, including a control group, in order to observe the different effects on the environment and the toxicity levels of nutrients in the water. Calcium carbonate, a literary-proven phosphate binder, was added to one of the tanks, and iron (III) nitrate was added to the final tank. The binders were added in order to remove and precipitate the excess nutrients in the water and improve the overall health of the marsh environment.

The *Scirpus californicus* in all three tanks grew very tall and evenly. However, a noticeable difference was the amount of biodiversity and biological activity going on in each of the three tanks. The tank with the calcium carbonate contained other grasses, and showed greater biological activity. The tank containing iron (III) nitrate had the least biodiversity of the three tanks, but was the most efficient in removing ammonia.

The outcome of this project leads to many cases of future research in finding other binders that can possibly be more effective in improving the environment. While the calcium carbonate showed improvement in biodiversity and health, the phosphate and nitrate levels were not significantly lowered. The iron (III) nitrate showed to be possibly toxic to some plants in the water, and therefore had the least environmental activity of the three tanks.

22
RAMAYYA, Shreya &DOKKO, Rachel
BOTANY

Environmental and Commercial Benefits of Carbon Sequestration by Coastal Sage Scrub: *Encelia californinica* and *Salvia Leucophylla*

Because global climate change is a widespread concern, studies to reduce the emissions of CO_2 and other greenhouse gases through plant carbon sequestration are of great interest. Carbon sequestration refers to the storage of CO_2 into reservoirs, including vegetation, and describes a method to delay global warming effects and slow the accumulation of greenhouse gases. This study has specifically investigated the dry weight biomass of two common drought-deciduous species, *Salvia leucophylla* and *Encelia californica* (purple sage).

Two methods were used to collect the eleven *S. leucophylla* samples. In method 1, 12.5-50% of the subject was harvested and dried, and various canopy measurements were recorded. Method two required the same field measurements in addition to five branch samplings from each sage. This acted as the sub-sample later used to calculate the total dry weight (biomass). *Encelia californica* was collected using only method 1.

Using regression analysis, the results showed that the species display a strong correlation between biomass, dry weight, and canopy dimensions. The correlation between the biomass and the canopy surface area was $y = 185.37x^{1.4514}$ and the correlation between the biomass and canopy volume was $y = 117.92x^2 + 420.93x + 659.72$. From this, the amount of CO_2 sequestered as biomass was calculated.

From data analysis, the significance of these plant species in maintaining our community's environmental balance of carbon has been highlighted. These plants can be planted in other areas in order to achieve similar results and help maintain the natural balance of carbon between Earth and the atmosphere.

23
SATO, Kevin
BOTANY

SURFACE TEMPERATURE RESEARCH OF LEAVES WITH CONTROLLED TRANSPIRATION CONDITIONS

Over the decades, global warming has been a great concern and increasingly attracts scientists' and policy makers' attention. Through the process of photosynthesis, plants use energy from the sun to draw down carbon dioxide from the atmosphere and then use it to create the carbohydrates they need to grow. Since carbon dioxide is one of the most abundant greenhouse gases, the reduction of the gas from the atmosphere may temper the warming of the planet as a hole. Plants also cool the landscape directly through the process known as transpiration.

When the surrounding atmosphere heats up, plants release excess water into the air from their leaves. By releasing evaporated water, plants cool themselves and the surrounding environment. As a matter of fact, transpiration accounts for approximately 10% of all evaporated water. In the present study, to investigate how much effect of temperature reduction is counted by the transpiration from the leaf and to examine how much difference is captured in effect by the difference of the kinds of the leaf, the leaf surface temperature under the halogen lamps with controlled transpiration conditions have been measured with six different plants.

Through the experiment, it was seen that the leaf surface temperature of most of the samples, no matter what controlled transpiration conditions they were under, had a sudden increase of 20℃ in the first three (3) minutes. While four samples out of six could survive and continue to be a subject of this research through the time, two samples had become outside of the scope in a certain time period as one had shrived quickly and the other had begun to round up its leaves so it became impossible to measure the leaf surface temperature.

As a result of this research, the leaf temperature reduction effect of the transpiration was quantitatively estimated with the relation to the water consumption volume and the difference of stomata on the leaf in placement, size and number. In addition, the homeostatic functions were interestingly observed as well in the present study. Conclusively, it was verified that there is a remarkable difference in effect of transpiration depending on the type of plant and on the condition of the leaf.

24
Jackie Johnson
Botany 2012

The Effect of Varying Iron Content in Fertilizers on Pigmentation and Growth of Pennisetum Clandestinum

This project and its limited results show the comparison between fertilizers with varying iron content and how they affect the pigmentation and growth rates of Pennisetum Clandestinum, also known as kikuyu grass. Pigmentation was graded and the growth rate measured during the winter months with varying photosynthetic exposure times for each fertilized plot.

During the experiment, six fertilizers were gathered for comparison: Polyamine (5% iron), EDTA (16% iron), 9-9-9 (11% iron), 7-7-7 (7% iron), 8-3-5 (no iron), Gro-Power (40% iron). Equal amounts of each fertilizer were measured and distributed in three 4 x 6 foot plots with varying exposure to sunlight. After one week of the photosynthetic process, observations of each plot were made grading pigmentation and height. The pigmentation grade was on a scale of one through six, with six indicating dark green pigmentation. The process of distributing fertilizer was repeated every other week for 12 weeks. Comparisons were made for each fertilizer applied to its three plots with varying photosynthetic exposure. Depending on the rate of growth and pigmentation of each fertilizer, it was determined which plot had the optimal amount of photosynthetic exposure for that week. One out of the three plots for each fertilizer were exposed to less sunlight during the daytime. Each plot received the same amount of water approximately once or twice a week depending on the weather. There was little difference in the slope or elevation between each plot. Finally, the six fertilizers and their pigmentation rates were compared in a graph format.

The results collected demonstrated the following: 9-9-9(11%) had an average pigmentation rate of six, 7-7-7(7%) had an average pigmentation rate of 4, 8-3-5(no iron) had an average pigmentation rate of 2, polyamine(5%) had an average pigmentation rate of 3, EDTA(16%) had an average pigmentation rate of 2, and Gro-Power(40%) had an average pigmentation rate of 4. It was determined early on in the experiment that the effect on growth rate between fertilizers was not different.

The EDTA fertilizer had the most significant effect on the pigmentation grade, with an average rate of 6. This effect proved to be short-term as the entire plot started to wilt and die after week 8. The 7-7-7 fertilizer proved to have higher pigmentation grades towards the end of the study, but was not consistent throughout experimentation. The 8-3-5 fertilizer without iron proved the hypothesis correct that it had a consistently lower grade of pigmentation. The 9-9-9 fertilizer demonstrated the best appearance with an overall higher grade of pigmentation, consistently throughout the experiment. In addition, 9-9-9 demonstrated a sudden spurt of growth rate in week 12 compared to all other fertilizers regardless of the duration of photosynthetic exposure.

CHEMISTRY

25
Shi, Cynthia
Chemistry,
2012

Nitrate and Nitrite Concentrations in Selected Vegetables and Their Change over Storage Time

Relative nitrate and nitrite concentrations in common vegetables and their relationship to storage time were studied in this project, which aimed to investigate the concerns that vegetables may accumulate unhealthy levels of chemicals.

Several popular vegetables were selected and prepared according to normal cooking practices. To show concentration dependency on boiling and storage time, controlled quantities of *Brassica rapa pekinensis* and *Brassica rapa chinensis* were first boiled and then stored at either room or refrigerator temperature. Samples taken at different elapsed times were analyzed for nitrate and nitrite concentrations using zinc reduction and diotization spectrophotometric methods. For comparison between different species, concentrations were measured using the same methods for four additional vegetables with identical boiling and storage conditions.

Experimental data showed that nitrate and nitrite concentrations behaved differently over storage time. Nitrate concentration increased as length of storage time increased, but nitrite concentration showed no clear trends. The temperature of storage made no significant effects on concentration changes. The observed nitrate to nitrite ratios were in the 10:1 to 50:1 range for boiled vegetables. The nitrite levels of the tested vegetables were all less than 100 ppm.

To reduce nitrate and nitrite intake, the storage time of vegetables should be minimized if the nitrate concentration increase over time is due to breakdown of organic compounds in cooked vegetables. High nitrate concentrations appear to be an indicator of high nitrite concentrations, although unidentified factors affected nitrite concentrations during storage. Lastly, the concern about nitrate and nitrite in vegetables seems unsupported as all vegetables had these concentrations at levels significantly less than those found in processed meats.

26
CHU, Edwin
Chemistry
2012

Analyzing temperature differences between entrochemical solutions in vacuum-pulled systems

This study deals with colligative properties and the Van't hoff factor. The purpose of this research experiment is to find out which systems containing a certain solution will yield the highest temperature differences. The data gathered from this experiment can be employed in researches regarding entrochemical systems, systems that power themselves using the laws of thermal equilibrium. These systems usually involve the use of two subsystems that are in particulate equilibrium with each subsystem having different temperatures; one of the main driving forces of the system happens to be the temperature difference generated by a system similar to the system being used in this experiment (a chamber containing distilled water and another chamber containing a certain solution).

By constructing a two-chamber system mentioned above, the temperature differences between distilled water and many other solutions (zinc chloride, sodium chloride, sucrose, calcium chloride, zinc sulfate, calcium acetate, and potassium phosphate monobasic) in a vacuum-pulled system were able to be gathered. As expected, besides the test results for calcium chloride (was concluded to be an outlier at the end of the experiment), the temperature differences were linear to the strength of each system's solution's colligative properties. There was also, noticeably, a significant, sharp rise between average temperature differences of systems containing solutions with Van't hoff factors greater than two and systems containing solutions with Van't hoff factors of two or lower.

27
RAMAYYA, Sulekha
CHEMISTRY

Increasing the Efficiency of DMFCs Using Different Supply Conditions, Temperatures, and Catalysts

This project was designed to improve the efficiency of Direct Methanol Fuel Cells by testing different factors including oxygen flow rate, methanol solution concentration, temperature, and catalyst used.

I constructed two different fuel cells by pressing two pieces of Teflon-coated carbon paper around a Nafion film. In both cells, the cathode was painted with a platinum black catalyst and the anode was painted with a carbon-supported platinum and ruthenium black catalyst. A commercial anode catalyst was purchased and compared to one synthesized in the lab with a novel 90% carbon, 10% tantalum carbide support. This membrane-electrode assembly (MEA) was then placed within a fuel cell housing, and the entire fuel cell, using tubing, was fed with a methanol solution at the anode and oxygen at the cathode. After conditioning the cells, data collection began by evaluating current and voltage output at various oxygen flow rates, temperatures, and methanol solution concentrations. All of the data was collected on the computer using a fuel cell test system.

The maximum power density attained was about 55 mW/cm^2. The cell did perform better at higher temperatures, as expected. The cell with the lab-synthesized catalyst was able to produce higher power density at lower currents. The stronger methanol solution also enabled the fuel cells to perform better. Overall, the second fuel cell with the synthesized catalyst performed better.

Ultimately, my hypothesis was supported and the synthesized catalyst allowed the cell to perform better than the commercial catalyst; more research could lead to its use in commercial cells.

28
SUH, Daniel
CHEMISTRY

USING CELLULASE TO CONVERT SEAWEED INTO ALTERNATIVE FUELS

Although the US is in an oil crisis, ethanol has been a popular source of alternative fuel. However, ethanol is usually made from corn, which is not energy efficient. Instead, seaweed has been shown to produce three times more energy than corn. But the difficulty in breaking down the tough cellulose layer remains a challenge.

For each experiment, 2 beakers were used as the control, the other 2 were used as the independent. The seaweed and the corn had an equal weight. The volume for the control and independent was also equal. After the test was completed, each sample was filtered and weighed.

In the first tests, water was added to the mixture, which caused the weight of the seaweed and the corn to increase. The second tests removed excess water and used 5 grams of waste seaweed and corn. The average weight difference for the seaweed was 12.6%, while and the corn was 12.7%. For the final test, 3 grams of seaweed and corn were used. The average weight difference of the seaweed was 22.8% and the corn was 19.3%.

The goal of this project was to manipulate certain factors to degrade the most amount of cellulose from seaweed. From these findings, the ratio of 10 mL of enzyme and 3 grams of seaweed degraded the most amount of cellulose. By using the enzyme cellulase from *Aspergillus sp.*, the cellulose layer was more effectively broken down that resulted in an increase of the amount of sugar made.

29
Yang, Heejae
Chemistry

The Ability in Successfully Preventing the UV-light from Penetrating the Skin among Caffeine, Caffeinated Sun Cream, Non-caffeinated Sun Cream

The project is set up to determine the ability of caffeine to absorb the Ultra-Violet Light. The research is conducted to observe and compare the rate of absorption among Neutrogena Ultra Sheer sunscreen, caffeinated eye cream, and the caffeinated eye cream dissolved into the Neutrogena sunscreen at a rate of one to one.

The three different products were applied to 3 different chicken skins (setting the Neutrogena sunscreen as the control group), and exposed to a strong UV-light directed from a UV lamp for an hour. After the contact of Ultra Violet light, a UV meter, a machine that detects the quantity of UV light, was operated to verify the penetration level. Then a Clinical Photography was used to observe the damages the skin obtained from the exposure of Ultra Violet radiation.

The chicken skin with caffeine applied on top had an inferior result in preventing the UV-light from penetrating through the skin, than the Neutrogena sunscreen. However, the product that was a mixture of the natural sunscreen and the caffeine was the most effective in successfully blocking off the UV radiation.

This project can be interpreted in one way. The caffeine does have an effect in preventing the UV light from piercing through the skin; however, the effect is very minor compared to a natural sunscreen. Nevertheless, if caffeine is dissolved in with the sunscreen, the mixed solution will create a triumphant outcome in saving the skin from the unwanted UV radiation.

30
YUN, Hee Kyun
CHEMISTRY

OPTIMIZING GASIFICATION OF MIXED PLASTIC WASTES TO REDUCE TAR AND MAXIMIZE LHV.

The project aimed to solve two problems in plastics gasfication: reduce tar generation and maximize LHV of the producer gas. To achieve this goal, the Equivalence Ratio (ER) and amount of activated carbon in the upper reactor were adjusted. It was hypothesized that increase in ER will decrease the tar generation but also decrease LHV, and that doubling the amount of activated carbon will lessen the tar generation without affecting LHV.

The process used a two-staged gasifier with bottom reactor acting as a fluidized bed and upper reactor filled with the activated carbon. Of the four runs, three were conducted with varying ER values of approximately 0.2, 0.3, and 0.4, other things constant; one was conducted with ER value of 0.3 and doubled amount of activated carbon. After the producer gas went through steps of purification, the gas was then examined by gas chromatography to analyze the composition.

The results directly supported the hypothesis. Increasing ER reduced production of tar, but also reduced the LHV of the gas. Doubling the amount of activated carbon showed a drastic reduction in tar production, almost by half, with only a slight decrease of LHV.

In conclusion, both ER value and amount of activated carbon significantly affected the quality of producer gas. The optimal condition to maintain a reasonable value of LHV with reduced tar was found to be ER value of 0.3 and doubled amount of activated carbon.

COMPUTER SCIENCE

31
Alexander Kasperovich
Computer Science

Implementation of Navigation Algorithms with Limited Processing Resources

The purpose of this project was to create an autonomous robot that could gather information about its immediate surroundings, react to that information so as to avoid obstacles in its path, and successfully find its way between two definite predetermined points, all while using a central processing unit with significantly limited processing resources. Essentially, the project consisted of creating an algorithm that is simple enough to work with the memory and processing power available, but still functional enough to accomplish its task.

The project was all about developing an algorithm that would achieve the desired result, and programming it into the robot. Testing consisted of installing the algorithms and running the robot through several obstacle courses, then marking the time, number of collisions, and final distance from the specified destination of the robot.

The results were encouraging: the algorithm brought the robot within a negligible distance from its destination the majority of the time. Several problems stemmed from the design of the robot; primarily its information-gathering system, which had several blind spots, which in turn resulted in a minor reduction to the algorithm's efficiency.

The conclusions drawn from this project are that an algorithm that separates navigation and obstacle-avoidance into separate components and uses a coordinate system to keep track of the robot and the destination yields optimal results in navigation. Although the robot's design and the algorithm's efficiency are subject to improvement, the two-mode algorithm yields optimal results.

32
Kim, Shu Hee
Computer Science

MATHEMATICAL MODELING OF CANCER CELL PROLIFERATION, DIFFERENTIATION, AND DEDIFFERENTIATION: YEAR TWO

The main purpose of this research is to obtain a better understanding of when and why relapses in cancer growth occur, especially after radiotherapy. Radiation therapy has been used as a form of cancer treatment. However, relapses in cancer growth have been known to occur, especially after extensive chemotherapy. These relapses happen as a result of increased rates of dedifferentiation. Dedifferentiation is a relatively recent discovery which shows that cancer cells may revert back to their previous cell stages, instead of, as always presumed, progressing forward in cancer lineage. This dedifferentiation seems to increase as a result of increased radiation exposure.

By using the parameter values of replication (p), differentiation (v), and dedifferentiation (q), the data collected from human breast cancer cells exposed to radiation was fit to the computer software model. By comparing the changes in the steady state values from the model as a result of changes in the dedifferentiation rates, the impact of differing dedifferentiation rates on cell state populations was quantified. Thus, when dedifferentiation rates increased, the cell state population of stem cells increased, which ultimately caused increases in cancer growth.

In conclusion, human breast cancer cells exposure to radiation showed a significant increase in dedifferentiation rates, which ultimately caused increases in stem cell populations and cancer growth. This successful model quantifies the behavior of the dedifferentiation rates as a result of exposure to radiation; furthermore, it modifies the computer model to more realistically portray cancer development in patients even after cancer treatment. Thus, this model can allow doctors to better predict the onset of relapses and improve individualized cancer treatment methods.

33
STEINBERG, David
Computer Science

Building a Database of Pre-Shortzian *New York Times* Crossword Puzzles

A major problem in the crossword puzzle world is that only *New York Times* puzzles published on and after November 21, 1993, when Will Shortz became editor, are in easily accessible electronic databases. Most pre-Shortzian crosswords can only be found on microfiche or in hard-to-read, unanalyzable Portable Document Format (PDF) files. This project sought to begin building a digitized database of crosswords published from February 15, 1942, to November 20, 1993.

First, a master Microsoft Excel spreadsheet listing all pre-Shortzian crosswords was created. Then, PDF files of 198 puzzles from 1993 were hand-converted into AcrossLite, a format compatible with an existing database of Shortz-era crosswords. These crosswords completed the year 1993, filling significant gaps in previous efforts to construct such a database.

The newly converted crosswords and master Excel spreadsheet shed light on construction techniques and long-forgotten constructors; trends in popular culture were not evident in the 1993 puzzles. Some unanticipated results included the discovery of a double tri-stack puzzle published in 1981, refuting the long-held belief that even single tri-stacks were not published until 1994. In addition, a new "youngest published constructor" emerged.

The completion of the master Excel spreadsheet and conversion of pre-Shortzian puzzles are still under way, but this project's initial findings suggest that further discoveries will likely surface in the future. Although much work remains, the complete, easily accessible, and fully analyzable pre-Shortzian database will be a valuable resource for cruciverbalists and historians alike.

EARTH & SPACE SCIENCE

34
Dawool Huh
Earth Science

Finding the Source of Kelvin Canyon Spring

Kelvin Canyon Spring is the largest, oldest, and one of the last remaining, year-round springs on the Palos Verdes Peninsula. However, the source is still unknown, but the Palos Verdes Peninsula Land Conservancy and University of South California geologist Dr. Bob Douglas are working together to uncover what exactly is leading to the large and fairly consistent outflow at Kelvin Canyon Spring.

The output of the spring, rainfall measurements, and groundwater results will be analyzed and compared to Levelogger results from nearby monitoring wells to help determine the source. This is a year-long study based on a previously irregularly recorded body of work, and the goal of this project is to clarify many questions concerning the spring. The fall and spring season thus far in 2011-2012 have been very dry, so a conclusion was very difficult to create. Based on the year before, which was a year with very high amounts of rainfall, data is still inconclusive. Anthropogenic sources might also have been significant in the spring's source, yet data on that is also not definite. Any trends found are not yet definite, so the source of the spring is still unknown.

35
Snyder, Ranya
Earth & Space Science

Hurricanes and Climate

The goal of this project was to study the historic relationship between the El Niño/Southern Oscillation (ENSO) and the number and strength of hurricanes, either in the Atlantic or Pacific Oceans. The past few years have histories of extremely powerful and dangerous storms. Storms have also become more numerous over the last few years. To investigate potential effects of climate on hurricane number and strength, in this project I studied the effects of El Niño on hurricanes. After analyzing the data on several highly respectable data sources I came to the conclusion that there is a significant correlation between El Niño/Southern Oscillation (ENSO) and the number and strength of hurricanes. Along with this conclusion I found through my research that with the rise of the global temperature also comes the rise of the number and strength of hurricanes taking place. The warmer the surface temperature of the ocean the greater the intensity and number of hurricanes our planet will have to endure. With this information we as a nation and residents of this planet must learn to make positive steps to avoid these human induced catastrophes.

36
Yin, Ashley
Earth Science
2011/2012

Correlation Between Kelvin Spring Flow Rate and Well Groundwater Level

Kelvin Canyon Spring is located at the Portuguese Bend Reserve, an area known for its severe landslides. One of the greatest contributing factors to landslides in this area is the flow of groundwater. This experiment aimed to determine the correlation between the flow rate of Kelvin Canyon Spring and groundwater level at nearby wells to better understand the directional flow of groundwater at Portuguese Bend.

The flow rate of the surface water at Kelvin Canyon Spring was measured once at the beginning of every month. Measurements were taken by determining the time needed for the spring to fill a five-gallon bucket, which was placed under a weir previously built on the spring. The spring was timed four times on each measurement day, and the times were averaged. Well measurements were taken automatically by dewatering wells built by the Abalone Cove Landslide Abatement District (ACLAD).

The rate of water pumped out of wells WW15, WW16, WW11, WW3, WW2, and WW18 generally mimic the fluctuations in the rate of Kelvin Spring water flow. WW15 and WW16, located directly south of Kelvin Spring, follow the fluctuations of Kelvin Spring water flow very closely. WW11 and WW13, located farther south from Kelvin Spring than WW15 and WW16, mimic the fluctuations of Kelvin Spring to a lesser extent than do WW15 and WW16, but they are still clearly patterned after Kelvin Spring. At WW2 and WW18, located still father south from Kelvin Spring, the mimicry of Kelvin Spring flow rate fluctuations are severely diminished, but the wells do follow the general trends of Kelvin Spring flow.

From the mimicry of Kelvin Spring water flow rate fluctuation by these wells, it was concluded that groundwater from Kelvin Spring travels in a generally direct path south and empties into the ocean.

ENGINEERING

37
CHEN, Alexander L.
ENGINEERING

A MAXIMUM POWER POINT TRACKING HARDWARE WITH AN IMPROVED HILL CLIMBING ALGORITHM

The objective of this project was to develop maximum power point tracking (MPPT) hardware to optimize the efficiency of the solar photovoltaic (PV) panel. The PV panel converts solar energy into electricity and the MPPT hardware enables the PV panel to operate at its maximum power point. Popular MPPT algorithms such as the perturb-and-observe (P&O) and hill climbing (HC) algorithms suffer from various deficiencies which were addressed in this project.

An improved HC algorithm was developed and implemented in the MPPT hardware. For each perturbation cycle, the algorithm sampled the PV panel output power for multiple duty cycles of the switched DC-DC converter then dwelled at the duty cycle which resulted in the highest power. This duty cycle was also used as the midpoint of the next set of perturbations. Hardware including a PV panel, a boost DC-DC converter, an LED load circuit, and a TMS320F28335 microcontroller was assembled to validate the algorithm.

Step-up voltage conversion of the DC-DC converter was demonstrated, and the sensitivity of output power over the perturbation of switch duty cycle was characterized. Efficient and robust maximum power point tracking was achieved at all irradiance conditions. At constant irradiation levels, the output power achieved by the MPPT algorithm was >98% of that achieved by manually setting the PWM duty cycle to the optimal values.

The improved algorithm of this project was significant because it addressed the deficiencies of popular algorithms with simple modifications. The sample-select-dwell process minimized oscillations, improved tracking speed, and reduced sensitivity to voltage noises.

38
HASHIMOTO, Mark
Engineering
2012

Bicycle Light Utilizing Bottle Dynamo Battery Charger

The experimentation performed in this project is an attempt to increase the efficiency of modern bicycle light generators. Whereas current generators, or dynamos, can only power the light when the bicycle tire is in motion, the addition of a rechargeable battery will allow this dynamo to supply power when rotary motion is both present and non-present.

The goal of the experiment is to successfully incorporate a 9 volt nickel cadmium battery in a system which includes a 6 volt bottle dynamo, and a bicycle headlight and tail light. Within my circuit a switch and a diode were added, facing away from the battery's positive terminal. A dremmel with a tire attachment was placed along the rotor of the dynamo to simulate tire rotation. Finally, the result was affixed upon the bike for a 2-mile travel as a final test of the system's capabilities.

During the test the light remained to stay on for the entire trip. It was realized afterwards that the battery's power had decreased from 8.7 volts to 7.2. The remaining components of the system had not been unaligned or tempered.

Because a drain had occurred on the battery it can concluded that the dynamo had not succeeded in recharging it, or that the power necessary to operate the light exceeded the power produced. For the second case, it was suggest that reasonable tire speeds do not suffice. In conclusion, the hypothesis for practically increasing dynamo system efficiency with this specific design was rejected.

39
Leslie Kurt
Engineering

The Temperature Effects on the Strength of Concrete Reinforced with Recycled Materials: Year 2

The objective of this experiment was to create a concrete that would be both useful for construction in hot and cold climates and reduce waste, being beneficial to the environment. By adding tire rubber and fiberglass (recycled materials) to reinforce concrete, it was predicted that the strength of the concrete would increase when exposed to extreme high and low temperatures.

To test the strength, a wedge was placed on the center of a concrete slab. Then increasing amounts of weight was placed onto the wedge until the concrete broke. The results showed that adding fiberglass to concrete increased the strength for all three of the different temperature conditions tested. Tire rubber, on the other hand, did not show an improvement in strength when mixed in concrete for any of the three different temperature conditions. The fibrous nature of the fiberglass in the concrete appeared to cause the fiberglass to act like rebar increasing the tensile strength of the concrete, allowing it to support more weight. Concrete is a hydrate crystal. The decrease in the strength of concrete exposed to high temperature was likely due to the dehydration of the crystal structure of the concrete. Concrete exposed to very low temperatures showed tremendous increases in strength due to the contraction of water molecules forming a more compact and strong crystal structure. When the tire rubber concrete mixtures were heated the strands of rubber appeared to soften causing the concrete mixtures to be weaker.

40
Nguyen, Ryan
ENGINEERING

The Effect of a DC-DC Converter on the Voltage Output Time of Supercapacitors

My experiment's objective is to determine if a step down DC- DC converter can extend the useful time power can be extracted from supercapacitors. First, I established a baseline discharge time with and without a step down DC-DC converter. Then, I varied the charging voltage and output load. It was expected that adding a converter would increase the discharge time and that the discharge time would vary proportionally with the charging voltage and load.

The test hardware consisted of a set of eight supercapacitors, a step down DC-DC converter, and two LED loads which were constructed from off the shelf components. Support equipment consisted of a power supply and a two digital multi-meters. The capacitor voltage into the converter and output voltage into the load were measured every five minutes until the capacitors were discharged.

The data shows the LEDs remained lit significantly longer when the converter was present. The next step doubled the LED load from 5 to 10 LEDs, and I retook the measurements. Interestingly, the discharge time did not decrease proportionally as expected . I expected the discharge time to decrease by 50%, but the data only shows a decrease of approximately 20%.

The unexpected 20% drop in discharge time when the number of LEDs was doubled should be explored further. This could be caused by several factors, such as nonlinear converter effects or visual perception of the red LED's brightness. Regardless of cause, this observation can potentially can be exploited to improve energy efficiency.

41
SAKAI, Kristi
ENGINEERING
2012

Effect of Various Types of FETs on Synchronous Buck Converter Efficiency

Over a short period of about 30 years, computers and the internet have come to touch almost every aspect of life. It is unusual to find a business or household that does not regularly use a computer in some shape or form and it has gotten to the point where people take computers for granted. Rarely do they think about the technology and engineering that has gone on behind the tapping of a keyboard and the impact that this technology has had on the environment. The purpose of this project was to take a look at a small part of this technology to see and understand how the selection of a few electronic components might affect the country's power grid. More precisely, this project compares the efficiency of a few selected MOSFETs used in voltage regulators (synchronous buck converters) which provide highly accurate and clean power to CPUs, the "brains" of computers.

The general set up of this project required two major sections: the bench test equipment and the evaluation board. The bench test equipment included power supplies, digital multimeters, electronic loads, shunt resistors, and a desktop computer. The evaluation board is a hand-built assembly consisting of a printed circuit board, integrated circuits, resistors, capacitors, inductors and MOSFETs. Using the PC to control the bench equipment and to set the test conditions, power was applied to the evaluation board. The electronic load was then used to increment through the output current levels of the voltage regulator while input currents, input voltages and output voltages were recorded. With combinations of 3 high-side FETs and 3 low-side FETs, a total of nine different tests were conducted. The efficiency of each FET combination was then calculated and comparison plots generated.

As predicted, the most expensive pair of MOSFETs operated at higher efficiency levels over any other MOSFET combination over the entire 0A to 40A output current range. The least expensive MOSFETs operated at the lowest efficiency levels across the same output current range. At the peak efficiency (10A load current), the most expensive pair of MOSFETs ran at 2.2% higher efficiency than the least expensive MOSFETs and difference was 9.8% at 40A load current.

In conclusion, the dilemma for computer manufactures is whether to save production costs by using less expensive FETs in the assembly of voltage regulators or to save electricity costs by using more expensive FETs. Instead of focusing on the "bottom line", computer manufacturers must be cognizant on the impact of operating less efficient computers on the country's power grid and the effect this has on the environment.

42
Joey Sin, Johnny Sin
ENGINEERING

Faraday's TireA Novel Approach of Regenerating Electricity through Rotary Mechanical Energy for Domestic Uses

The project "Faraday's Tires" deals with applying the concept of Faraday's Law of Induction to generate sufficient electricity by rotary motion of the skateboard wheels. The purpose of this project is the idea of regeneration of energy instead of "free-energy". Using the rotation of the wheels from the board, the Faraday's Box, the generator, contains a combination of magnets and coils that should be able to produce an ample amount of electricity. This generator is attached to the truck of the board and is detachable, an interchangeable part. This hence will charge the battery directly of some objects require less energy. Modification of the structure of the skateboard was somewhat necessary in order to attach our device close enough to the tires. Complications were inevitable as we realized that our concept of applying the simple coil-magnet faraday's law was limited to the tire rotors, rims on the wheels, and the basic confines of the tires. The skateboard was chosen over other transportation methods such as cars, because of environmental reason (the car uses gas) and because about one in seven youths in the nation ride skateboards, which more than a million riders only in the United States, between ages fifteen and nineteen. This application can be efficient because energy can be conserved in the generator. Herein, we apply the concept of creating electrical energy with mechanical energy in typical skateboards.

43
Ryan Wong
Engineering
2012

INVESTIGATION OF PHOTOVOLTAIOC CELLS IN PARALLEL WITH SMALL LITHIUM ION BATTERY

The purpose of this project was to build an emergency cell phone powered by solar energy. This product would be useful for hikers and campers while out in the wilderness without a source of external electricity. Initially, it was thought that solar panels could accomplish this objective. However, after doing research on cell phones, it was determined that solar panels roughly the size of the phone do not provide enough peak instantaneous electrical current for the cell phone radio (power amplifier). A battery would be needed to store the energy from the solar cell to provide the peak current to make the call.

With a voltmeter, three different solar cells were tested and the results were recorded. Based on size and efficiency, the most suitable solar cell was chosen for the remainder of the project. Then, based on information about cell phones and batteries, the smallest size battery that would be sufficient for the cell phone call of 20-minutes was calculated. Research was done to find a battery closest to the calculated size. The chosen battery was then connected to the selected solar panel and the cell phone utilizing alligator clips, and the call was tested.

Each solar panel had a different peak current, however, they all recorded the same current at the required 5 volts (needed to charge a 4.2 V battery). Based on calculations, an 83-mAh battery was determined sufficient. Interestingly, the impedance of a lithium-ion battery generally increases as the battery's size decreases, and a higher impedance results in a higher drop of voltage when current is drawn from the battery. The impedance in Lithium-ion batteries available that were smaller than 110-mAh was too high, and therefore, a 110-mAh Lithium-ion battery was chosen. This specific battery was bought and then tested.

The findings of this research proved that a solar panel in conjunction with a small lithium-ion battery can be used to power a cell phone to make a 20-minute emergency phone call. During the experiment, the phone call exceeded what was expected. The call lasted 46 minutes and only ended because the researcher disconnected it in order not to fully discharge the battery. The reason that the phone call exceeded the expectation is because the peak current that is required is determined by the distance from a cell phone tower and in the calculations, the maximum peak current assumption is used. By the use of only the solar cell, the battery was fully charged in 1.5 hours in direct sunlight, proving to be very useful for outdoorsmen.

ENVIRONMENTAL SCIENCE

44
Bartholomew, Annie
Environmental Science

The Efficacy of a Simple Water Filter at Filtering Pathogens from Drinking Water

Unsafe drinking water has increasingly become a problem in developing countries. Methods of filtering dirty water are in extreme need in impoverished areas, particularly methods that are inexpensive, portable, and easy to clean.

A simple, inexpensive water filter using easily obtained materials (sand, gravel, cotton) was tested to determine the efficacy of the water filter at removing pathogens. Water samples were tested for the presence of non-harmful E. Coli prior and after filtration to see if the filter was able to remove enough bacteria to make the water safe to drink. Total Dissolved Solids were also measured, as it can be an indicator of bacteria presence.

While it was expected that the filter would filter enough bacteria to make the water sample safe to drink, the opposite was true. The filter did not reduce the bacterial concentration in the water sample to safe level and the TDS data was inconclusive.

The results of this study show that the combination of cotton, gravel, and sand are not viable materials for use in a filter. Later projects could change the materials used to find a successful method of bacteria filtration. To create an inexpensive, portable filter for use in impoverished areas.

45
CHA, KATIE
ENVIRONMENTAL SCIENCE
2012

THE EFFECT OF BACILLUS THURINGIENSIS SUBSPECIES ISRAELENSIS ON COPEPODS (SPECIES CYCLOPS)

The government uses Bacillus Thuringiensis subspecies Israelensis, also known as Bti, on fields where mosquito and black fly larvae are present in order to control their population. However, with copepods living in the same regions, they eventually consume the bacterium making it questionable of whether they are affected in the same way as the mosquito and black fly larvae. So the purpose of my project is to observe the effects of Bti on the copepods. Also, it is to monitor how the Bti affects the copepods, whether it changes the way they act and the amount of species alive and dead. With some success, a similarity was found between the trials even with different amounts of light.

Initially, the water quality was assessed through various checks on the oxygen level and others and the copepods were placed in with the bacterium. Change in activity and behavior were observed on the given days within the week. To verify the question, the difference in amount of copepods were counted at the end of each trial. However, within the two trials, one had a major increase in the number of copepods and one had a drastic decrease in the amount.

Through the first trial, there was a significant growth of copepods and a minor decrease in the amount of water of each container. However, because there was not a large amount of sunlight the copepods were not very active and the water did not evaporate significantly. However, during the second trial, there was an extravagant decrease in the number of copepods alive. The cause of this defect was because there was too much heat given off to the containers. However, this caused the copepods to be more active at the end of the experiment, but there was also a major decrease in the amount of water available. Because there was too much heat being given off, more than half of the water had evaporated, leaving barely any water left.

Through this experiment, it was demonstrated that Bti does not affect the copepods in the same way as it does to mosquito or black fly larvae. Instead, in its present form, this project came out with the results that with a larger amount of Bti, more copepods tend to stay alive and reproduce whereas the ones with none or small amounts of Bti are consistent.

46
Chen, Christine
Environmental Science

Assessing *Polioptila californica* population in differing *Artemisia californica* habitats (Year 2)

This purpose of this project was to study the bird population in varying habitats. Specifically, this project assesses the population of *Polioptila californica* (California gnatcacher) in a sub-optimal newly restored *Artemisia californica* (California sagebrush) habitat versus that of a mature *Atemisia californica* habitat. This year, I also correlated the plant growth with the bird population data I continued to collect this school year. Therefore, for this project, I hypothesized that with an increase of plant growth at the newly restored habitat, the California gnatcatcher population will also increase. To test my hypothesis I conducted bird surveys, in which I counted the number of birds at different sites at two different reserves; the mature habitat, Vincente Bluffs reserve and the newly restored habitat, Three Sisters reserve. These surveys were conducted between October 2011 and February 2012. I also collected extra measurements of the California sagebrush at the Three Sisters Reserve in 6 month intervals to assess the plant growth. Since the bird and plant data collected had a non-normal distribution, I used a Mann-Whitney rank sum test to statistically compare the maturity of both reserves, and California gnatcatcher population at both reserves. For both the California gnatcatcher and the California sagebrush data sets, the median values between the two reserves for both sets of data was greater than would be expected by chance and therefore has a significant statistical difference (P=<0.001)This statistical result demonstrates that the Vincente Bluffs reserve is more mature and more optimized than the Three Sister reserve. However, this year there was a slight increase in population for the California gnatcatcher. This collected data and the increase in average plant size proves my hypothesis that an increase of plant growth at the newly restored habitat, the California gnatcatcher population will also increase.

47
CHOE, Justin
ENVIRONMENTAL SCIENCE

MODELING THE EFFECTS OF NANOCOPPER ON ENVIRONMENTAL MICROORGANISMS

To accurately assess the impacts of ever-increasing inputs of engineered nanomaterials into the environment, it is important to explore their interactions with microbes, which are at the foundation of all ecosystems, serving as primary producers and drivers of global nutrient cycles. Copper nanoparticles (CuNPs) are gaining widespread use in industrial processes and consumer products, such as electronics, structural steel, cosmetics, and printer inks. To date, their toxicity is not thoroughly investigated in environmentally sensitive organisms. This project aimed to characterize the effects of CuNPs on freshwater photosynthetic algae, which are key participants in aquatic carbon cycling. Copper is critical for photosynthesis because its deficiency causes chlorosis of chloroplasts, while excess copper is toxic to photosystem II.

***Chlamydomonas reinhardtii* cultures were grown in Tris Acetate Phosphate medium at 25°C under 16h:8h light:dark cycle. The cells were exposed to CuNPs ranging from 0.098 to 100 mg/L or equivalent concentrations of Cu^{2+} ions derived from $CuCl_2$. Chlorophyll, ATP content, and photosynthetic yields were measured to assess cellular health. All these indicators of algal viability declined with increasing dose, confirming that CuNPs were toxic to algae. Average IC_{50} values for CuNPs were 20 mg/L, while those for $CuCl_2$ salt were 15 mg/L, which are comparable. Thus, our results indicate that CuNPs cause toxicity due to release of Cu^{2+} ions.**

This research provides a foundation for understanding CuNPs impact on environmental microbial communities as well as management of global aquatic carbon cycle. Future research will confirm these findings by utilizing advanced mass spectrometry and gene expression studies.

48
CHOI, Julian
Environmental Science

The Effects of Bacterial Pollution on Average Population Density and Size of Pacific Mole Crabs

Pollution is a widespread problem in the environment today. Because of various types of pollution caused by humans, much ecological harm has been inflicted on numerous animals, plants, and entire ecosystems. The Pacific Mole Crab is a dominant species living in the swash zones of beaches along the west coast of America.

Ten different observations were made on beaches along the west coast of Southern California. Each beach was given a grade by an environmentalist organization, Heal the Bay according to levels of bacterial pollution in the area, and data was analyzed accordingly. A 30cm. long by 30cm. wide by 15cm. deep area of sand in the swash zone was dug at each site. The sand was then sifted through a filter, hence leaving the sand crabs remaining, and each crab was counted, measured (length in cm.) and recorded.

Initially, I made the hypothesis that the beach sites with lower ratings for bacterial pollution would have a smaller average size and population density than the beaches with higher ratings and the results of this study proved my hypothesis positive.

It was found that the average number of sand crabs found in beaches with ratings of "A" or "B" was much larger than the average number sand crabs found in beaches with ratings of "C", "D", or "F". Also, the average size of the sand crabs found at the higher graded sites was much bigger than the average size of the sand crabs found in areas with lower ratings.

49
Coulter, Cameron
Environmental Science

A Composite Study of Bio-Diesel

This project investigates the potential of five plant oils (avocado, camelina, castor, coconut and palm) as alternatives to petro-diesel and the increased potential resulting from trans-esterification of these oils into "bio-diesel" based upon: i) properties; ii) performance as fuel; and iii) comparative economics and logistics. Based upon physical and chemical properties (viscosity; freeze/melt point; density; pH), castor, coconut, and palm oils were eliminated as alternatives. However, all bio-diesels, including those of eliminated oils, proved viable, though coconut and palm diesels are constrained to serving as warm weather fuels.
Remaining fuels were evaluated for energy efficiency relative to petro-diesel using a diesel generator. Testing showed a baseline performance of 131 grams petro-diesel consumed, which was converted to a base of 42.0 mpg. Fuel efficiency of petro-diesel was followed by camelina and its bio-diesel at 38.3mpg and 38.4 mpg, then avocado and its bio-diesel at 38.1 mpg. These were followed by the remaining bio-diesels, with the worst performing fuel tested, castor bio-diesel, at a still respectable 34.3 mpg.
Ultimately, for four of five fuels, conversion from oil to bio-diesel was an improvement in physical characteristics and performance. Camelina was the exception. Also, though trans-esterification of camelina and avocado proved economically unjustified, those two oils, as well as all five bio-diesels were found to be superior to petro-diesel in terms of environmental impact, and competitive with petro-diesel in performance measured on cost per mile basis. Furthermore, these can be produced at scale to be a measurable component of the total U.S. energy sup

50
GHANIAN, Ryan
ENVIRONMENTAL SCIENCE

GREENING OF PVPHS – PROTECTING THE ENVROIMENT, NATURAL RESOURCES, AND OUR FUTURE

This project in its present form is the result of a global increase in energy demand, climate change, and constrained energy supplies, all of which are likely to impact our future. The annual energy bill to run America's primary and secondary schools is a staggering $6 billion — more than is spent on textbooks and computers combined. The initial idea was to determine if PVPHS could reduce its consumption on electricity through the implementation of an energy efficient program.

A comprehensive energy efficient program involves five necessary steps. First, establishing the commitment for improvement. Secondly, assessing performance. Thirdly, setting clear and measurable goals using renewable energy technologies. Next, with goals in place, developing an action plan. Finally, implementing the necessary change. Reaching these goals frequently depends on the awareness and commitment.

Once approval was obtained from Mrs. Kris Safford, PVPUSD's Energy Specialist, and Mrs. Cress, PVPHS principal, the first step towards improvement was established. Next, an energy audit of every room on PVPHS campus was documented. A physical walk through of all common spaces and interior rooms and offices helped document all sources of electrical use. Research was performed on weekends and after school, both during the day and in the evenings. The variation of the different time periods allowed for a more detailed report of energy usage.

The contributions of this project are twofold. First, Panther community's awareness of the importance of energy conservation and efficiency will be in. Secondly, initiating change will ultimately help the school community reduce the use of natural resources, instead expending them more productively and efficiently.

51
HU, Richard
Environmental Science
2012

RHUS INTEGRIFOLIA FOR ABSORPTION OF CARBON MONOXIDE

Plants are a viable option for the abatement of carbon monoxide levels, as they rapidly oxidize carbon monoxide. A further incentive offered is that native plants, specifically *Rhus integrifolia*, are well adapted to the local area and extremely drought tolerant. This experiment was aimed to evaluate the efficiency of *Rhus integrifolia* as a resource-conserving carbon monoxide filter for automobile exhaust.

Data was collected by collecting exhaust fumes from a Honda 2010 Accord Crosstour in an airtight file box and starting the engine for 90 seconds. The carbon monoxide monitor and one-gallon *Rhus integrifolia* were sealed in afterwards, and carbon monoxide readings were taken regularly for the next 12 hours, including the initial. Leaf surface area was then measured by scanning the leaves using an EPSON WorkForce 610 and utilizing the analysis and scaling functions of ImageJ.

A rapid pace of decrease in carbon monoxide levels prompted investigation of a control with no plant. After 12 hours of experimentation, all samples decayed to values under the federal 1-hour exposure limit of 35 PPM for carbon monoxide with leeway. The carbon monoxide absorption rate was estimated to be 0.019764 PPM/(cm^2*hr). However, the control, with no *Rhus integrifolia* present in the system, showed a loss of 1.833333 PPM/hr.

While the error created by the incompletely sealed system is not to be overlooked, the results clearly indicate that *Rhus integrifolia* are viable for automobile exhaust carbon monoxide abatement.

52
KAWAKAMI, Nicole
ENVIRONMENTAL SCIENC

Phytoplankton Levels in the Cabrillo Salt Marsh

The Cabrillo Salt Marsh stands apart from the other 30 salt marshes dotted along the Southern California coast in that it is an entirely man-made salt marsh within the Port of Los Angeles. Southern California salt marshes are unique wetland habitats because they are twice daily, hydro-logically influenced by oceanic tides as well as freshwater inflows from rivers and street run-off. Phytoplankton are autotrophic organisms that inhabit the upper sunlit layer of the ocean. The lack of which can effect the levels of zooplankton and other salt marsh inhabitants. For this project, phytoplankton levels were monitored along with water nutrition and health levels to observe whether specific populations of species of phytoplankton decreased or increased in correspondence with the weather. This field study would allow further knowledge about the relationship between the habitat and its inhabitants.

Over the course of one month, seven field trials were conducted at the same dock in the salt marsh. From each trial, four five drop samples were taken and individually observed under a compound microscope. For each sample, a tally was kept of each species seen and how many of that species. Additionally, the water temperature, salinity, and pH were recorded for each trial. Using the sample collected from each trial, nitrate, ammonia, and phosphate levels were also noted and recorded for each trial. Also, the number of hours since the last rainfall was recorded for each trial.

The results showed that three species of phytoplankton consistently appeared during each of the seven trials—Navicula, Pleurosigma, and Nitzschia. More specifically, Navicula demonstrated as the dominant specie of phytoplankton. Other phytoplankton such as Chaetoceros, Coscinodiscus, and Pseudonitzschia seriata size class, did not appear in significant numbers.

It was concluded that despite the water health and weather, Navicual demonstrated a consistent presence. This study may add knowledge to the relationship between the habitat and its inhabitants.

53
KIM, Jeff
ENVIRONMENTAL SCIENCE

Toxicity of Synthetic Builders in Detergent on Daphnia magna

Sodium triphosphate has been a major component of detergents since their inception in the 1940's. However, a study in the 1970's linked the eutrophication of water in aquatic ecosystems to the increased levels of phosphate in water, caused mainly by the heavy use of phosphates in fertilizers and phosphates. Since then, increasing government and civilian pressure have caused a general shift away from the use of phosphates as builders, and most companies have now completely removed phosphates from their products, or have offered phosphate-free versions of their original product. The synthetic builders that replaced phosphates, however, may still yet bode ill for the environment, in a different process from eutrophication.

Approximately 300 specimens of Daphnia magna were placed in an environment containing diluted detergent water, ranging from 1.0 ppm (parts per million) to 8.4 ppm. During a 12-hour interval, the conditions of the Daphnia were recorded at 1, 3, 6, and 12-hour marks. With each set of data, the amount of detergent was modified depending on the previous results of the experiment to determine the possible maximum concentration of detergent the keystone species may be able to tolerate.

The different brands of detergent displayed considerable amount of variability in the tolerance of Daphnia to their chemical content. Some brands were showed to have a tolerance level of lower than 1.0 ppm; less than the safety level of sodium triphosphate. However, other brands seemed to have only moderate impact at relatively high levels of concentration (4.2ppm to 8.4ppm), and generally could be regarded as being essentially irrelevant to the welfare of Daphnia at reasonable concentration.

Non-universal compounds in the different brands of detergent may be attributed to this seeming disparity in the tolerance of Daphnia to its presence. Molecules such as sodium alkylbenzene sulfonate, sodium lauryl sulfate, and sodium borate may be possible common components of detergent that may actively affect organisms' ability to survive in a freshwater ecosystem containing the compounds. In the future, it

would suffice to test solutions containing purely the suspected compounds to determine the tolerance of ecosystems.

54
KURUPPU, Praveen
Environmental Science
2011/2012

THE CONTROL OF INVASIVE PLANTS AT THE MADRONA MARSH

The purpose of this experiment is to ascertain if Concern, a pre-emergent, in granular form can control invasive plants. Additionally, we wanted to ensure native buckwheat (Polygonaceae) would continue to grow with pre-emergent being applied.

The procedure for this experiment started out with three 12'X12' plots of land containing five buckwheats approximately 2' in diameter. For the first plot, we applied 1.5lb's of Concern evenly throughout the plot. Then, we applied Concern around the dripline (base) of the plants on the second plot. The third plot was the Control (unaltered). Next, we watered all the plots each for five minutes once every four weeks, for 12 weeks, totaling 45 minutes in all. The plots were watered one inch deep. After twelve weeks, we checked to see if the pre-emergent was successful.

The buckwheats at the beginning of the project started out with a diameter of 2'. The height to the seed pods were 15.00", 13.50", and 17.00". The height to the green leaves was 12.00", 11.25", and 18.00". After application the diameters were 26.50", 25.50" and 27.25". The height to the seed pods were 16.25", 14.25", and 18.25". The height to the green leaves was, 13", 12.50", and 19.00".

At the experiment's end, there were numerous weeds that started to grow within all three plots. However, the dripline plot was effective. As the data shows, this project partly met the objective of this experiment. We are developing a plan to overcome the growth of invasive plants during next year's project.

55
Liu, Albert
Environmental Science
2012

Can Volunteer Successfully Restore a Habitat for an Endangered Species?

Palos Verdes Peninsula Land Conservancy works to restore habitats around the Palos Verdes. Currently, Palos Verdes Peninsula Land Conservancy focuses on restoring habitat for the Palos Verdes Blue Butterfly, one of the world's rarest endangered butterflies. At Linden H. Chandler Preserve, one such restoration planned to be carried out. The project will determine whether if volunteers can successfully restore the habitat using patch habitat restoration. Further, the project will determine whether or not restoration effort will be more effective if the area is disturbed prior to the restoration effort. It is hypothesized that as long as volunteers regularly weed and plant new native plants in the area, the habitat can be restored for the Palos Verdes Blue Butterfly and that disturbance will help the native species grow more effectively.

To test the hypothesis, there are three different areas: Weed area, Disturbance area, and the Control. The weed area is the area where no disturbance will be applied prior to the restoration. Only regular weeding will be carried out in the weed area. The Disturbance area is the area where six inches of soil will be disturbed by the volunteers prior to the restoration. Regularly weeding will also be applied. Lastly, the control is an adjacent area where no restoration effort will be carried out. A 10 m² transect will be set up in each areas (Weed, Disturbance, and Control) randomly using stakes and strings. Within these transect, plant density for *Astragalus trichopodus*, *Lotus scoparius*, and weeds will be recorded weekly for six months.

Result from the experiment show that while the disturbance did not increase the survival rate of the native plants, it decreased the amount of weed growth. The result also showed that the volunteers did make a significant amount of difference in the Disturbance area to be considered as successful. The Weed area is not quite as successful but still made a difference.

Therefore, volunteer has shown they have the potential to restore habitats for the Palos Verdes Peninsula Land Conservancy and the Disturbance method appears to be a more effective method.

56
Woo, Kelly
Environmental Science

THE EFFECTS OF N:P RATIO IN FERTILIZER ON THE ABUNDANCE OF HARMFUL MICROALGAE

Harmful algal blooms have been increasingly disrupting marine environments due to elevated nutrients from fertilizer runoff. When limiting factors such as nitrogen and phosphorous become available, algae growth is induced. Recent studies have shown different nutrient levels aid in excelled growth in certain species of microalgae. The purpose of this experiment was to determine whether contrasting N:P ratios in fertilizers will cause greater growth in certain harmful species of phytoplankton found in southern California.

Natural seawater samples were collected by plankton tows and inoculated with two types of fertilizer, All Purpose Miracle Gro (12:4) and Quick Start Miracle Gro(4:12). Samples were held in 1 L polypropylene bottles with fertilizer dilutions of 1:5, 1:10, and none for control. The bottles were placed in a large outdoor tank, with natural sunlight and water for 6 days. Samples were drawn and examined under a light compound microscope for identification of algae genus.

While many diatoms increased in abundance, harmful phytoplankton specifically did not display such dramatic change in number. The addition of fertilizer did contribute to increased HAB species in comparison to the control. The pseudo-nitzchia genus especially experienced a higher increase with the addition of All P (12:4) fertilizer. This suggests pseudo-nitzchia requires a higher concentration of nitrogen over phosphorous to carry out its metabolic processes.

MEDICINE & HEALTH

57
Royce Chen
Medicine and Health

Reducing Infection Rates Through Increasing Tissue Oxygen Levels

Year after year, time, energy, and medication are all spent on post-operative infections. Drug-resistant bacterial strains are growing more numerous as widespread antibiotic usage has wiped out all competing, nonresistant strains. Due to the heavy usage of antibiotics, hospitals are an ideal breeding ground for these drug-resistant strains, who multiply unfettered by competition. Thus, developing a simple, reliable method to reduce infection rates without the usage of antibiotics would be immensely useful to patients and staff alike. Increasing the tissue oxygen level is already proven to reduce infection rates, as the oxygen allows the body's natural responses to function more efficiently. The purpose of this study is to test whether an external heating pad or an oxygen mask can significantly increase tissue oxygen levels. Data was collected by the LA Biomedical Research Institute and then analyzed by the student researcher, me. The primary variable involved was tissue oxygen level. Tissue oxygen level at the area where the heating pad was applied was compared to an unheated area, and a T-test was used. The inclusion of a heating pad was found to significantly increase tissue oxygen levels. After performing this statistical study, an externally applied heating pad was found to significantly improve tissue oxygen levels.

58
Jeffrey Farooq
Medicine/Health
2012

Comparison of Post-Bariatric Surgery Protocol and Vitamin Consumption of UCLA and Kaiser Permanente Patients

The process of healing and acquiring sufficient nutrition levels after bariatric surgery (i.e. gastric bypass, lap band) is an arduous task. It is extremely important to make sure the nutrition requirements are met to avoid the effects of nutritional deficiency. Determining which hospital to trust your healing in is vital in ensuring the best results. Thus two popular hospitals were studied in order to compare post-bariatric healing effectiveness.

Post-bariatric healing was interpreted by using data gathered from patients' multivitamin consumption. Vitamins important to post-bariatric healing such as vitamin A and B were recorded and compiled onto a multivitamin comparison list for quick reference. Data was gathered for a total of thirty patients within each hospital.

Data clearly indicated that patients of the UCLA hospital received higher levels of vitamins than patients at Kaiser Permanente hospital. Research indicated than patients at the UCLA hospital were most commonly recorded using the same multivitamin to satisfy nutritional requirements. However, patients at Kaiser were recorded using a variety of multivitamins.

These findings indicate two things. First the research indicates the UCLA has a better system in place to help patients recover. That system involves their staff-wide post-bariatric protocol that must be followed. Second, it indicated that Kaiser patients, while having lower vitamin levels than UCLA patients, mostly meet nutritional requirements as long as they are compliant.

59
GOLD, David
MEDICINE & HEALTH

THE DIFFERENCE BETWEEN AUDITORY AND VISUAL RESPONSE TIMES

This project shows the difference in auditory and visual response times. The initial hypothesis was that was that and auditory stimuli would cause a faster reaction than that of a visual one. It was found that the hypothesis was indeed correct in saying that on average a visual response was slower than an auditory one.

Data was measured by means of a microcontroller. The response to the stimuli was the release of pushbutton. Reaction times were measured for a 80db, 60db buzzer, and a red and green LED. Each type of test was taken five times. All outliers were immediately removed from the data.

On average the 60db test had an average time among subjects of .240 sec, the average for the 90db test was .238 sec. The red LED test had an average of .331 sec and the green LED had an average time of .326 sec. This is statistical evidence to prove the hypothesis.

Between all of the subjects in the hearing response time test, not a lot of variance occurred. In the 90db test the standard deviation between subjects was 47. In the LED test, the standard deviation between subjects was significantly higher.

In conclusion the hearing response time was not only faster ,but ad less standard deviation between subjects.

60
GRZYWACZ, Sara
MEDICINE AND HEALTH (2011/2012)

A CURE FOR *RETINITIS PIGMENTOSA*: RE-ENGINEERING OF THE PHOTORECEPTOR MOSAIC

Retinitis Pigmentosa **(RP) is the leading cause of inherited retinal blindness worldwide. This disease is characterized by loss of rod photoreceptors followed by slow, progressive reorganization of the retinal circuitry, specially of the mosaic of cone cells. The reorganization follows the remodeling of the processes of the glial Müller cells. This study tested the hypothesis that transient disablement of Müller cells allows the re-engineering of the cone mosaic.**

Müller cells were transiently disabled by injection of the drug DL-alpha-am inoadipic acid (AAA) into the eye of a rat model of *retinitis pigmentosa* (S334ter-line-3). Cones were marked immunohistochemically in control, RP, and RP-with-AAA conditions, and whole-mount retinas were photographed with fluorescence microscopy. The geometries of the photographed cone mosaics were analyzed statistically using MATLAB programs.

The data confirmed the result of previous studies showing that the cone mosaics in RP retinas were abnormally inhomogeneous, displaying an array of rings. Analysis of the nearest-neighbors-distance distribution revealed that AAA treatment restored the regularity and spatial homogeneity of the cone mosaic. A similar benefit of AAA was observed in the dependence of the density of cones on distance from a cone of origin. Both in normal and AAA-treated retinas but not in RP ones, this density rose with distance over about 10 µm. Moreover, AAA treatment reduced the sizes of empty spaces in the cone mosaic, which RP had compromised.

These results are consistent with the hypothesis that transient disruption of Müller cells allows the re-engineering of cone mosaics. Such retinal re-engineering raises hope of restoring normal sight to people blinded by RP.

61
Hung, Megan
Medicine and Health

The Effects of Caffeine and Alcohol on Coronary Artery Calcification

This project involves the retrospective data analysis of 3,084 patients over two years. The goal is to determine whether or not the consumption of caffeine and/or alcohol has an effect on coronary artery calcification scores.

A retrospective analysis of data collected in 2007 and 2008 from Los Angeles Biomedical Research Institute was conducted. Data from the 5,900 patients included general health and social information. These patients underwent a rapid sequence CT scan which allowed for the measurement of coronary artery calcification. Patients with insufficient information were excluded from the study, bringing the number of studied subjects to 3,084. Patients were then divided into four groups: 1) those who consumed neither caffeine nor alcohol, 2) those who only consumed caffeine, 3) those who only consumed alcohol, and 4) those who consumed both caffeine and alcohol. Those groups were then further stratified by the number of drinks consumed per day. Student's T-test was used to analyze the calcium scores and their statistical significance.

For those who consumed neither alcohol nor caffeine (n=1485), the mean Coronary Artery Calcification score was 309.0 ± 772.6. For those who only consumed caffeine (n=275), the mean score was 303.9 ± 643.8. For those who only consumed alcohol (n=177), the mean score was 430.6 ± 924.1. For those who consumed both alcohol and caffeine, the mean score was 424.1 ± 806.0. A Student's T-test was performed to evaluate the significance of the statistical analysis. It showed that only the combined consumption of caffeine and alcohol had a statistically significant increase in coronary artery calcium scores. Upon adjustment of the many variables, such as age, history of hypertension, extreme body activity, cholesterol levels, etc, the coronary artery calcium score was again significantly elevated ($p < 0.001$).

This study shows that there is no significant correlation between the consumption of either caffeine or alcohol alone and coronary artery calcification scores, which contradicts some of the earlier studies. On the contrary, consumption of both alcohol and caffeine appears to have a direct correlation with coronary artery calcium scores.

62
KANG, Min Gyung (Lucy)
Medicine & Health;

Measures of Task Performance in the Paretic and Non-paretic Limb after Stroke at Home and in the Lab

An accelerometer is a sensor that measures motion; when worn on the body, the accelerometer measures the movement of the person who wears it. In this research experiment, a post-stroke patient wore accelerometers on his stroke-affected left limb and healthy right limb. The data from both accelerometers were used to find differences in task performance at the home and in the laboratory.

The experiment was mainly divided into five steps. First, a laboratory was set up with materials that were used in the experiment. Next, patients with stroke were recruited to participate in the experiment. After that, patients put accelerometers on their limbs and moved their arms accordingly. When the exercise was done, patients were told to wear the devices in their homes for 3 days. All the data were collected from accelerometers later, and a program called MATLAB was used to analyze the results. Specifically, MATLAB was used to evaluate the time and frequency characteristics of the accelerometer signals.

Analysis from MATLAB revealed that the patient's right arm (which is the non-paretic) or healthy limb showed smoother movements than the patient's left arm (which is the paretic or stroke-affected limb) both at home and in lab. However, the movements of right arm were more wavering than the left arm. Also, smoothness and shakiness measured at home were greater for the right arm, but less for the left arm.

Concluded from the analysis, motion from the healthy right arm was smoother (as expected) but was also more oscillatory than that of the stroke-affected arm.

63
KUMAR, Vedika
MEDICINE & HEALTH

OPTIMIZATION OF TRASFECTION EFFICIENCY OF FETAL KIDNEY EXPLANTS.

Spatiotemporal gene expression during rodent nephrogenesis has been greatly facilitated by analysis of in vitro cultured fetal kidneys. Small molecule activators/inhibitors, receptor ligands, and other external effectors have been used to modulate and identify key stages of kidney development. To date, use of small molecule effectors has been helpful but the introduction of whole genes such as cDNA whole gene constructs would greatly accelerate studies. These cDNA constructs have not been used because introduction of the cDNA to the explant, using a method called liposome transfection has proven to be extremely poor. Within the last few years however, a large number of newly developed liposome preparation have entered the market although no data on their efficacy has been reported for explant transfection. Therefore, in this study, we compared lipisome-mediated gene transfer methods for efficient transfection of fetal kidney explants and compared it to a viral based method of transfection. Initial transfection conditions were performed using a GFP reporter gene plasmid construct (pMAX-GFP) with the commercially available liposomes Lipofectamine 2000, Purfectin, Bio-T, PepMute, TransIT-LT1, ExGen500, and X-tremeGENE HP at recommended DNA:reagent concentrations for 1-3 days. Our results demonstrated transfection at 24 hours, maximal after 48 hour, and somewhat decreased expression at 72 hours. Of the liposome reagents, X-tremeGENE HP was found to be twice as efficient as all other liposome reagents. An adenoviral vector expressing the GFP protein was also used and showed maximal transfection after 48 hours using 10^7 plaque forming units. It was comparable in efficiency to the X-tremeGENE liposome preparation. These results demonstrate that transfection of explant tissue such as fetal kidneys can be efficiently accomplished using a cDNA vector in the presence of X-tremeGENE liposome.
Key words: Nephrogenesis, Explant, Transfection

64
Lauren Pell
Medicine & Health

Equine Melanomas

The purpose of this research experiment was to learn more about the factors that predispose horses to getting melanomas. This is currently an important field of study because it could help prevent unwanted melanomas and because it is linked to skin cancer in humans. Although equine melanomas can be classified similarly to those in people, it is much more uncommon for horses to develop malignant melanomas, so scientists are investigating why horses get melanomas so much more often than people do while still experiencing negative health effects fairly rarely.

The hypothesis for this project was that when gray horses older than six years old are tested for melanomas at random, more horses with frizzy, course hair texture will have melanomas than those with silken, fine hair textures. Horses were only included in the study if their individual owners provided information regarding possible previous melanomas, and only gray horses above the age of six were chosen, because this particular group of horses has significantly increased risks of contracting melanomas. After each horse was classified into groups, the study found that at least 80% of the gray horses with frizzy hair had been diagnosed and treated for multiple melanomas (though not all had been diagnosed as malignant), while over 80% of the horses with silky hair had never been diagnosed with a melanoma. This evidence overwhelmingly supports the hypothesis, so the result of this study is that there is a definite positive correlation between tail hair texture and the likelihood of contracting melanomas.

65
SHAH, Sanjana
Medicine & Health

APOPTITIC EFFECT OF CURCUMIN ON MURINE METASTASIZED BREAST CANCER CELLS IN VITRO

Turmeric (called Haldi in Hindi language) and named by British as curry spice, is the dried rhizome powder of Curcuma longa, a perennial herb of the Zingiberaceae (ginger)
family, which is 3–5 ft tall bearing oblong, pointed, short-stemmed leaves and funnel-shaped yellow flowers.The rhizome of turmeric is a valuable cash crop, which is
widely cultivated in Asia, India, China, and other tropical countries. Turmeric (curcuma longa), which is widely used as a spice and coloring agent in several foods, has recently been shown to possess anticancer activity [5-6, 8]. The active ingredient of curcumin is diferuloylmethane. To test the anti cancer activity of Turmeric, The murine cancer cell line, 4T1, is a metastatic breast cancer cell line and they were obtained from the American Type Culture Collection (ATCC; Rockville, MD). Curcumin was purchased from Sigma-Aldrich Chemicals (St. Louis, MO). Curcumin was prepared as a 20-mM solution in dimethyl sulfoxide and then further diluted in CM.Tumor cells were maintained in complete medium (CM).
4T1 cells ($1x10^4$ /well) were seeded in 6-well plates and cultured in triplicate in the presence or absence of various concentrations of curcumin (2.5, 5 and 10µM). The final volume of medium in each well after addition of curcumin was 2 ml. Control cells contained medium and DMSO (0.05%). The plates were incubated at 37°C in humidified 5% CO_2. At different intervals (24, 48, and 72 hours after treatmen) the antiproliferative effects of curcumin against 4T1 cells were determined by standard trypan blue dye exclusion and MTT dye uptake methods as described. Statistical significance was determined by a t test. Differences were be considered significant at the $p< 0.05$ level.

67
ZHANG, Andrew
Animal Physiology

An Automated Process of Calculating Bone Mineral Density Using 3D Image Processing Algorithms

An abnormal bone density leads to fractures and/or osteoporosis. Currently, the way to measure patient's bone density is to take a bone mineral density (BMD) measurement. This process requires a patient to take a CT scan, which is analyzed by image-processing software. Currently, the most frequent method for BMD is Quantitative Computed Tomography (QCT), where the doctor draws three rectangles for each vertebral unit, capturing the area of the trabecular bone. From this, the software calculates the mean density. However, this process has several problems. The rectangles do not cover the entire area of the bone and inexact sections will be drawn for each scan because the doctor cannot perfectly determine the correct position.

The purpose of this project was to write new software that would calculate a more accurate region of the trabecular bone by using 3D image processing algorithms and minimizing human labor. Based on the certain range of density for trabecular bone, the software will approximate the volume of the trabecular bone. After the doctor checks the validity of each 2D slice, the software will proceed to calculate the BMD.

The new software generated results that were about 3% greater than the results from the QCT method. The areas which the new software approximated were more accurate than those using the QCT method, which probably resulted in the differing results. By having a more accurate and faster process of measuring BMD, doctors can give better diagnosis and prevent the diseases caused by an abnormal BMD.

MICROBIOLOGY

68
CHAN, Victoria
MICROBIOLOGY

The Antiseptic Effects of Natural Substances on Bacterial Colonies

The purpose of this study is to compare the antiseptic effects of different natural substances on the bacterial colonies. Another goal of this experiment is to test possible ways to improve the water quality of contaminated water Usable bacterial colonies were obtained from the Madrona Marsh water. The marsh water was diluted and incubated on MacConkey Agar plates for 24 hours at 37°C. Then Tee Tree Oil, Eucalyptus Oil, Lavender Oil, Thyme Oil, and Aloe Vera Gel were pipetted to each of the Agar plates and data was collected over a six-day period.

The results founded were that Tee Tree and Lavender Oil had the greatest antiseptic effects since most of the bacterial colonies in those natural substances were completely wiped out and had the greatest color change. As for Eucalyptus Oil, it only had a moderate antiseptic affect on the bacterial colonies. The natural substances that had the least antiseptic affect on the bacterial colonies were Aloe Vera Gel and Thyme Oil; however, those bacterial colonies had the greatest morphological change. Bacterial colonies affected by Aloe Vera changed from a round, smooth edge, to having a starrid center with a rugged edge.

This experiment is very important because the abundance of these bacteria caused by eutrification results in water intakes being clogged, the growth of slimes, the unsightly shorelines, and deoxygenation (hypoxia) that causes toxic water and damage the ecosystem of the world. In addition if humans consume these bacteria, they may result in severe diarrhea and vomiting. Diarrhea causes dehydration and can eventually lead to death. In conclusion, E. Coli found in the marsh water also affects other water sources such as in Africa and other third world countries, this experiment proves that by using natural substances, the quality of water can be improved.

69
CHOO, Agnes
Environmental Science
2012

Counts of Escherichia Coli in Seawater

Approximately seventy point eight percent of the Earth is covered by water and of this amount; only three percent of the water is fresh, leaving about sixty-seven point eight percent of the Earth to be covered by saltwater. People, especially those who live near the ocean, do not recognize the potential hazard of sea water and may not completely aware of what is inside seawater. Escherichia Coli or E. Coli is one of the many dangerous components that may affect humans as well as animals. Escherichia Coli is not always harmful; however, it may cause food poisoning in humans, bloody diarrhea, and even kidney failure, which may ultimately lead to death.

In order to discover if there are strains of Coliform Bacteria and Escherichia Coli present in sea water, an experiment was conducted with a Water Quality Testing Kit using Easygel. Five beaches, Cabrillo, Redondo, Manhattan, Dockweiler, and Long Beach, were used to retrieve samples of water. A small plastic container was filled with water from the beaches. Then, five milliliters of water were removed from each sample with a sterile plastic dropper, and placed inside the Easygel solution where it was mixed together gently. This was done for each sample. When the solution was completely mixed, it was put into a Petri dish for the solution to incubate where the solution will harden and colonies of bacteria may form. When the bacteria form, the pink/fuchsia colors in the solution reflect Coliform Bacteria and the purple hues represent the E. Coli bacteria. These steps were done twice, once before rainfall, and once after rainfall.

Both sets of data represent a significant amount of Coliform Bacteria and E. Coli in the water per five milliliters of sea water. In the second trial (after Rainfall), the amount of bacteria from Long Beach,

Cabrillo, and Redondo drastically decreased. However, the amount of bacteria remained quite constant for Redondo Beach and Dockweiler Beach.

Thus, we can conclude that there is a potential hazard level for those who come into contact with sea water frequently, but that it is safer to come into contact with sea water after rainfall. Although we can't completely neglect seawater for the rest of our lives, we can be more knowledgeable about the contents that are in the water and be more cautious not to drink large quantities of sea water, etc.

70
KIM, Christine
MICROBIOLOGY

THE STUDY OF BACTERIA AND THEIR GROWTH ON WATER BOTTLES OVER TIME

As the economy worsens, the common people are searching for ways to save some extra change, one of which includes reusing water bottles. What people do not realize is that bacteria can build up on the mouth and bottom of the bottle and cause harm if not cleaned each day. With this study, society will become more aware of the bacteria that can grow.

In this experiment, two comparative tests were conducted: a one-month test and a one-day test where bottles are used for those time periods. After one month/one day, samples from the designated areas around the mouth and bottom of the bottle were collected using sterile swabs and then plated on agar plates and incubated for 2 days in 30°C. After, samples of the bacteria colonies from incubated plates were attained onto microscope slides and a Gram staining was performed to be used for identification. The used swabs to take samples were set aside to be used for a bacterial count conducted through a serial dilution.

After the completion of the experiment, the types of bacteria were determined and bacterial counts were calculated. In conclusion, harmful types of bacteria, such as Staphylococcus and Streptococcus, were found in an amount of millions. Though the counts of bacteria from the one-mouth test were significantly larger in comparison with those of the one-day test, the amount of bacteria on the one-day test was shockingly abundant in some.

There are many types of bacteria that can grow on a bottle and the amount can continuously augment if the bottles are not washed in hot water with soap every day. For a better state of well-being and health, people should learn to keep their water bottles free from pathogens.

71
Lee, Julie
Microbiology

Halobacterium in Alkaline Margin Habitat at Madrona Marsh Preserves

This project in the stage of completion is the result of the experiment of identifying haloarchaea in the salty soil at Madrona Marsh. This project held the sole purpose of identifying a new species not yet classified at the Madrona Marsh. With the conclusion of my project, Madrona Marsh will be able to conclude if halobacterium is found in the alkaline margin habitat.

Archaea was cultivated in Media, Halobacterium Agar purchased from Carolina Company. After mixing the soil and roots with buffer in a one to ten solution, one milliliter was taken and poured onto the medium. The agar was placed in an incubation tube set at thirty seven degrees Celsius.

After seven days, in all four samples no sign of cultivation of archaea colonies were to be seen through the light microscope. This experiment did not fail; it proved that this certain species of microorganism did not live in the habitat of alkaline margin.

In this trial or error project, the knowledge that halobacterium does not inhibit the alkaline margin habitat was discovered. The conclusion of no halobacterium existing in the Marsh was made and haloarchaea was not classified as a microorganism found at Madrona Marsh.

PHYSICS

73
KELLEY, Sean
PHYSICS
2011/2012

Measurement of Glucose in Aqueous Solution using a Proton Magnetometer

My hypothesis is that if glucose concentrations are varied in solution with water using a proton magnetometer, with a two coil relay system, the concentration differences will create a different resonance frequency which can be measured.

Two coils were created out of 18 gauge wires around a 5.8cm diameter and 7.8cm long around a PVC pipe. Each coil contains 600 turns of wire with a resistance of 4ohms and 21.34mH of inductance. A relay system was created to connect the coil to power and switch to a National Instruments measurement unit. The experiment began by activating a switch which connected the coil to power for 1 second. Then the coil was disconnected from power and reconnected to the measurement unit.

A total of 160 trials were conducted; 140 were with glucose dissolved in 125ml of water from 0.79% to 7.5%, 20 were with only 125ml of water and 20 were with no solution. The 20 trials of water all showed a singular resonance peak at 2006Hz, while the 20 trials without solution showed no resonance peak at all. The 140 trials with glucose demonstrated a different resonance frequency for glucose compared to water only.

The experiment confirmed my hypothesis that I would be able to detect a difference in the glucose concentration by measuring the resonance frequency. This study shows that it is physically possible to noninvasively measure glucose, which has not been done before, and is a first step towards measuring glucose levels in diabetic patients.

74
SAKIKABARA, Yuma
PHYSICS

Methods on Improving the Efficiency of a Magnetohydrodynamically Powered Boat.

Magnetohydrodynamics is often used to contain substances such as plasma that will destroy anything it touches. A force is created when a magnetic field is perpendicular to a electric field. When this happens, a force that is perpendicular to both of these forces is formed. In this experiment, I will research the efficiency of this force to propel a boat. This research focused on the voltage and the weight of the boat. The efficiency is measured by the ratio of the boat's propulsion to the voltage used. Instead of measuring the distance the boat traveled in a set amount of time, which can be inaccurate, I measured the time it took the boat to travel a set distance.

Data showed that voltage and the speed of the boat had a correlation, but it isn't a linear correlation, but more of a logarithmic correlation. The data also showed that it was the drag, not necessarily the weight of the boat that affected its speed. Therefore, is a boat design where there is almost no drag is created; more weight can be put on the boat without losing speed.

In conclusion, the speed of the boat depended greatly on the voltage, but not necessarily the weight. Although it is not as efficient as a motor powered boat, further research should improve the efficiency of the MHD powered boat.

ZOOLOGY

75
ADOUMIE, Maeva
ZOOLOGY

Effects of Different Light Wavelengths on Food Consumption in *Hippolytidae*

This project was designed in order to determine the effects of exposing Hippolytidae (broke back shrimp) under red and blue lights on the food consumption of brine shrimp. The project stemmed from an earlier experimental idea to see the varying pigmentation patterns on spot prawns under differing lights. However, maturation of the larval prawns had setbacks, and a more viable test organism was found in the broke back shrimps. Taking the basis idea of lightings effect on organisms, this modified project seeks to extend the lighting environment to stimulate differing depths in the ocean. Therefore, experimentation provided a broader understanding to these species environmental surroundings.

In order to obtain quantifiable data from experimentation food density was calculated prior to and after each twenty-minute feeding period. Brine shrimp proved to be readily counted, by sampling portions of the food mixture and counting brine shrimp per portion under a TEC microscope. From this known concentration of food mixture a counting after feeding was used to see the change in food density, which would thus indicate how much food was consumed in each tank under specific lighting conditions. Brine shrimp are known to be phototactic, moving to the area of light, so light was placed equally distributive over the tanks.

The initial experimental data of shrimp was taken from gravid females, however they soon became gravid and further experimentation continued with solely non-gravid shrimp. However, comparison between gravid and non-gravid shrimps was noted. For the gravid shrimp the greatest food consumed was seen in the tank exposed to blue light, the difference in food density was 13.00 brine/ 10mL as opposed to the shrimp in red light whose food density only equated to 5.50 brine/10mL. Data indicates gravid females prefer deeper ocean depth, an environment chosen for larval dispatching. As expected, the non-gravid shrimp had a greater difference in food density when under the red light. The difference between all trials of non-gravid shrimp averaging to 12.00 brine/10mL in red light tanks compared to 6.60 brine/10mL in blue light tanks. This data supports the hypothesis that shrimps use phototaxic cues during feeding, and thus being at a shallower ocean depth is ideal.

The knowledge gained from this project not only helps distinguish effects between gravid and non-gravid shrimp, but also better related oceanic feeding. The gravid shrimp, preferring deeper depth to hatch larvae were consumed more under blue light simulating the deeper depth. Non-gravid shrimp not inclined to deeper oceanic depth consumed most in their preferred shallow habitat. Analysis of experimental data was used to further accommodate these species in aquarium environments, assimilating the shrimps to man-made conditions.

76
CHEN, Bonita
ZOOLOGY

RED-TAILED HAWKS: EATING HABIT IN URBAN AREA

With the fast speed of urbanization in recent years, it has become increasingly difficult for wildlife animals to find prey. The red-tailed hawk, because of its versatile and wide range of prey consumption, has survived in urban areas. Most previous studies on the red-tailed hawk's dietary composition were conducted from the 1950s to the 1970s, a period of time when urbanization was not as widespread as now. This project is performed to determine the red-tailed hawk's dietary composition in urban areas, and whether their food intake is connected to Madrona Marsh Preserve in Torrance, California.

When red-tailed hawks eat, they usually swallow their prey whole and regurgitate pellets—small balls of hair, feathers and bone. By analyzing these pellets, the hawks' eating behavior can be determined. This study collected more than 20 pellets from the three to four red-tailed hawks that frequently visit

Madrona Marsh. These pellets were dissected, and the feather and bones inside them are being identified. A majority of the bones are from the remains of pocket gopher (*Thomomys bottae*) and California Meadow Voles (*Microtus californicus*) , which are both cited as common food sources for red-tailed hawks. The study also found some unusual prey, such as a hummingbird and a Jerusalem cricket (Oder Orthoptera).

Both pocket gophers and California Meadow Voles are found commonly in Madrona Marsh, so it is most likely that the red-tailed hawks obtain their food from Madrona Marsh. Madrona Marsh Preserve is vital to the survival of these hawks and is a good example of how urban areas can provide habitats for indigenous animals.

77
DIJORI, Stacey
ZOOLOGY

THE EFFECTS OF OCEAN ACIDIFICATION ON THE DEVELOPMENT OF RED ABALONE LARVAE

Increased amounts of atmospheric CO_2 have been absorbed by the ocean, causing it to become more acidic. This has affected the survival of many marine calcifying organisms, such as abalone. This project focuses on the effects of increasing atmospheric CO_2 and decreasing pH on the development and calcification of larval red abalone shells.

Female and male abalone were induced to spawn. Fertilized eggs were then siphoned into a beaker and a homogenous mixture of embryos was pipetted into each experimental bowl. There were 6 bowls per gas chamber. Four gas chambers were used: a control injected with 200 mL of air, one injected with 200 mL of 10% CO_2, another injected with 400 mL of 10% CO_2, and the fourth injected with 600 mL of 10% CO_2. After 48 hours, final water quality measurements were taken. The larvae were transferred into culture flasks and examined under an inverted microscope.

In the control chamber, 99.67% of the abalone developed normally. In the chamber injected with 200 mL CO_2, 91.17% developed normally. 29.83% of the abalone in the 400 mL CO_2 chamber developed normally, and only 1.33% developed normally in the 600 mL CO_2 chamber.

My hypothesis that increasing levels of CO_2 and decreasing levels of pH would cause the abalone shells to develop abnormally was supported strongly by my results. In the future, I would like to test the effects of ocean acidification on abalone spawning and fertilization to see if abalone can still reproduce as our oceans increase in pH.

78
FURUTA, Anna
ZOOLOGY

THE EFFECT OF ZOSTERA MARINA ON THE LINGEVITY OF BROKEBACK SHRIMP

Grass Shrimp (*Hippolyte clarki*) have been known to dwell in low intertidal habitats, such as eelgrass beds or kelp forests. This experiment sets out to determine which physical habitat is most suitable for the shrimp. The initial idea was to observe how various habitats influence the longevity of grass shrimp.

The specimens were place in pseudokreisel tanks that contained a bag of mud with eelgrass, kelp, or artificial eelgrass protruding out of each bag. The control had a bag of mud with holes, similarly to the eelgrass, kelp, and artificial eelgrass. However, the bag did not have any substrate protruding out of it. This tank set-up allowed for animal interaction with the substrate in the tanks. In all of the trials, the number of shrimp in each tank were counted and recorded.

The data collected showed that the number of shrimp in each the tanks was fairly constant. However, after the ninth trial the number of shrimp decreases dramatically. This dip in shrimp population may be due to outside contaminates on the eelgrass that were harmful to the shrimp. The data shows that the habitat that

the shrimp occupy does not have a large impact on the survival of the shrimp and that grass shrimp can live in a variety of areas.

80
Kimura, Julian
Animal Sciences
2012

Copepod Culturing- Conditions and Designs for Maximum Yield per Generation: Year 2

Copepods are essential food sources for captive marine animals. However, due to their slow reproductive rate in laboratories, copepods are not a viable food source for some organisms. In addition, pelagic copepods are notorious for their delicateness and cannibalism, resulting in difficulty when producing large volumes. Previously, culture conditions for the species *Tigriopus californicus* were explored, resulting in a 260% increase in copepod population by feeding *Isochrysis* algae. This year, the effects of DHA and ARA, the two major HUFA components of *Isochrysis*, were compared. In addition, a specialized tank that solves for all problems associated with culturing pelagic copepods was designed.

Trials testing fatty acid diets lasted four weeks. Cultures were 5gallon buckets with an air pump, starting off with 100 gravid females of *T. californicus.* Every two weeks, water was agitated to keep copepods in suspension, and three 20ml samples were taken. The average of samples was used to estimate the population. Tanks were built for the pelagic species *Acartia tonsa* using a fiberglass container as a base. PVC piping with 45 and 150 micron mesh was used for automatic adult and nauplii separation.

Cultures fed on high DHA diets yielded 37% more than those fed a combination of the two HUFA's, and 80% more than those fed ARA. *A. tonsa* tanks successfully separated *nauplii* from the adults with steady parameters.

The data suggests DHA components in copepod diets over doubles the population per generation. Moreover, the *A. tonsa* tank increased the ease of culturing pelagic copepods.

81
LEE, ANISSA
ZOOLOGY

Effects of Salinity and Temperature on Brine Shrimp

This project presents the effects of different temperatures and diverse salinities on hatching brine shrimp. The results will help many scientists or people, in general, who want the most efficient way to culture brine shrimp. Maybe higher salt concentrations and water that is about room temperatures will hatch more brine shrimp than lower salt concentrations and higher temperature of water.

The salinity was measured as normal sea water, ten percent concentrated, twenty percent concentrated, and thirty percent concentrated. Once, the brine shrimp were hatched, they were counted using a magnifying glass and then averaged out. The temperature was measured as the following: seventy-one degrees, seventy-seven degrees, eighty-three degrees, and eighty-seven degrees (all in Fahrenheit). The experiment was tested in four similar trials. In each test, the temperatures stayed the same, but the salinity differed.

Brine shrimp hatched the most in the container with twenty percent concentrated sea water and that was about eighty-seven degrees Fahrenheit. The averaged amount was 20.2%. The lowest hatching container was the one with thirty percent concentrated sea water. The temperature did not have an effect on this container.

From what is known, brine shrimp eggs hatch better in warmer water that is in a higher concentration than normal sea water. On the other hand, if the water is thirty percent or above concentrated, this is too high of a salinity and will decrease the number of brine shrimps hatched.

83
NAM, Sean
ZOOLOGY

The Bite Mark Patterns on Asians and Caucasians

This project was to find the bite mark differences and patterns within two different races. With the information, forensic scientists have a new way to find suspects and see who was responsible for the crime. Also, the different bite mark pattern would give an idea of what race the mark belonged to and possibly narrow down the possibilities. The initial idea was to find a different bite mark and depth measure in the two different ethnicity.

Molds of people's teeth gave the accurate measurements of the bite marks. Teeth plates used in dental offices and everyday children molding clay were used on 30 males, 15 Asians and 15 whites. Lengths of molars, incisors, and canines were measured as well as the depth of the teeth. Rulers and paper clips were used for measuring.

After the data was collected and the average was found, Asians and Caucasians did have a slight difference. The Caucasians' canines were generally more spread apart, but the depth of it was almost the same and exact. However, the Asians had their molars more spread apart and nearly 10mm longer than the Caucasians. Another interesting fact is that the lengths of the four incisors of the teeth are about 3mm longer than the Asian's.

And so, the findings of the experiment had their benefits and negatives. First, if and when forensic scientist or detectives are looking for a suspect and they do not know where to start, the findings of this information will help them determine who the person is. However, the conditions of a flesh and molding clay are different, but if the measurement is take fresh, then the data should be accurate. Secondly, the data could have had many factors that affected it, but the main contributing factor would be the food that people eat. Asians eat different food that Caucasians, but because the data was collected in the same environment that may have possibly caused the subjects to have similar measurements. Adapted toward the food they eat locally and the food they ate as the subjects grew up could have affected the data, so that was another negative effect.

84
Shimizu, Toshiaki
ZOOLOGY
2012

The Effect on the Life Cycle of Maggots in Increasing Amounts

The purpose of this research project was to see how a maggot's life cycle would be affected by living in larger groups. This experiment will show if population affects growth in maggots and how they differ amongst their overall size as they grow into full- grown flies. Some factors in the experiment were changed to suit the living conditions of the maggots better to maximize their growth efficiency. The materials were changed in order to benefit the rate in which the maggots will evolve through the instar stages.

The maggots were organized into two populations of ten and two populations of twenty in order to compare the differences between the growth cycles of both groups. The maggots were placed in a tupperware container, each containing an equal sized piece of beef. The maggots were then left alone in order to show how they would grow independent from other variables.

The data showed overall that many of the maggots did grow at a more slightly rapid rate when they grew in larger quantities. The growth between each instar cycle was only affected by approximately one day.

The effect of this experiment helps show how growth is effected by population and the growing patterns of maggots throughout their young life cycle. This knowledge can help slow down or prevent large growth of maggots amongst households.

85
SOUTHWELL, Luke
ZOOLOGY

The Effects of Nutrition on the Oral Arm Development of Chrysaora achlyos

The oral arms of a sea jelly are essential to their survival. The oral arms use sting cells in which a sea jelly can paralyze its prey and consume them. This experiment studied the impact of enriched diet on the development of the oral arms of Chrysaora achlyos from the early Medusa Stage into their later stages. Experiments have been conducted with other marine life – such as mollusks and muscles – to measure the affect of nutrition on their development. In those experiments, sea life fed a diet with essential lipids and proteins were larger and healthier.

Five Chrysaora achlyos were studied for the duration of this experiment, with two different diets. Their development was photographically documented twice a week. In one tank, two Chrysaora achloys were fed unenriched brine shrimp twice a day, while the three others were put in a different tank and fed a diet of Reed Mericulture's N-Rich enriched brine shrimp. ImageJ software was used to precisely measure the oral arm length over the period of the experiment.

Overall, the findings of the experiment supported the original hypothesis. The average physical development of the ruffles and length of the oral arms of those jellies fed the protein and lipid enriched diet was greater than the average development of those fed an unenriched diet.

Further studies with greater numbers of jellies and for longer durations need to be conducted to substantiate these findings.

86

UETRECHT, Madison
ZOOLOGY

Melanin-Based Dietary Supplements Promote Pigmentation in *Chrysaora colorata*

***Chrysaora colorata* is a local southern California jellyfish with dark purple stripes on its bell. However, cultured specimens develop coloration that is only faintly reminiscent of that seen in their wild counterparts. The purpose of this project was to test whether certain dietary enrichments promote the development of proper bell pigmentation in cultured *Chrysaora colorata*. This experiment is important because the absence of the characteristic purple stripes may be an indicator of poor nutrition; cultured *C. colorata* may not be receiving optimal nutrients.**

In this project, nine juvenile *Chrysaora colorata* medusae were divided into three tanks. One group was fed *Artemia* nauplii enriched with *Haematococcus* microalgae, a source of carotenoid pigment. The second group was fed nauplii enriched with squid ink, a source of melanin pigment. The control group was fed unenriched nauplii. Feeding occurred twice daily for 14 weeks. Photos were taken of all specimens once a week and were analyzed to measure each animal's bell pigmentation.

After 14 weeks of experimentation, one specimen from the squid ink treatment developed distinct pigmentation, which was not seen in any other specimens; a ring of pigments formed above its stomachs along with stripes radiating outwards from the ring. Six weeks after the conclusion of the experiment, this individual's stripes continued to develop and darken.

These promising results suggest that melanin-based dietary supplements may promote increased pigmentation in *C. colorata*. The results have the potential to revolutionize the way aquariums care for this species.

87
Vaish, Manu
Zoology
2011/2012

The Effect of the Removal of Rhopalia on the the *Aurelia aurita*: Year 3

The *Aurelia aurita*, or Moon Jellyfish, is the most commonly found jellyfish on the California coastline. The jellyfish has eight rhopalia symmetrically spaced out across the bell. The rhopalia are the *Aurelia aurita's* sensory organs that serve to sense light and gravity in the water. They also serve as an intermediary force between the motor nerve net (controls swimming muscle fibers) and the diffuse nerve net (sends sensory information).

The objective of this study was to determine if the removal of a certain pairing of rhopalia would result in loss of regenerative abilities, strange growth patterns, and awkward movement of the *Aurelia aurita.* The concept was that the eight rhopalia would be similar to our human nervous system. One pair of rhopalia would function as the brain while the other six rhopalia would act as neurons.

The third year focused solely on the movement portion of the study. 40 jellyfish were cut only one time without waiting for regeneration and placed into a tank to observe their movement without those rhopalia. There were seven different parings of rhopalia possible therefore in order to provide support for the theory 1/7th of the cut jellyfish should have shown the hula movement. Out of the 60 cut, four exhibited the movement. Running this through a chi square test it resulted in a 0.0957 chi square value supporting the idea that the two populations were statistically similar yet; they differed in the rhopalia being removed.

This study was done in order to better understand the regenerative capabilities of the *Aurelia aurita*, in order to one day apply the same techniques in regenerative medicines for humans. If a jellyfish at the bottom of the evolutionary chain can regenerate 100% compatible neural tissue within itself, why can't humans?

88
WEI, Wendy
ZOOLOGY
2012

EFFECTIVENESS OF SETTLEMENT CUES ON INDUCING SETTLEMENT IN *HALTIOTIS RUFESCENS* LARVAE

Aquariums have been trying to restore the population that once dominated the Pacific Ocean. A major problem occurs during settlement, a stage in the abalone's life with a tremendous mortality rate. In order for abalone larvae to settle, the right cues must be present. This project aims to find the most effective cue in ensuring survival and inducing settlement.

This experiments tests the settlement rates among three cues including abalone mucus, a y-amin butyric acid (GABA) dip, and red coralline algae. Gravity was also tested. An food source of diatoms was cultured on plastic plates. The plastic was then lined in four buckets four horizontal trays. Along with two controls, the containers held either larvae that had been dipped in GABA, coralline algae rocks, or paddles rubbed with mucus. In each trial, each container started with approximately 1,000 larvae. After five days, settled larvae on plastic sheets were counted.

Results revealed that the mucus-containing trays yielded the greatest number of settled larvae. GABA dip showed the second most settlement, and the coralline algae had the lowest settlement rate. Gravity was also proved to have an effect on settlement.

The data shows that adult mucus is most successful at inducing settlement in red abalone. The chemicals in mucus signal larvae to settle on the diatom substrate. With these results, the high mortality rate of pre-settlement larvae could be greatly reduced by wiping settlement surfaces with mucus.

89
Juliana Wu
Behavioral Sciences

Effect of Deceased Ants and Poison in Food on Behavior in Ants

Argentine ants are one of the few species found in six continents around the world and have adapted well in each environment. Studies conducted at the University of Bristol suggested that ants may have intellectual capacity based on tandem ant's behavior of teaching other ants. In this study, Argentine ants will be tested for their ability to detect danger in their surroundings or food.

Argentine ants were tested in a closed system and an open system. Within the closed system, ants were put into a sealed jar that either had food or food mixed with poisonous substances. In the open system, there were two boxes with food and two boxes with toxic food. Dead ants were placed in one of the two boxes per category.

There are two significant results that have been found. First, ants had avoided eating the food surrounded with dead ants for a certain time, but their attraction to the food overcame their fear of the dead ants. Second, between the open system and the closed system, the open system needed three hours before the ants started being attracted to the food, while the ants in the closed system began to consume the food within thirty minutes.

Overall, ants do show some low intelligence levels, but this trait is easily disrupted because of their primary goal in life, which is to collect food for survival.