ABSTRACTS 2010/2011

BEHAVIORAL AND SOCIAL SCIENCES

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CHOO, Agnes
BEHAVIORAL AND SOCIAL SCIENCES

COMPETITION AND COOPERATION AMONG TWINS

Many parents of twins debate whether to put their children in the same class or different classes. They wonder if the separation (most likely first) will affect the twins in a negative way or rather allow their children to be more independent.

Three pairs of twins, ages between 5-6, were given two addition tests that were of the same difficulty. Each test contained ten addition problems. Before the test was given, the twins were told that they had two minutes to complete the test and they were encouraged to do their best. The first test was given in two separate classrooms and the test was timed at two minutes. After the first test, the twins were given a five minute break and then they were reunited in one classroom. Once again, the tests were timed at two minutes and the second test was given as the twins were sitting across from each other. The results from these tests, the amount correct and the time the twins finished was used to determine whether twins should be placed in the same class.

Originally, I believed that the twins would do better in the same classroom because they would feel more competition and feel the need to do better than the other twins. Even though that thought was correct, they did not do better. They actually did worse. Because they felt that need to win, they finished their problems more quickly, making more mistakes. They were highly distracted and often looked up at the other twin to check their progress and this caused negative effects.

Thus, the final results proved that twins work more effectively and efficiently when they are in separated classrooms.

3
FAROOQ, Jeffrey
Behavioral Science
2010/2011

EFFECTS OF TIME OF ACADEMIC AND PHYSICAL PERFORMANCE

Research has show that up to 75% of a human's intelligence comes from his genes. This means only 25% comes from social and environmental influences. This experiment was designed to gather research to see whether or not one could significantly affect their "average" performance when under pressure.

In order to successfully gather statistically significant data, a total of 80 participants were interviewed. A total of 40 people were asked to perform a pushup test. Then afterward, they were asked to match their previous score but with less time. Finally, if they beat their first score, they were asked to beat it again with less time (but really given the original amount of time). If they did not beat their first score, they were told to try to beat it given the same amount of time as the first test. In addition, 40 other people preformed a similar test in the academic subject area.

The research revealed data that indicated that under pressure, humans can significantly better in physical activities. However, when put under the same type of stress, they perform significantly worse.

These findings indicate that time plays a significant role in the human mind. The very concept cause various reactions that seem to parallel that of adrenaline. This research could potentially help improve test taking methods given in the SAT test, ACT test, AP tests, or regular tests in general along with helping with the obesity epidemic plaguing America.

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GRZYWACZ, Sara
BEHAVIORAL AND SOCIAL SCIENCES

EFFECT OF SHADOWS ON PERCEIVED BRIGHTNESS

In the "checkershadow illusion," a white square of a chessboard under a shadow may appear brighter than a dark square outside the shadow even if the lightness of the latter is higher than that of the former. The main hypotheses to explain this illusion use the local contrasts of the squares, the brain's knowledge of the chessboard geometry, and the knowledge that shadows darken surfaces. This study tested these three hypotheses.

The psychophysical point of subjective equality was measured in five human subjects as a function of the intensity of the shadow. The original images were photographed chessboards with or without a shadow. The shadow was extracted and manipulated with Photoshop, and the psychophysics performed with MATLAB.

In the "checkershadow illusion" of this experiment, the lightness of the white square was about five times lower than that of the dark square when they yielded equal brightness. Manipulating the shadow to be physically unrealistic caused the lightness of subjective equality to increase by about 50%. In turn, equalizing the local contextual intensities increased the lightness of subjective equality by an extra 90%. Therefore, even with the shadow and local-context effects removed, the lightness of the white square was about 55% that of the dark square when both appeared equally bright.

In conclusion, shadows, local context, and geometrical knowledge all affect perceived brightness, although in different degrees. Hence, the perception of brightness depends not only on the lightness of a surface but also on its context.

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KAPLAN, Michelle
BEHAVIORAL & SOCIAL SCIENCES

DO PEOPLE WHO PLAY THE SAME INSTRUMENT HAVE SIMILAR PERSONALITIES?

This study aimed to discover whether or not people who play the same musical instruments share one or more similar personality traits. Two different instrumental groups were assessed in this study: flautists and alto saxophonists. A modified Myers Briggs Type Indicator (a highly approved method of testing someone's personality) was administered to middle and high school students, and indexed ten different aspects of their personality, as well as two more aspects that were not intended. The results of this study show that alto saxophonists show both decisive and perceiving tendencies, and flautists show both indecisive and self-conscious tendencies.

6

KARIA, Karan
BEHAVIORAL AND SOCIAL SCIENCES

CATEGORIZING AND IMPROVING HUMAN VISIONARY AWARENESS

The aspect of visionary awareness that has not yet been tested and researched on is the process of classifying and enhancing. From the data collected over the past months, it is clear that some types of people have a certain way of perceiving different types of light and different parts of a videos clip that gives them a greater ability to see a certain part of that clip in a more clear way than others can. The most reoccurring example is seen at a movie theater, when some people automatically catch certain details, pertaining to a certain type of visionary awareness that others do not. This project analyzed and improved the different types of vision of various types of people using an action-packed video clip from the animated show Spongebob Squarepants. The whole visionary awareness was broken up into the following three categories: color, background details, and fast action shots. The color category was those people who were very clearly able to quickly discern and remember specific colors from the clip. The background details category was those people who very able to see and remember very minute, specific occurrences from the clip. The last category, fast action shots, was those who were able to see and remember clearly while the action was happening in a blur. The data showed that women between the ages of 16-25 had the best awareness of color, men between the ages of 16-25 excelled in the fast action category, and men between the ages of 10-15 were the strongest in recognizing and remembering minute details.

7
KAWANO, Hironori
Behavioral and Social Science

EXPERT VERSUS MASS: THE DIFFERENCE IN LEVEL OF CONFORMITY

This project examined the participants' behavior when the expert and the mass presented different answers to a question. Will the subjects rely on their decisions or conform to the answers of those of the expert or those of the mass? This project also examined the difference in level of conformity of the participants when the expert and the mass presented the same answers and when they presented different answers.

In this experiment, a subject was asked to match a musical note with three other notes. Besides the subject, four other people who worked as "confederates" took the test. One of the confederates was known as the "expert" and the other three confederates were known as the "mass". In the control group, the expert and the mass presented the same, wrong answer. In the experimental group, the expert and the mass presented the different, wrong answer.

In the control group, 81.5% of subjects conformed. In the experimental group, 75% of subjects conformed. In the experimental group, 23% conformed to the expert, 33% relied on themselves, and 44% conformed to the mass.

The experiment indicated that when the expert and the mass presented different answers the level of conformity decreased. It also indicated subjects rely on the mass more than the expert and themselves. Even if it is wrong, even if the expert and their instincts tell them it is wrong, people conform to what the majority of people do.

8
KOROTZER, Jared
BEHAVIORAL SCIENCE

FIGHTING AMERICA'S OBESITY CRISIS: EFFECTS OF POSTING NUTRITIONAL DATA IN A HIGH SCHOOL SNACK WINDOW

Obesity has risen significantly in the United States. Previous studies have shown that posting nutritional information has helped patrons make healthier choices. The purpose of this study was to see if posting nutritional data would influence high school students' snack choices.

This study was performed in a large public high school in Southern California. Nutritional information was obtained and ten snack window items were picked for display. Nutritional information including calories, fat, saturated fat, trans fat, and sugar for the ten items was posted in front of the snack window. Sales data were recorded for one week before posting the information and for one week after posting.

No significant differences in the average of the number of items purchased per day before and after posting nutritional information were found.

This study demonstrated that high school students did not change their choices based on point of purchase nutritional information.

9
LEE, Jason
BEHAVIORAL & SOCIAL SCIENCES

STANDARDIZED TEST SCORES UNDER DIFFERENT MUSIC ENVIRONMENTS

This study seeks to find a causational relationship between listening to music during testing and test scores. Music is a powerful tool that has been shown to induce higher brain functioning. This experiment was designed to find a more practical application for music in school and home environments.

Thirty (30) students were to each take three (3) sections of the PSAT: Critical Reading, Writing, and Mathematics. They were separated into five groups of six students each at random. Each group returned the next week, on the same day of the week and same time of day. Each group was then placed in a separate room, with a music player in each room. Rock, Classic, Hip Hop, and RnB music was played in these separate rooms. The control room did not play any music. Each group took a different version of the three (3) sections of the PSAT than it did the first version.

Data collection showed that music did in fact lower test scores across all genres, except for Classical. Out of the other genres, RnB was shown to have the least negative effect on students' scores. The control group showed an average increase in test scores.

From these results, we can conclude that music plays a negative effect on test taking. This is probably because the music that was played distracted the test takers from focusing all of their attention onto the tests. It would be interesting to extend this study to have students listen to music right before the second test, right after the first test, or consistently during the week between the two tests.

10
LUNDBERG, Jaclyn
BEHAVIORAL & SOCIAL SCIENCES

FINDING THE REGION IN THE BRAIN LINKED TO ADDICTION

This experiment uses the Stroop test, a psychological test first performed by J. Ridley Stroop, which targets the frontal lobe of the human brain, specifically the anterior cingulate cortex. The anterior cingulate cortex functions as an intermediary between higher cognitive thinking and basic cognitive thinking. The Stroop test was implemented on the control group, females 18-65 who rarely drank, and the experimental group, females 18-65 with a history of addiction. Each participant was asked to read off a set of words, which demanded a different set of responses to the same stimuli (Stroop, 1935). The reactions of the participants were timed and recorded. The data results concluded that there is a significantly lower average time of reactions of the experimental group, which validates the hypothesis that the anterior cingulate was affected in adults with a history of addiction. Possible causes of this difference in results of addicts could be from damage due to alcohol/drugs, or a genetic trait linked to the neuroanatomy of an alcoholic or drug abuser's brain.
***Keywords*: anterior cingulate cortex, drug and alcohol addiction, neuroanatomy**

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PARK, Robin
BEHAVIORAL & SOCIAL SCIENCES

BYSTANDER APATHY: VARYING REACTION TIMES OF WITNESSES OBSERVING A PROBLEM

The bystander effect is a psychological syndrome, usually in an emergency situation, that causes individuals to feel more reluctant in giving help in a given situation when others are present. Though its causes and reasons are uncertain, there are two possible theories to explain this phenomenon: the diffusion of responsibility theory and conformity. By causing a non-emergency, public situation in which the "victim" will need aid, the behaviors and reaction times were analyzed and recorded to determine whether both, one, or neither of the two theories were effective in influencing bystander apathy. While conformity did not seem to affect or trigger apathy, the diffusion theory was proved to be true as the reaction times of witnesses steadily increased as the number of people present increased.

12
Tababtabaiepur, Samira
Behavioral and Social Sciences

EFFECTS OF MANIPULATED FOOD LOCATION ON FIRST SELECTIONS OF INDIVIDUALS

Obesity is on the rise all over the country and in figuring out what foods people go for depending on their location, food positions can be manipulated to help the nation overcome the growth. If more desirable foods are placed in inconvenient locations, then people will settle on the more conveniently placed foods because people are becoming increasingly lazy.

To conduct this experiment, two tables were set up with three different snacks on each. The snacks were arranged at each of the nine meetings based off of a survey that was handed out asking that the foods be ranked in order of preference. The data collected is of each individual's first selection of the six available snacks. At each of the nine sessions, the six different snacks were arranged in different locations with two different snacks.

Out of eight experimental sessions, only at two session did the whole group settle on more conveniently located foods. Three-fourths of the time the whole group selected the snacks that were generally perceived as more desirable based off of their average survey ranking, regardless of where those snacks were located.

By observing each individual's first selection, it can be predicted if they are lazy enough to settle on a less desirable food or not. After analyzing the data collected, it was apparent that most of the time people did not settle on less desirable foods just because of their location. So if people are given the choice of food, no matter the location of each, they tend to gravitate first to the more desirable foods.

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TAVAKOL, Delana
BEHAVIORAL & SOCIAL SCIENCES,

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 omnipresent shadows could give insight to how external factors affect the human psyche. This study attempted to determine if different personality types respond differently to different types of shadows, and what the overall subconscious reactions to shadows are.

To test this, high school Psychology AP students first took a personality quiz in order to determine which of the five main personality traits; openness, conscientiousness, extraversion, agreeableness, and emotional stability; each was dominant in. They were then shown twenty-one images depicting several different types of shadows. By analyzing their recorded responses to the images and comparing the general response to those of specific personality groups, one could see if there were any correlations between shadows and the human mind.

The data produced during this experiment showed that certain personalities, such as that of the individuals who tested dominant in all five categories, voted exactly the same for most images when recording their responses. However, other circumstances such as that of the people who scored dominant in all categories but emotional stability had varied responses to the shadows and showed no correlation. There was also a notable trend in the reactions of the overall group of subjects to the different kinds of shadows. People generally tended to find softer shadows of a medium shade more pleasing, while most marked negative responses to the darker scenes.

At its conclusion, this experiment found that personality does not always affect ones response to his or her surroundings, though in some cases it does play a role, and that people generally tend to like mid-toned scenes versus the darker or severely lighter alternatives.

BIOCHEMISTRY

14
GHADIMI, Arya
BIOCHEMISTRY

NAGLU-ApoE Distribution in Brain for Effective ERT

Sanfilippo B Syndrome (mucopolysaccharidosis IIIB, MPS IIIB) is a lysosomal storage disease that is characterized by a deficiency in the enzyme α-N-acetyl–alpha-D-glucosaminidase (NAGLU). The lack of this enzyme causes a buildup of glycosaminoglycans (GAG) throughout the brain tissue – which ultimately leads to death. Although no cures have been found, enzyme replacement therapy (ERT), in which patients temporarily receive their lacking NAGLU remains a possibility. For this project, we are injecting a number of C57BL/6 NAGLU-deficient mice with NAGLU and NAGLU-ApoE and then testing the results through immunoflouresence staining and GAG assays. We believe that the addition of the ApoE vector to NAGLU will help with detection *in vivo* and allow the enzyme to be noticed by the host and ultimately serve its function of reducing GAG in cases of MPSIIIB.

If the NAGLU-ApoE spreads throughout the tissue and lowers the GAG levels in the brain tissue, then NAGLU-ApoE should be considered as a future enzyme replacement therapy. This project's long-term goal is to create an effective enzyme replacement therapy for patients across the world.

The results of this study show that both injections of NAGLU and NAGLU-ApoE help in the reduction of GAG levels in the mammalian brain. The immunoflouresence staining shows us that both NAGLU-ApoE and NAGLU are spreading throughout the tissue, and the GAG assays give us a quantitative study that the GAG is reduced. The NAGLU-ApoE vector should be considered in future studies of this disease.

15
GIANVECCHIO, Crystal
BIOCHEMISTRY

EXPRESSION OF NEURONAL NITRIC OXIDE SYNTHASE IN OBESE-PRONE RATS

The metabolic syndrome is a multi-factor condition caused by abdominal obesity, insulin resistance, high arterial blood pressure, and a high triglyceride/glucose level, and is associated with cardiovascular disease and type 2 diabetes. For centuries, acupuncture has been a method of treating symptoms of cardiovascular disease, but the mechanisms behind it are still unclear. The purpose of this study is to examine the expression of neuronal Nitric Oxide Synthase (nNOS) and its role in contributing to obesity, as well as the effects of acupuncture on the expression of this specific molecule.

nNOS is responsible for producing Nitric Oxide, which increases vasodilation and, therefore, decreases blood pressure. Expression of this molecule was found by performing immunohistochemical staining and NADPH-d staining on brain slices of both Obese-Prone (OP) and Obese-Resistant (OR) rats, and quantifying the number of positively stained neurons in regions of the rats' brains.

Along with the observation that the use of acupuncture decreases arterial blood pressure, it was found that OR rats indeed show a higher expression of nNOS than OP rats. The correlating data shows that acupuncture conclusively accounts for an increased expression of nNOS and that nNOS itself is related to obesity. These results are critical in learning more about how to target obesity and the ways in which it can be targeted, contributing not only to identifying specific molecules in a relatively new model animal type but also in combining Eastern and Western medicine.

16
LEE, Kenny
BIOCHEMISTRY

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

The goal of this project is to study both the role of hepatocyte apoptosis in high fat diet (HFD)-induced hepatic steatosis and testosterone's action in the rat HFD-induced non-alcoholic fatty liver disease (NAFLD) model. In the past 20 years, the Western world has been subject to a dramatic increase in obesity. One common manifestation of obesity is NAFLD. Both hepatic steatosis (the basis of NAFLD) and testosterone deficiency have been shown to be significant risk factors in developing type 2 diabetes and metabolic syndrome. It has been reported that testosterone replacement drastically reduces fat accumulation within the liver. However, the mechanism of testosterone's protective effect in fatty liver has not been well studied. Apoptosis levels were determined via Terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL) assay and Western blot.

Male rats were randomly placed into four groups: castrated rats on HFD, castrated rats with T replacement on HFD, intact rats on HFD, and intact rats on regular chow diet (RCD). They were fed ad libitum for 15 weeks, sacrificed, and liver tissue was collected for apoptosis detection. TUNEL assay directly stained apoptotic cells. Western blot evaluated concentrations of cleaved PARP (89 kDa), a common marker for cell apoptosis.

The results showed that HFD increased hepatocyte apoptosis compared with RCD in intact rats, while testosterone replacement reduced HFD-induced hepatocyte apoptosis in castrated rats.

It was concluded that testosterone reduces HFD-induced hepatocyte apoptosis in the liver, and this study may forge a path toward developing methods to eventually attenuate NAFLD.

17
Palosaari, Andrew
Biochemistry

IMMUNE RESPONSE TO ACTIVATED TARGETED KILLER CELLS FOR TREATMENT OF NEUTROPENIC FUNGAL INFECTIONS

Neutropenia, an abnormally low count of neutrophils, predisposes patients to life-threatening fungal infections (e.g. Candida albicans). It has recently been shown that Activated Targeted Killer (ATAK) cells (i.e. human leukemic cells) can be used as a surrogate for true neutrophil transfusions in mice. Host-versus-graft responses are known to be critical to long-term prevention of leukemic relapse. We therefore sought to determine if a host-versus-graft response to ATAK cells could be detected, which would indicate the likelihood for engraftment of the leukemic cells.

An Enzyme-linked immunosorrbent assay (ELISA) was used to determine the magnitude of the immune response to ATAK cells in mice. In this assay anti-ATAK IgG antibodies in serum from mice treated with ATAK cells and mice not treated with ATAK cells were compared by titer.

First, the optimal amount of ATAK cell membrane antigen absorbed to ELISA plates, maximizing the signal to noise ratio, was determined to be 25 µg/ml. Second, using the optimal ATAK antigen concentration, we identified a moderate immune response to ATAK cells in multiple exposed mice.

The moderate immune response identified by the ELISA assay confirms the presence of a host-versus-graft response, which may prevent long-term engraftment of ATAK cells and resulting development of leukemia in the host. These results lay the ground work for safe and effective treatment of opportunistic fungal infections using ATAK cells.

18
QU, Stephen
BIOCHEMISTRY

DETECTING *COXIELLA BURNETII* THROUGH CONJUGATED ANTIBODIES

The bacterium Coxiella burnetii is a highly infectious pathogen, causing the disease known as Q-fever. Q-fever can be contracted by mere inhalation of contaminated droplets, and causes symptoms similar to the flu. If left untreated, Q-fever can develop chronic symptoms, leading to death. Therefore, finding a method to rapidly detect this agent is crucial in order to begin early treatment, before these chronic symptoms develop.

Traditional ELISA uses secondary antibodies conjugated with an enzyme to bind to a primary antibody, which binds to the specific antigen. This allows for the detection of the antigen. However, this procedure was modified in this experiment by conjugating the primary antibodies, eliminating the need for a secondary antibody. This method would allow for speedier detection of Coxiella burnetii because of the elimination of some procedures associated with conventional ELISA.

BOTANY

19
CHEN, Hanqing
BOTANY

COMBINED EFFECT OF *ANABAENA* AND *AZOTOBACTER VINELANDII* ON *ALLIUM SCHOENOPRASUM*

This study compares the effects of two microorganisms and commercial nitrogen fertilizer on the growth rate of chive (*Allium Schoenoprasum*) plants. Although nitrogen is present in the atmosphere, it is well known that plants cannot utilize this nitrogen directly. Instead, plants have to rely on nitrogen-fixing organisms to convert nitrogen into a usable form of nitrates. Therefore, farmers sometimes also add these microorganisms to the soil as an alternative to inorganic nitrogen fertilizers. Two of the most commonly used microorganisms are *Azotobacter Vinelandii* and *Anabaena. Anabaena* is anaerobic and produces oxygen during photosynthesis, while *Azotobacter Vinelandii* is aerobic and requires oxygen in the environment in order to survive. The results of this experiment illustrate whether introducing both microorganisms at the same time will result in a higher growth rate of plants, due to *Anabaena* increasing the amount of oxygen for *Azotobacter Vinelandii* to use, as opposed to adding only one of the microorganisms.

First, fifteen seeds were planted in each pot. After at least one from each pot has germinated, nitrogen sources were added. Two different nitrogen sources were used. *Azotobacter Vinelandii* was added to the second pot, *Anabaena* to the third, and a combination of both microorganisms to the fourth. The first pot with no sources of nitrogen added served as the control for this study. The pots were then placed in sunlight for about eight hours per day, and the height of the plants in each pot was measured and averaged.

It was found that, surprisingly, plants in the pot with both microorganisms added did not grow as fast as the two pots with only one type of microorganisms added. The chives in the pot with *Azotobacter Vinelandii* experienced the fastest growth.

In summary, the experimental results show that one should not add both *Azotobacter Vinelandii* and Anabaena at the same time to the soil. Instead, one should add *Azotobacter*, which the experimental results show to be the better alternative to artificial fertilizers.

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CHEN, Jeff
BOTANY

SOUNDS OF 5,000 HZ'S EFFECT ON THE PRODUCTION OF ETHYLENE IN BANANAS

This project is on how sounds of 5,000 hz affect a banana's production of ethylene.

A solution of 3 tablespoons of reverse osmosis water was used to test for starch, and 2 teaspoons of Lugol's iodine was used to test for starch. 2-3 droplets were put on the fruit. The iodine binds with starch to form a dark color, so the color of the fruit was used to determine how much ethylene was produced.

When testing for ethylene, it became apparent that the fruit with the sound of 5,000 hz was actually darker than the fruit kept in a quit environment. So, this meant that sounds of 5,000 actually slowed the the production of ethylene.

This data or the results can be useful in determining what the optimal environment is for growing /ripening fruits or plants. Also, on the flipside, it can be used to show what the optimum environment for slowing down the process of ripening.

21
HUH, Dawool
BOTANY

FACTORS AFFECTING COASTAL SAGE SCRUBS ON THE PALOS VERDES PENINSULA

On the coast of the Palos Verdes Peninsula there are three main coastal sage scrubs, *Encelia californica, Opuntia littoralis, and Salvia leucophylla.* The Palos Verdes Land Conservancy is currently working to learn more about the conditions these plants prefer and two preservations where the plants are prevalent, Forrestal and Three Sisters, were chosen.

Data is being collected on several plants of each species in each preservation, mainly on temperature, dew point, and humidity levels with data loggers, which collect data at 30 minute intervals. Along with hand collected data using tape measures and micrometers, the information was analyzed and compared.

Due to an abnormal year in rainfall, each plant showed high humidity levels, which could easily be distorted due to the heavy rain. Despite these conditions during the main data collection, trends were spotted as *Salvia leucophylla* was found to have consistently lower temperatures than the other two plants, *Encelia californica* had many variations in dewpoint and temperature, and *Opuntia littoralis* had higher temperatures.

22
KIM, Michelle
BOTANY

EFFECTIVENESS OF MAGNETIZED SOIL ON SWEET ALYSSUM

Paramagnetic soil is soil that had been exposed to volcanic rocks that were magnetized from the earth's magnetic field (Garrett). Through this natural process, the use of magnetism has shown numerous benefits in the agricultural field such as increased germination of seeds and increased crop growth rates, which is how the experimental idea developed into testing the possibility of magnetized soil. Since farmers have increased use of germinating seeds through magnetism and irrigating crops with magnetized soil, this additional information may revolutionize the agrarian system to reduce the initial amount of seeds needed for germination and enlarge the amount of vegetation grown. As magnetism raises interest in its use for agricultural purposes, this experiment assessed the effectiveness of magnetizing soil using the immersion method on the growth of Sweet Alyssum.

Soil was magnetized through the immersion of magnets in tap water where the soil was added to supersaturate the solution. After varying amounts of time, the solution was drained and the soil dried. Subsequently, the Sweet Alyssum seeds were placed in plant nursery containers and placed indoors near a window to monitor amount of water and sunlight taken in. Growth was recorded on a weekly basis to determine the validity of this experiment.

From observations and recorded data, the hypothesis was rejected as the growth varied only slightly. These variations reflected those that would be found in nature.

Unfortunately, farmers may have to wait a little longer to discover new farming tactics. This conclusion, however, does not undermine the fact that magnetism has demonstrated improvements in the other areas stated above.

23
LI, Kevin
BOTANY

EFFECT OF USING RAW POLLEN AS SUPPLEMENTAL FERTILIZER FOR FLOWERING PLANTS

The objective of this project was to experiment the possibility of using raw honey pollen as nutritional fertilizer supplement for growing Marigolds. Raw pollen is commonly used commercially as nutrient supplements for humans and is also known to contain an abundant amount of N-P-K minerals which could be highly beneficial to the growth of plants. For this experiment, I hypothesized that by adding raw pollen to the soil of marigolds will result in an increased growth and survival rate.
This experiment was done by comparing the height of a control and experimental group, both of which contained pots of marigolds placed in environments of similar conditions. The control group is set as a pot containing regular fertilizer and seeds with nothing else added. The experimental group consists of 5 pots of marigolds, each with incrementally increasing amounts of raw pollen added in order to see whether or not there is a most efficient amount.
In the observations, the flowers grew at a gradually decreasing rate, growing really fast at the start and later on even began experience slightly negative growth. The majority of the experimental pots grew taller than the control despite it having been the tallest before the pollen was added with the tallest. No definite pattern could be seen since the pots with both the most and the least pollen added happened to grow the tallest.
From the data collected, it is concluded that the addition of raw pollen to the soil does have an impact on the growth of flowering plants.

24
LIN, Jacqueline
BOTANY

Biomass Analysis of *Eriogonum Cinereum*

***Eriogonum Cinereum* is a buckwheat shrub plant native to coastal California. My project's focus was to determine the relationship between biomass dry weight to canopy volume or to canopy area.**

During its blooming season, fifteen samples of the buckwheat were chosen and collected by differing size and aspect. One half or quartile of the canopy for each bush accounted as one sample, each measured for diameter, height, symmetry, shape, and circumference to find the canopy volume and area. The collection was then separated and put onto a gram scale to measure the dry-weight biomass of the leaves, branches, and flowers. The utility of these dimensional measurements is to make a regression equation.

The results of the analysis show that biomass of *Eriogonum Cinereum* is related to canopy area and volume. The positive slope of the regression line illuminates that the relationship is directly proportional.

The importance of this study is to examine the broader investigations upon regional carbon emissions or herbicide testing. The use of the regression equation can be to compare differing plant habitats and estimate its effectiveness of environmental manipulation and productivity.

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McGREGOR, Jack
Botany

MODELING THE EFFECTS OF A CAULERPA PROLIFERA INFESTATION OF GRACILARIA BEDS UNDER VARYING ENVIRONMENTAL CONDITIONS

In the summer of 2000, beds of the highly invasive algae, *Caulerpa taxifolia,* were found of the coast of California, prompting an expensive and devastating removal effort. In order to prevent another infestation, many species of Caulerpa were banned in California under the Noxious Weed Act. *Caulerpa prolifera;* however, is still allowed in California. The aim of this project is to determine whether *C. prolifera* is capable of infesting and killing off beds of the native alga *Gracilaria* and if increasing ocean temperatures can expedite this process. In order to test this, four 10 gallon aquarium tanks were set up with two tanks at 70 degrees Fahrenheit and the other two at 72 degrees Fahrenheit. In each tank, 38 fronds of Gracilaria and 2 fronds of Caulerpa were planted. Fronds were counted every other day for 16 days.

Although a complete infestation of Caulerpa in the tanks with the increased temperature and a smaller scale infestation in the control tanks were expected, this was refuted by the data which showed little growth in all four tanks with slightly more fronds in the tanks with increased temperature.

26
SATO, Kevin
BOTANY

SURFACE TEMPERATURE RESEARCH OF LEAVES WITH CONTROLLED TRANSPIRATION CONDITIONS

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 whole. 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. Over a forest canopy or a vast expanse of grassland, large amounts of transpiration can markedly increase water vapor in the atmosphere. 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 by the leaf transpiration, the surface sample with water as ordinal condition (sample A), the sample without water (sample B) and the sample with Vaseline which covered the leaf surface (sample C).

In the end, it was clearly seen that the leaf surface temperature had risen in order of sample A, sample B, and sample C, and the water reduction rate of sample A was higher than that of sample C for all time region. As a result, the leaf transpiration reduction effect by transpiration was quantitatively examined, and conclusively it was verified that the active transpiration promoted to maintain the leaf surface temperature lower.

In the present study, the surface temperature of hydrangea was investigated. However the temperature reduction effect may be different in other plants. It is interesting to investigate many kinds of plants to study the temperature reduction effect of transpiration. It should contribute to find plants, which are effective to reduce the atmosphere temperature.

27
SNYDER, Rayna
BOTANY

THE EFFECTS OF A HOT WATER TREATMENT ON PAPAYA SEED GERMINATION

This project tests the effect of hot water treatment on papaya seed germination. The reasoning is there are seed borne bacterial diseases in papaya seeds that prevent germination. These diseases may be eliminated with hot water treatment. My hypothesis is if papaya seeds are submerged at higher temperatures, then they will have higher rates of germination than those not submerged at higher temperatures.

For this experiment, I obtained two papayas, removed their seeds and soaked them at room temperature water for two days. I then put the seeds between two tea towels and rubbed them together to remove the gelatinous coating from around the seeds that inhibits germination. Then the seeds dried in the fridge for a couple of days in preparation for treatment. The seeds were bundled into groups of 30 and submerged in heat baths at set temperatures. The control bundles were submerged at room temperature (20ºC), Treatment 1 bundles at 40ºC, Treatment 2 at 60ºC, Treatment 3 at 80ºC and Treatment 4 at 100ºC. After treatment, seeds were removed from each bundle and placed on a baking sheet where room temperature water was added daily for moisture.

My results proved that seeds submerged at higher temperatures have a greater ratio of sprouting seeds than those not submerged at high temperatures. With this information, there is the possibility that papaya growers will be able to stop the use of pesticides and instead heat papaya seeds to stop the growth of disease causing bacteria.

28
YONEDA, Yurida
BOTANY

DETERMINING THE BIOMASS OF *ERIOGONUM FASCICULATUM*

This project in its present form is the result of determining and analyzing the biomass of *Eriogonum Fasciculatum*. The initial idea was to determine the carbon intake from the biomass of *Eriogonum Fasciculatum* from the local location at Forrestal Palos Verdes Land Conservancy. Biomass was determined by means of the plant biomass dynamics. Fifteen measurements of height, diameter, volume, canopy type, and locations, including the aspect were recorded. After separating the branches, leaves and flowers, they were put in an air-forced drying oven open and left dried for 48 hours, setting the oven at a temperature of 75-80 degrees C. It was then calculated by the differences of

weight and thus the biomass and productivity per canopy volume for the 15 measured plants. Biomass per canopy volume then was multiplied by canopy volume per area to estimate stand biomass and productivity.

The greater the dry weight, the greater the biomass thus the carbon intake. The results showed that *Eriogonum Fasciculatum* did in fact have a significant part in the contribution of the biomass. Though this experiment, it gave specific measurements of the biomass of a local native plant, *Eriogonum Fasciculatum*, also known as the California buckwheat while informing the community to preserve the Palos Verdes land and give carbon offset credits in the local neighborhood. This coastal sage scrub plant, important for the native species for its habitat, can be a renewable energy source for plants. It contains gas composed mainly of methane, which is one of the greenhouse gases related to global climate change, and carbon dioxide. Therefore, the more there are biomass, the more the amount of carbon intake. When biomass crops are grown, a nearly equivalent amount of carbon dioxide is captured through photosynthesis.

CHEMISTRY

29
CHOI, Gloria
CHEMISTRY

DETERMINING THE CAUSE OF DISSOLVED SUNSCREEN'S NEGATIVE EFFECT ON TETRASELMIS

Four ingredients found in sunscreen are known to contribute to coral bleaching by promoting viral infections in zooxanthellae, coral's symbiotic algae. Experimentation done last year found that Neutrogena sunspray, which contains one such ingredient, killed off a species of green algae called *Tetraselmis,* but the means were unknown—whether viral infections were again the culprits or some other phenomenon was to blame. The purpose of this experiment was to determine whether UV absorption by sunscreen, and hence decreased photosynthetic rates, is responsible for sunscreen's negative effect on *Tetraselmis.*

Six different treatments were tested, including the control, the positive control (covered with mesh), Neutrogena sunscreen inside and outside the flask, and Coppertone inside and outside. All eighteen flasks (3 in each group) were placed under a UV light and population density and chloroplast production were measured for three 6-day trials.

The results showed that the average population counts for the flasks with sunscreen outside were generally higher than those for the control. A statistical analysis showed that the different variables among each treatment did not have a significant impact on chloroplast production. In addition, the index cards that were placed in the "sunscreen inside" groups turned slimy and orange by the end of the six-day period, consistent with previous results.

The hypothesis was accepted, as the results clearly showed that UV absorption is not a factor, and the slimy orange residue points instead to some chemical reaction taking place.

31
HONG, Kimberly
CHEMISTRY

NANOPARTICULATE FOULING OF POLYPROPYLENE MICROFILTRATION MEMBRANES BY CLARIFIED SECONDARY TREATED WASTEWATER AND RIVER WATER (YEAR TWO)

This project was conducted in order to analyze the flux rates of Nanoparticulate fouling of microfiltration membranes in four different types of feedwater: clarified secondary treated wastewater, tertiary treated wastewater, plant influent, and Santa Ana River water. The analysis of flux rates of the different types of feedwater were observed by using fluorescent nanobeads instead of actual nanoparticles.

Flux rate was determined by mimicking a microfiltration set-up. First, water samples were collected: clarified secondary treated wastewater from Orange County Sanitation District, tertiary treated wastewater and plant influent from West Basin Municipal Water District, and river water from Santa Ana River. Then, a mimic microfiltration was set up, consisting of a vacuum pump, a 4 place electronic balance, and a computer that grammatically collected flow data with an acquisition program. A microfiltration test cell was prepared using several 20-cm long tubes of 0.2µm nominal size polypropylene membrane tubes. Next, base flow of deionized water was measured for 3 minutes. (A base flow rate with deionized water was done before each flux rate measurement with the feedwater.) Next, the deionized water was spiked with Fluospheres® carboxylate-modified microsphes 0.1 µm, orange fluorescent (540/560) nanobeads using a pipet. Each flow rate was measured two times each. After, each feedwater was spiked with the same nanobeads, and the flow rate, which lasted for 22 minutes, was measured two times each. Finally, at the end of each flow rate experiment, the fiber was frozen and cross sectioned for microscopic observation and photos.

Plant influent fouled the quickest (its flow rate decreased the most rapidly) than all the other types of water. By comparing the four different types of feedwater' flux rates, the flux rate at 10.75 minutes of the first and second plant influents were 7.05% and 10.33%, respectively, while the flux rate of CAS was 11.46%.

The contributions of this project were beneficial. It is seen that plant influent fouled more quickly than any of the other types of water, a realization that further study of nanoparticles and their effect in different feedwater should be conducted.

32
KIM, Stephen
CHEMISTRY

COMPARISON OF BIOCHAR AND BAMBOO AS A SOIL REPLENISHER

This project was to compare whether bio char or bamboo charcoal was a more effective soil replenishing material.

The project was to use soil without any organic materials similar to depleted soil using sand and rocks then to create one set of soil using crushed bamboo charcoal one set of plants using biochar and the final group using just sand and rocks. Then plants were germinated in a wet paper towel on a dish and left at room temperature until enough plants were germinated for the experiment. These plants were later moved into the soil.

Then plants were to be grown in this soil then record the amount of plants which survived, how much they grew by the use of a ruler and how much nutrients did it take out of the soil by using a soil testing kit at the beginning of the experiment and the soil at the end of the experiment. The rapid decline of the plants in the sand without organic materials was a bit disturbing but those in with bamboo charcoal and bio char still have the majority of the plants left.

The initial results showed that the plants which were used (Califonian Poppies, Eschscholzia californica) thrived on all soils however and time progressed the poppies in the sand were almost eliminated with the exception of a

few which continue to grow. Later studies could show how much plants could thrive with different forms of charcoal added into the soil.

33
LIU, Jean
CHEMISTRY

THE MAGNITUDE OF THE EFFECTS OF EGGSHELL MEMBRANE ON THE ABSORPTION OF CARBONIC ACID

It is suggested that there is an excess amount of carbon dioxide resonating on the planet Earth. Not just in the atmosphere, but carbon dioxide compounds – in a dissolved or gaseous form – can also be found in ocean reservoirs. When carbon dioxide comes into contact with water, the resulting compound is a weak acid called carbonic acid. Since an acid is formed, acidification comes into play and the water's pH decreases. Ocean acidification is a pressing headline in environmental problems, and presents an opportune new research study conducted with eggshell membranes; scientists suggest that the membrane which lines an eggshell can absorb approximately 7 times its own weight of carbon dioxide. Here a new prospect is presented; would the membranes of the eggshell also absorb carbon dioxide in water?

Eggshell membranes were removed from the calcium base shell and placed into 1 gallon of saltwater with the pH of 8.3. Every 2, 4, 6, 8, 10, and 12 minutes, a sample of the solution was taken out and placed into a labeled container. After the trial was over, the pH of each container was determined and recorded.

Each trial increased in pH after membrane exposure: trial 1 had a 1.038% change, trial 2 had a 2.307% change, trial 3 had a 1.408% change, and trial 4 had a 1.001% change. The average change of pH every 2 minutes was 0.022. This exemplifies that the acidity level had decreased in each of the trials because of the increase of the pH; in turn, each of the solutions had become more basic.

My prediction was supported – the eggshell membrane was able to absorb carbonic acid, and as the pH level increased, the solution became less acidic. Although the percent of change is insignificant, it was not expected that the eggshell membrane in the saltwater would absorb as much as the membranes and carbon dioxide. With the results of my experiment, it can be inferred that eggshell membrane can not only absorb carbon dioxide in the air, but can also be applied in the ocean. However, it is discernable that the membranes became contaminated with the acidity of the vinegar, and depositing the membranes into the water led to the increase of the water's pH.

34
MADANI, Jasmine
CHEMISTRY

DISSOLVING RATE OF A DRUG VS. PACKAGING OF A DRUG

Introduction: Drug solubility is a popular field of research, which requires scientists' to thoroughly acquire a database of medications and their rate of effectiveness. The questions being addressed are: Is there a direct correlation between the dissolving rate and packaging of the drug? Does the gel dissolve faster than the traditional pills? Does the pH of the stomach have an effect on the dissolution rate in the body? Hypothesis: I believe there's a direct correlation between the dissolving rate and packaging of the drug. If the gel pills dissolve faster than the traditional pills, then there's a direct correlation between the dissolving rate and the type of packaging of a drug. Also, if the pills dissolve faster in more acidic environments then the pH of the stomach has an effect of the rate of dissolution. Materials: The materials used for experimentation included four cups each filled with 10 mL of water (H_2O), 1 traditional 500 mg Acetaminophen pill (Tylenol®), 1500mg gel pill (Tylenol Rapid Release Gel®), 1 200mg traditional Ibuprophen pill (Advil®) 1 200mg Ibuprophen pill (Advil Liquid-Gel®) and a stopwatch. The liquids used dissolving the pills were (10ml each): lemon juice (pH 2.0), vinegar (. pH 2.2), H_2O (pH 7), milk of magnesia (Maalox) [pH 10.5], and Baking soda solution (pH 8.3). Results/Conclusion: There isn't a direct correlation between the dissolving rate and the packaging of a drug. However the pH of the stomach has an effect on the rate of dissolution of the drugs.

35
RAMAYYA, Sulekha
CHEMISTRY

INCREASING THE EFFICIENCY OF ENERGY EXTRACTION FROM LANDFILL GAS

The overall objective of this project was to prove the scientific and commercial viability of utilizing landfill gas (LFG) to produce renewable energy in the form of electivity and to reduce green house gas emissions (GHG) from the landfills.

This project involved two main steps: effectively separating methane (CH_4~55%) and carbon dioxide (CO_2 ~45%) from LFG, using the chemical absorption process called carbon sequestration and converting CO_2 to CH_4 using Ruthenium nano-particles as catalysts and commercially available hydrogen through the Sabatier reaction.

The Sabatier reaction is highly exothermic and occurs spontaneously in the presence of Ruthenium catalyst at temperatures above 250°C. Various flow rates of CO_2 and hydrogen (H_2) were analyzed to determine the optimum rate to maximize conversion of CO_2 to CH_4. Methane production rate was measured by measuring the electric current produced by the methane detector. This process converted almost 100% of CO_2 to CH_4 using our setup of Ruthenium nano-particles as catalysts compared to current efficiency of 90-92%.

This novel way of converting CO_2 to CH_4 creates the possibility of providing purified CH_4 to gas turbine to produce electrical power under optimal conditions. This increases the net efficiency of the power generation by a factor of 2.5 (250%) as the energy density of CH_4 is 980 BTU/SCF compared to the energy density of LFG 480 BTU/SCF and the Derate factor for the gas turbine using methane is 1 compared to the Derate factor of 0.69 for LFG. The conversion of landfill gas into methane essentially kills two birds with one stone: reduces the CH_4 released into the atmosphere and produces renewable energy from an alternative source.

36
SHABBIR, Moizza
CHEMISTRY

DETERMINING THE VARIANCE OF TASTE THRESHOLD

Humans are sensitive to five different tastes: sweet, sour, bitter, salty, and unami. However, the concentrations of these tastes that can be perceived vary from person to person. Taste thresholds are key in determining what food one eats, because some people are more sensitive than others to strong tastes. The project strived to determine whether factors such as gender, ethnicity, food preference and age were prominent variables in predicting taste thresholds.

Subjects were asked to taste salt, sugar, and vinegar solutions and record the whether they detected the solution as very light, light, medium, or strong. They were also asked to identify their ethnicity, age, food preferences, and gender. The variables were all analyzed as part of the data.

Gender seemed to have a significant effect on taste thresholds for all but bitter solutions. Age was relatively insignificant, although younger people did have a higher threshold for sugar solutions. Food preferences and ethnicity seemed to have less of an impact on threshold, which may seem counterintuitive.

The data seems to suggest that although a part of our taste thresholds are genetic, a lot of our food preferences and taste thresholds have to do with acquired tastes and situational food aversions. Although the reasons behind these disparities are not evidently apparent, further research may provide conclusive evidence.

37
WATHUGALA, Samantha
CHEMISTRY

COMPUTER SCIENCE

CONTROLLING THE LENGTH OF FERMENTATION FOR TRADITIONAL HOMEMADE KEFIR

Kefir is a probiotic drink only properly brewed at home, but little scientific information exists to standardize the process. This study seeks to provide quantitative knowledge for efficient home brewing.

A full factorial (2^3) design of experiments with a replicate center point was used. Eight samples represented all permutations of 10 and 30 g grains, 0% and 3.5% milkfat, and 200 and 400 mL milk. Two controls contained the median of each variable: 20 g grains, 2% milkfat, and 300 mL milk. A final sample was an unstirred control. All eleven samples were started and regularly checked on for pH and separation until they finished fermenting (marked by a clear separation of whey around 4.6 pH), and were then immediately re-measured and started for a second run. This process occurred thrice, though once there was no second run; thus there were five sets of data.

With this data, a polynomial model was fitted with the three variables in which one could plug in their available amount of grains, milk, and milkfat to predict the duration. This polynomial was used to create four charts for four common cowmilk types, 0%, 1%, 2%, and 3.5%.

The normal probability plot exhibits that while grain amount is positively significant, milkfat made little difference. Qualitatively, the extra control showed that stirring is vital to the separation of kefir, while pH is unaffected. Now, when brewers want, say, 200 mL of kefir of 2% milkfat in 20 hours, they can know how much grain to use.

38
MAZIAR, Amini
COMPUTER SCIENCE

OVERCLOCKING PROCESSORS WITH EXTREME SUB-ZERO TEMPERATURES: INTEL VS. AMD

This project is testing the maximum potential the processors have to reach higher clock speeds. This is being tested due to consumer use. By using extreme temperatures, this shows the maximum limit each processor can reach without reaching its maximum limit. This can also give consumers an idea about how well the processor can be overclocked.

The maximum potential that the processor can reach will be determined by overclocking the processor with dry ice (-78.5°C), and raising the clock speed until the computer crashes, or becomes unstable. Stability was measured based on temperature; over 60°C was deemed unstable due to the malfunction point of the processor is at roughly 70°C. 70°C is not a definitive point, however, it is widely considered the maximum temperature a processor should reach before problems can be reached.

The finding shows that the Amd processor has a higher percent of change in comparison to the Intel processor. Due to the percentage change increase in the Amd processor, this processor will be easier to overclock for consumers. The use of dry ice also managed to lower the processor temperature down to -30°C.

From the data, the conclusion has been reached that the Amd processor has a higher potential to be overclocked to higher clock speeds. This means that consumers will have a better chance of overclocking to higher clock speeds by choosing an Amd processor rather than an Intel processor.

39
KIM, Shuhee
COMPUTER SCIENCE

MATHEMATICAL MODELING OF CANCER STEM CELL PROLIFERATION AND DEDIFFERENTIATION

The main purpose of this research is to obtain a better understanding of the process of cancer stem cell proliferation in order to contribute to the creation of more individualized cancer therapy and treatments for each patient. The research was executed using a computer program comprised of a set of parameters such as the rate of cell differentiation and dedifferentiation. These constant parameters values were then varied to best-fit the model to the individual patient's cancer proliferation data. The parameter values used were the rates of forward differentiation and dedifferentiation, and the rate that a cell produces another cell of the same state.

The model includes an important factor: the rate 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. Using this new factor by incorporating it into the model as a feedback condition,

the computer program model can become more realistic and better follow the actual proliferation of cancer cells. Consequently, a better and more realistic model will allow for more exact individual parameter values which can then be used to create individualized therapy for each patient.

In conclusion, the final program model very closely fit the experimental data which represented the cancer proliferation data of a virtual patient. Thus, this successful model can allow the future of medicine more insight and better foresight and improve individualized cancer treatment methods.

40
NGUYEN, Perry
COMPUTER SCIENCE

APPLICATION OF COGNITIVE ROBOT DECEPTION TO COMPUTER SECURITY

The purpose of this project was to demonstrate a different computer security paradigm in which artificial intelligences are utilized to protect specified data from unwanted intruders, also allowing the AI to differentiate unwanted from permitted use. Currently, there are a vast number of different security processes used to protect personal information and to maintain privacy, many of which revolve around the use of encryption algorithms, which programs a unique key into the relevant data that can only be decoded through a dedicated password that is read through a hashing function such as MD5. However, regardless of the effectivity of each security process, there are different brute-force methods often employed to counteract them.

The coding of the application was carried out in the Python programming language. Using existing libraries for neural networking in Python, an application was written that has basic functionality in detecting misuse and "deceiving" the user by executing a variety of methods to alter the initial permissions and properties of the target data.

Using the created program, a software hacking test was employed to test the strength of the application. The output suggests inoperability in a real-world environment, but show a potential proficiency for the application of artificial intelligence deception in such a form.

While the project has been completed, the program itself is in a very immature stage in development and itself has many possible security exploits. However, the basic successes of the application demonstrate a possible new paradigm for the computer security, using cognitive neural networks to further strengthen personal and sensitive computer privacy.

41
Rajewski, Justin
Computer Science

UTILIZING FIELD PROGRAMMABLE GATE ARRAYS TO CREATE AN ARTIFICIAL NEURAL NETWORK CO-PROCESSOR

As artificial neural networks (ANNs) gain popularity the need for larger, more complex, and faster networks has arisen. Traditionally ANNs are modeled in software. The problem is that ANNs are parallel by nature. When the network is modeled in software, that parallel nature is lost as each neuron has to be calculated sequentially. To restore the parallel nature and increase speed, artificial neural networks can be modeled in hardware.

Field programmable gate arrays (FPGAs) have come a long way in recent years allowing for high density custom circuits to be created at a relatively low cost. Therefore, a FPGA was chosen to model the ANN in hardware. The FPGA was connected to an AVR32 microcontroller over a SPI (Serial Peripheral Interface) bus. This way, the AVR32 sends inputs to the ANN and receives the outputs. To test the performance increase, a similar ANN was implemented in software on the AVR32. Both the AVR32 and FPGA ran off the same 33MHz clock for consistency.

Once both networks were implemented, each one was timed. The results show that the FPGA has a very significant speed advantage over the AVR32. The software implementation utilized by the AVR32 requires approximately 339 clock cycles per neuron in the network while the FPGA requires approximately 12 clock cycles per layer in the network. Due to the parallelism of the FPGA as a network increases in width it requires no extra time to compute, while the software implementation does.

For projects that require a large fast ANN FPGAs provide an effective way to model the network. As ANNs become even more popular hardware implementations may find themselves being included as peripherals in devices like the AVR32. Large hardware networks could even be added to computers to allow for complex ANNs to be used in programs such as computer vision, speech recognition, or games without consuming precious CPU time.

42
CHEN, Justin Kevin
EARTH 7 SPACE SCIENCE

STRONGER HURRICANES CORRELATE WITH HIGHER WATERTEMPERATURES AND LOWER PRESSURE

Hurricanes are often over water, but when they reach land, the results can be devastating. During Hurricane Katrina, an estimated 6,000 to 12,000 people lost their lives in this Category 5 hurricane, which caused around $125 billion dollars in damages. Hurricanes Katrina was characterized by high sea temperatures and low pressures around the hurricane. The goal of this project was to see if there is any correlation between warmer sea temperatures and stronger hurricanes, through data collection on the Internet.

This experiment was basically a collection of hurricane data through the website, weather.unisys.com. Buoy data for collecting water and air temperature was collected through www.ndbc.noaa.gov. Data was collected for the hurricane names, the start date and the end date of the hurricane, the overall wind speed, pressure, and category strength of the hurricane, the location of the strongest point, the pressure at this point, as well as the water and air temperatures collected from the buoys themselves. Over the course of this experiment, the water temperatures at the strongest points were considerably higher than water temperatures at weaker locations in the hurricanes path. The air pressure was also lower in areas where the hurricane was stronger as well.

After the conclusion of the experiment, the hypothesis was confirmed that warmer seas and lower pressures correlate directly with stronger hurricanes. Although some buoys were not near any hurricane paths, many of the experimental data were complete and thorough, with every informational category filled out. Water temperatures ranged from 11.3 Celsius in the East Coast (much colder due to East Coast location) to 30.0 Celsius. Pressure ranged from 294 mb to 1008 mb.

The outcome of this experiment produced results that were initially predicted. All of the experiments showed higher sea temperatures and lower air pressures at the hurricane's strongest point. Hopefully in the future, detection of the exponential increase of water temperature while a substantial decrease in air pressure will lead to more efficient ways of predicting the formation of hurricanes.

43
NGUYEN, Lauren
SUNAGA, Akari
EARTH & SPACE SCIENCE

THE ORIGIN OF THE KELVIN CANYON SPRING

This project is a part of an ongoing study to assess and characterize the Kelvin Canyon Spring. Collected data will allow researchers to gain insight into the hydrology and geology of the Abalone Cove area. The interest in this area is accentuated because it is subject to land movement as part of Portuguese Bend. Kelvin Canyon Spring is one of the few springs that run year round in the Palos Verdes area. The spring is located directly below the landslide demarcation so understanding the spring's behavior, specifically, knowing its flow rate may assist in predicting land movement in the area.

Twice monthly, measurements of the Kelvin Canyon Spring flow rate were taken. A five-gallon bucket was used to measure the flow rate of the water. The same five-gallon bucket was used for every measurement. The amount of time it took to fill the five-gallon bucket to the brim was measured with a stopwatch, for six trials each measuring day. By taking the average time out of those six trials, the number of gallons per day of water was calculated.

A delayed direct correlation between rainfall and water flow rate was found. For example, the 74% increase in flow rate between December and January demonstrates such a correlation. The delayed action signifies the gradual movement of rainfall through the geological strata, eventually emerging as groundwater at the spring. A much smaller but noticeable correlation can be seen in October's rainfall and November's spring output.

The findings support the original hypothesis that the spring's origin is a natural phenomena and not the result of a man-made water leak or other artificial source. Overall, our data contributes to the Abalone Cove Landslide Abatement District, which seeks to track the effects of water flow in this area's land movement. This project will be merged into the larger, long-term study that will improve the understanding of both the spring and local geology.

44
SMOLKE, Peter
EARTH AND SPACE SCIENCE

EFFECTS OF WILDFIRE ON COYOTE AND FOX VISITATION TO PORTUGUESE BEND PRESERVE

A wildfire at Portuguese Bend Preserve in August 2009 destroyed the vegetation in the northern portion of the preserve. It was hypothesized that the presence of local fauna would increase this year due to the reemergence of vegetation. This experiment compared the visitation of coyote (*Canis latrans)*, red fox (*Vulpes vulpes*), and gray fox (*Urocyon cinereoargenteus*) to Palos Verdes ecological preserves.

Portuguese Bend and Forrestal Preserves were surveyed for scat to assess activity of the fauna. Forrestal Preserve was used as the control region because it was not burned by the fire. The scats found were categorized into coyote and fox groups by shape, size and content. Visitation rates for both animal groups were calculated for each preserve and compared to the rates from the previous three years. A motion sensor camera was placed in each preserve to confirm the scat data.

The coyote and fox visitation rates to Portuguese Bend were respectively higher and lower in the 2010-11 surveys than the three previous years. At Forrestal, the frequencies of the 2010-11 surveys for both the coyote and fox decreased in comparison to the rates from 2007-10. The camera traps yielded no pictures of coyote or fox at either location.

The data did not confirm the hypothesis as there was a significant rise in coyote activity but a decrease in fox visitation at Portuguese Bend in the past year. Other factors affect the frequency of visitation and could be more aptly studied in future research.

ENGINEERING

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CHEN, Alex
ENGINEERING

A NEW PERTURB-AND-OBSERVE ALGORITHM FOR SOLAR PANEL MAXIMUM POWER POINT TRACKING

The objective of this project is to improve the maximum power point tracking (MPPT) algorithm to optimize the efficiency of solar panel systems. Solar panels are used to convert solar energy into electricity and the MPPT circuit helps the solar panel to operate at its maximum power point. The simplest and most popular MPPT circuit uses the perturb-and-observe (P&O) algorithm which suffers from some widely criticized deficiencies and is the subject of this study.

A new variable-step P&O algorithm was developed. This algorithm used the ratio of output power change to voltage change of each perturbation cycle to determine the direction and step size of the next perturbation. It also included boundary conditions for the step size and allowed the solar panel to reset to a predetermined voltage when its output power was below a minimum value for two consecutive perturbation cycles. A two-diode solar panel model and measured solar irradiance profiles were used for simulations.

Simulations of the new P&O algorithm showed an MPPT efficiency of nearly 100% regardless of weather conditions. The same simulation method was applied to the original and two modified P&O algorithms in the literature for comparison. The original P&O achieved an MPPT efficiency of only 93.2%. The two modified algorithms were inferior to the original.

The new algorithm of this project was significant because it improved the original P&O algorithm with simple modifications. The improvement was attributed to the addition of the boundary conditions of the step size and the voltage reset mechanism.

47
KASPEROVICH, Alexander
ENGINEERING,

THE RELATION OF SENSOR BEHAVIOR TO EFFICIENCY IN NAVIGATION AND OBSTACLE AVOIDANCE

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 predetermined points. Another goal was to use that robot to find out which combination of sensor positions and behaviors (oscillating, nonmoving) yielded the better responses to foreign objects.

The robot's construction took up more than half of the research time, and writing the algorithms for the robot took up almost all of the rest. 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 unexpected: the combination of fixed and moving sensors did not work at all due to the interference the sensors' light sources exerted on each other, and the oscillating sensors reacted somewhat slowly to external objects. However, the fixed sensors were surprisingly efficient, and were not affected by blind spots as much as was hypothesized. There was less progress in the navigation portion of this project; navigation will be the subject of future research.

The conclusions drawn from this project are that fixed sensors help make more effective decisions than just oscillating sensors, or a combination of fixed and oscillating sensors. No conclusions can be drawn on the subject of navigation, as progress in that field was obstructed by the limitations of the mathematical software libraries for the Isopod microprocessor platform.

48

Kelley, Sean
Engineering

USE OF A PROTON MAGNETOMETER TO ACCURATELY MEASURE HYDROGEN ION CONCENTRATION

Nuclear Magnetic Resonance has been used to measure the concentration of different types of atoms and molecules in a variety of materials. However, although this technique is extremely accurate it requires a very strong and uniform magnetic field which makes the equipment impossible to use in an everyday environment.

In order to overcome these problems a device was created that used the Earth's magnetic field and a single pulsed magnetic field to create proton alignment. In this experiment the hypothesis was that if a polarizing magnetic field was created and then turned off it would induce resonance in a receiving coil; the amplitude of the resonance curve would be determined by the number of protons in the solution. To accomplish this, two coils were created one with an inductance of 41.2mH and the other with 2.580mH, hereby called coil one and two respectively. The coil two was placed inside the coil one with both coils having their axes perpendicular to the Earth's surface. Coil one was then connected to a .28 MFD capacitor that established a resonance circuit, this circuit was then connected to a voltage recording device. Coil two meanwhile was connected to a switch that would allow 0.831 Amps of current into the coil.

The experiment began with waiting five seconds after the recording began, then the current was allowed into the coil for 10 seconds, and finally the recording was stopped five seconds later. In this experiment 6 different conditions were tested one with no distilled water and the other five with different amounts of distilled water ranging from 2ml to 10ml by increasing the amounts in increments of 2ml. Each condition had 10 trials separated by five minutes.

The results of this experiment proved the hypothesis to be mainly true in that the 10ml sample showed the lowest median amplitude while 2ml showed the highest amplitude. However, the no water sample was an outlier and had to be excluded from the data analysis. In conclusion the experiment was able to show that the numbers of protons do affect the amplitude using only the Earth's magnetic field.

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Leslie Kurt
ENGINEERING

THE IMPACT OF BUILDING WASTE MATERIALS ON THE PROPERTIES OF CONCRETE

This experiment aims to create a concrete that would help the environment as well as be more functional. By adding tire rubber, dry wall, and fiberglass to concrete, I predicted that tire rubber and dry wall would increase strength, and fiberglass would increase strength and lower water permeability.

To test strength, a wooden wedge was placed on a concrete slab. Then sand buckets were placed onto a wooden wedge until the concrete broke. Permeability was calculated by finding the mass of a cylindrical block of concrete before and after it was soaked in water.

The results showed that adding fiberglass to concrete increased the strength the most. The permeability of all the concretes with waste material drastically decreased compared with that of regular concrete. Density and strength were positively correlated. Fiberglass had the highest density and lowest strength and normal concrete and drywall had the lowest density and lowest strength.

Tire rubber and fiberglass acted like rebar, which builders use to enhance concrete's strength. This caused concrete with tire rubber and fiberglass to increase in strength. Concrete has little to no tensile strength, the force that something can withstand until it breaks. Like rebar, tire rubber and fiberglass improve concrete's tensile strength; which allows it to withstand more weight before breaking. On the contrary, drywall does not improve tensile strength, because it lacks the tire rubber's and fiberglass's fibrous characteristics. Drywall also may have affected the crystal structure; which could also have caused the strength to decrease.

50
LEE, Ronald
ENGINEERING

THE ENGINEERING OF A HYBRID RAIL/COIL ELECTROMAGNETIC LAUNCHER, YEAR 2

This project aims to improve last year's dual stage electromagnetic launcher, where a coil launcher was the initial stage and a rail launcher as the second stage. A number of tests, including measurements of the velocity of the projectile and the energy efficiency were taken to assess the improvement of this design over last year's iteration.

The launcher itself was built in accordance with a modified schematic. Specifically, the power source and regulator, switch, capacitor banks, and barrel were changed. In order to test the velocity of the projectile shot from the launcher, last year's improvised velocity meter was also implemented for continuity. The test itself categorizes the velocity, kinetic energy, and energy efficiency for projectiles fired from the combined electromagnetic launcher. The velocity is calculated by dividing a preset distance by the time difference between the trigger times of two endpoints. For this experiment, last year's combined launcher voltages were retested and a focus was placed on varying the rail voltages with a constant coil voltage. With this data, the kinetic energy and efficiency were also calculated. The velocity was measured in meters/second while the energy was measure in joules.

Overall, the three trials conducted at 150, 175, and 200 volts and the trials where the coil voltage was held constant, the modified launcher's velocity, energy, and efficiency were lower than that of last years.

This project's contributions demonstrate the tradeoffs of this new design outweigh the benefits. Finally, this project investigates the properties of electromagnetic launchers and further clarifies the nature of such launchers.

51
LIN, Steven
ENGINEERING

EXPLORING THE EFFECTIVENESS OF A MASTER-SLAVE SYSTEM IN SOLAR PANEL TRACKING

This project examined the effectiveness of a master-slave system in solar panel tracking. This is beneficial to society because current systems are mostly preprogrammed and therefore not very portable to other areas. Each preprogrammed system is tailored for each specific solar farm which makes it inapplicable elsewhere.

This project developed a system capable of detecting the best position of the solar panel in any situation. One master can be applied to an infinite amount of slaves, which allows for an infinitely higher net gain. This experiment was done by programming an Atmel Atmega 328 using the C language and the Arduino software and board. The program directed a servo to run in a loop and pan the solar panel 180 degrees, testing the voltage of the electricity generated by the a solar panel throughout the process. The position with the greatest voltage output was then transferred to another servo, which directed another solar panel to the best position.

Once complete, the system was able to track light sources. However, the accuracy of the system is not perfect due to electronic noise, even though measures were taken to reduce this. The panel adjusts itself up to one degree even if there is no change in lighting.

In conclusion, the hypothesis was proven to a degree as the system was able to track a light source and allow the panel be more efficient. This project successfully solved its problem as the system was able to work in multiple situations. It is viable in areas where high portability and efficiency is needed, such as aerospace applications, where other, preprogrammed systems would not work.

52
Lowe, Patrick
ENGINEERING

COMPARISON OF FANWING CONFIGURATION EFFICIENCY: (YEAR II)

This project was designed to continue research into finding the optimal ducting configurations on a fanwing propulsion system in respect to its efficiency in lift and thrust. A fanwing works on Bernoulli's principle and the principle of high bypass engines. Bernoulli's principle states that the velocity of an air flow varies directly with its pressure. One of the principles used in high bypass engines states that the more air that is taken in the more air moved and therefore the more thrust is generated. This is done with less energy than an equivalent system with multiple smaller engines. The fanwing takes this to the extreme by embedding a squirrel cage fan along the upper leading edge of the wing. This enables the fanwing to take in a larger amount of air and therefore has a better thrust to energy consumption ratio. The fanwing system takes in air from the leading edge, accelerates it, and then expels it over the trailing edge, which creates lift by Bernoulli's principle. Ducting has been used to make existing propulsion systems more efficient such as in ducted fans, jet engines, turboprops, and turbofans. If designed correctly, ducting causes increased thrust and decreased drag so that it overcomes such drawbacks. No one has fully applied ducting to fanwings in order to make an efficient design even more efficient. In year one of this project, the feasibility of improved efficiency through ducting was confirmed. Year two of this project focused on finding the optimal ducting configuration to increase both lift and thrust with an emphasis on lift.

A new wing was designed with the fan running almost the entire length of the wing, and a lighter drive system reduced weight from 1.9 kg to less than .9 kg, the middle section of a fully functional fanwing, was tested in a subsonic wind tunnel. The section of a fanwing was designed to fit into cross section so that wing tip vortexes would not be an influence in this experiment. The fanwing was tested in over 25 different configurations each with different ducting shapes, positions, and drive systems. Each was tested 12 times for lift or down force and thrust or drag. The inherent lift and drag of all configurations was measured and factored out of the raw results. Smoke tests were performed on all high performance configurations to gather qualitative data that could lead to a trend or pattern behind successful fanwing ducting designs. All data was compared to the control configuration of a ductless wing.

The average lift of configuration C'5 at 2.25 was the greatest at 153.1 grams. The control configuration generated 129.5 grams of lift. The average thrust of configuration C'5 at 2.25 was the greatest with 21.6 grams of thrust. Comparatively the control configuration produced 11.7 grams of thrust. Ducting increased lift by almost 20% and thrust by almost 100% over the control configuration.

The data gathered shows that configuration C'5 at 2.25 was the best all-around. . Even though configuration C'5 at 2.25 was found to be the best out of all tested configurations research is not over. Dynamic ducting, internal ducting, genetic programing, larger scale models, and many other modifications could reveal more efficient designs. This experiment, however, has determined several trends that lead to efficient ducting and further reinforced the promise of efficiency through ducting.

53
Nguyen, Ryan
Engineering

THE EFFECT OF PARTIAL STERILIZATION(HEATING) ON MICROBIAL FUEL CELL ACTIVITY

A current need in the world today is finding energy sources that are environmentally friendly and inexpensive. The microbial fuel cell proves to satisfy both criteria by harvesting the electrons produced by bacteria in the mud to produce electricity. This project explored if a conventional oven can effectively sterilize "wet mud" that is used as media in a microbial fuel cell(MFC). If so, then scientists would be able to introduce "high energy" yielding bacteria in place of the native bacterial colonies in MFCs using available third- world country equipment.

Biologically active mud was gathered from a local source. Then, a portion of the mud was heated in a household oven at 350°F for two hours. The heated mud reached an internal temperature of 202°F. Next, a control MFC and a heated mud MFC were made. Daily measurements were collected for the voltage and current output using a digital multimeter.

At first, the measurements supported the hypothesis that heating the mud would sterilize the mud. However, the heated mud MFC's voltage output rapidly increased until it surpassed the control cell. The conclusion is that the heating only partially killed off the bacteria. The rapid rise in electrical activity appears to show that the residual bacteria rapidly re-established themselves.

The experiment indicates that the hypothesis was only partially correct. Heating in a conventional oven initially reduced the level of biological and electrical activity. Nevertheless, the rapid rise in electrical activity indicates that there were residual bacteria present in the heated mud that quickly re-established themselves.

ENVIRONMENTAL SCIENCE

54
BISHOP, Marie
ENVIRONMENTAL SCIENCE

LEAD LEVELS IN THE SOIL AT TORRANCE MUNICIPAL AIRPORT

Leaded fuel was outlawed in 1996, however leaded Aviation Fuel (Avgas) is still allowed. To determine if lead concentrations in the soil are legally hazardous at an airport where Avgas is used, soil samples can be analyzed. The hypothesis is that the level of lead at the airport will be higher than that of the control, and that the highest concentration of lead will be at the location closest to the approach end of the runway.

The locations of the soil samples were chosen carefully; explicit permission had to be first given by the airport officials. A total of five samples were taken: four from the airport, and one from a control location. The purpose of the control location was to provide a comparison for the other samples; it was taken from an area where there is no known lead contamination. Each sample was collected using a spoon, and put in a plastic bag. The samples were then sent to a local testing facility. Two samples were taken from the approach end of the runway, one at the opposite end of the runway, and another along the middle of the runway.

The locations saw a large range in their lead concentrations. The location that contained the greatest amount of lead was not the one closest to the runway, but the one closest to the taxiway, near the approach end of the runway.

Lead concentrations at the airport are high compared to the control, however they are still far below the legally designated hazardous level. There might at first appear to be a direct correlation between the use of leaded Avgas and increased lead concentrations in the soil, but other factors also must be addressed.

55
CHAN, Victoria
ENVIRONMENTAL SCIENCE

THE EFFECTS OF IRON (III) NITRATE ON MARSH WATER PHOSPHATE REDUCTION TO MINIMIZE EUTROPHICATION

Phosphate ion is a main contributor to eutrophication in much of the developed world. Madrona Marsh in Torrance has seasonal vernal pools caused by rainfall and street runoff. Algae problems have been found in the springs, summers, and early fall due to the phosphate impact. This experiment was designed to test the effectiveness of iron (III) nitrate to reduce phosphate levels in the marsh water.

There were five separate containers used, one container for the control and four other containers with different levels of iron (III) nitrate in it. The control container had marsh water without any iron (II) nitrate. For the other four containers, 3.60 mg, 7.19 mg, 10.30 mg, and 13.39 mg of iron (III) nitrate were added to each container with 1 L of marsh water and were allowed to react for two weeks. All five containers were stirred three times during this time period, and then sent to a professional laboratory to be analyzed.

The results were that all dosed containers showed a significant decrease in the level of phosphate ion in the marsh water. However, the results of the dosed samples were variant. There were 0.18 mg/L of phosphate ion in the control. The deviations of the dosed containers were attributed to the inability of the analytical machine to deal with such small amounts of dissolved phosphate.

The conclusion is that iron (III) nitrate did cause a decrease in the phosphate levels in the marsh water. This implies that iron (III) nitrate could be used to control algae efficiently in vernal pools at the marsh with little cost.

56
CHEN, Christine
ENVIRONMENTAL SCIENCE

ASSESSING *POLIOPTILA CALIFORNICA* POPULATION IN DIFFERING *ARTEMISIA CALIFORNICA* HABITATS

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. My hypothesis was that California gnatcacher population would be greater in a mature California sagebrush habitat in comparison to a newly restored, California sagebrush habitat. To test my hypothesis I conducted bird surveys, in which I counted the number of birds at a 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 2010 and February 2011. I also collected measurements of the California sagebrush at both sites to assess the optimization of each habitat. Since the bird and plant

data collected had a non-normal distribution, I used a Mann-Whitney rank sum test to compare the maturity of habitat, and California gnatcatcher population at the Vincente Bluffs reserve and Three Sisters reserve. For both the California gnatcatcher and the Artemisia californica data, the median values between the two reserves 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. The results also represent that the California gnatcatcher population is significantly higher at the Vincente Bluffs preserve. Both parts of the statistical analysis prove my hypothesis that the population of California gnatcacher population is greater in a mature California sagebrush habitat in comparison to a newly restored, California sagebrush habitat.

57
CHEN, Monica
ENVIRONMENTAL SCIENCE

BIODEGRADATION OF PFOA AND FTOH BY PSEUDOMONAS PUTIDA

Perfluorooctanoic acid (PFOA) and fluorotelomer alcohols (FTOH) are perfluorinated compounds (PFCs). They are used in the manufacturing of common household and industrial products such as Teflon, non-stick cookware, paint, electronics, insulation, and surfactants and lubricants as a result of their exceptional stability and inertness. In turn, these surfactant properties cause PFOA and FTOH to persist in the environment and often end up in human blood via dietary intake. This is alarming because PFOA and FTOH are known to be carcinogens, and reproductive and developmental toxins.

In an effort to combat the presence of PFOA and FTOH in the environment, this study tested the potential of *Pseudomonas putida*, to rely on PFOA and FTOH as a carbon or energy source, and its ability to break PFOA and FTOH down into non-toxic byproducts such as carbon dioxide. *P. putida* is a common soil bacterium strain, which has been shown to bioremediate a wide range of environmental pollutants and to adapt to its surroundings over time. Long-term and short-term dose response studies evaluated the growth of *P. putida* and the dehalogenation of FTOH and PFOA under a variety of incubation conditions.

Data demonstrated a general increase in fluoride ion concentration. *P. putida* concentration remained consistent throughout the study.

Fluoride ion concentration was used as in indication of *P. putida*'s efficacy in degrading PFOA and FTOH. However, more analytical measurements need to be conducted to draw definitive conclusions.

58
CHEN,Xiyue (Bonita)
Environmental Science

THE EFFECT OF POSTING SIGNS IN RESTROOMS ON PAPER USAGE REDUCTION

Natural resources are limited, but people continue to waste resources. This is especially evident in the excessive use of paper towels in public restrooms. It is hypothesized that if faced with signs suggesting the conservation of paper towels, people will reduce their usage of paper towels, thus creating less waste and conserving more natural resources.

This study was conducted at the women's restroom of three locations: Palos Verdes Peninsula High School, the Peninsula Center Library, and the Del Amo shopping center. Data on the number of people using paper towels and the number of paper towels used were collected, and the average number of towels used per person was calculated. Then, a sign suggesting the reduction of paper towel usage was posted on each paper towel dispenser in the restrooms. The data were once again collected, and the new average usage of paper towels per person calculated.

It was found that in all three locations, the average number of paper towels used per person decreased significantly after the signs were posted. Although high school students had the highest average usage of paper towels before and after the signs were posted, they also had the highest percentage reduction due to signs.

The signs were shown to be very effective for the reduction of paper towel usage. The hypothesis was supported by this study, and it was found that high school students responded most to the sign being posted. This experiment suggests that more public restrooms should post signs urging people to fewer paper towels in an effort to conserve natural resources.

59
CHOE, Justin
ENVIRONMENTAL SCIENCE

UTILIZING A MAGNETIC FIELD TO RECLAIM NANOPARTICLES IN WATER TREATMENT PROCESS

The purpose of this project was to discover the possibility of utilizing magnetic silver nanoparticles as a primary method for water disinfection. The current methods for water disinfection are through contact with sodium hypochlorite or ozone, both of which yield potentially hazardous byproducts. Magnetic silver nanoparticles could eliminate reliance on these current methods for disinfection, and could also be retained and reused.

1:3 and 1:4 ratios of silver to iron by mass were chosen as the nanoparticles to be tested. First, a control and control duplicate were taken by placing 1 mL of plant influent water from Anaheim's Lenain Water Treatment Plant. Next, the 1:3 ratio was tested by placing those particles in plant influent water. 1 mL samples were taken at each of 10, 20 and 30 minutes. Two electromagnets were employed to collect the nanoparticles, and the water was pumped out. More plant influent water was added, and the process was repeated twice. The test for the 1:4 ratio was the same as the test for the 1:3 ratio. Lastly, to prove that the magnets were collecting the nanoparticles, the final test had the 1:4 ratio in plant influent water, but did not collect the particles between trials.

Both the 1:3 and 1:4 ratios of silver to iron by mass yielded positive results. Bacterial colonies formed in all of my tests, though significantly less were counted in the tests utilizing nanoparticles. On average, the control had around 50 cfu's, while the trials utilizing nanoparticles only had a few colonies of bacteria each.

In conclusion, both ratios of nanoparticles worked effectively in eliminating bacteria. Also, electromagnets allowed the magnetic silver nanoparticles to be retained and reused. These conclusions display the possibility of eventually incorporating nanoparticles into conventional water disinfection processes.

60
COULTER, Brennan
ENVIRONMENTAL SCIENCE

THE POTENTIAL FOR "PLANT BASED" OILS AS A SUBSTITUTE FOR DIESEL

This research investigates the potential for plant oils as a substitute for diesel fuel. Due to increasing concerns of U.S. dependence on foreign oil, dwindling global oil supplies, rising oil prices, and climate change there has been a shift in focus toward alternative energies. As a potential solution to these problems, plant oils have become part of the debate. While research has been done in the past on these oils, results on vegetable oils have been mixed, and data on tree oils are closely guarded. Therefore, more research must be done to determine if there are plant oils with potential to be a viable substitute to diesel. For an oil to be a viable substitute, it must provide comparative performance in terms of energy produced, demonstrate positive net energy gain, reduce carbon emissions, and have economics equal to or better than diesel fuel. The oil must also be able to produced to scale in order to have an impact.

Oils derived from trees tend to be heavier oils with longer fatty acid molecules. As a result, viscosity of these oils can overwhelm an engine's fuel system. These oils also tend to solidify at higher temperatures, with coconut and palm oils being solid at 70 F. Thus the properties of these oils, their viscosity and ability to flow in an engine's fuel system, are major concerns. The advantage of many vegetable oils is that they are widely planted and readily available now. Meanwhile, oil producing trees, unlike annual crops that require planting and harvested every year, require much less fuel to plant, grow, and harvest but are not yet widely available. Yearly yields of oil per acre for tree oils are higher with, for example, avocados, producing 282 gal/acre/year while using only 30 gallons of fuel to grow and harvest. In contrast, soybeans under current farming techniques, produce only 48 gal/acre/year and require roughly 140 gallons of diesel: a net loss of energy.

In this research, the properties of the following seven tree oils, four vegetable oils, and eleven diesel/oil blends were studied for their properties as a fuel: viscosity, freeze point / melting point, density, and blendability with diesel. From this assessment palm, palm kernal, castor, coconut, and jojoba oils, along with blends of diesel and palm, palm kernal, castor, coconut, and jojoba were eliminated as candidates leaving avocado (both refined and unrefined), peanut, soybean, olive, corn and diesel blends of avocado (refined and unrefined), peanut, soybean, olive, and corn as viable candidates.

The fuels that were not eliminated in the properties testing, and which could therefore be safely run were evaluated for energy efficiency relative to diesel in a converted Aurora AGI6800SDE diesel generator. By placing a constant load over a 15 minute interval per run the fuel consumed in each of three runs was measured in grams. The amount grams consumed over a test period was then converted to an equivalent miles per gallon as compared in terms of percent efficiency to the diesel baseline. The testing showed a baseline performance of 206.7 grams of diesel consumed, which was converted to a base of 27.0 mpg. Fuel efficiency of diesel was followed closely by Canola and Soy, both at 21.9 mpg, and Unrefined Avocado at 22.1 mpg (all within the expected ranges). The blended fuels (90% diesel) were also tested with results landing between diesel and the pure oils. Avocado oil emerged as having the best overall properties as a fuel with the best blending characteristics. The other oils were eliminated for a variety of reasons.

Avocado oil is viable only if it can be sourced at a cost delivering a cost per mile equal to or better than diesel and can be scaled to produce 6 billion gallons. Based on an economic model for the production of avocados, a delivered cost of $1.74/gal to Houston was estimated, which is below the threshold $1.82/gal to be equivalent to diesel. Tax credits of $1.00/gal for the oil make the economics more favorable. To produce 6.0 billion gallons of avocado oil, it was determined that 14.2 million acres would need to be planted. A United Nations study shows that countries in Central America and the Caribbean have a total of 73.6 million acres of unplanted crop land that is viable for this purpose. Avocado oil has been found to meet all the criteria to qualify as a viable substitute for diesel fuel and may provide the US consumer a savings of $0.05 per gallon; a first for an environmentally friendly bio-fuel.

61
CROFTON, Charis
ENVIRONMENTAL SCIENCE

DETERMINING THE CAUSE OF DISSOLVED SUNSCREEN'S NEGATIVE EFFECT ON TETRASELMIS

Four ingredients found in sunscreen are known to contribute to coral bleaching by promoting viral infections in zooxanthellae, coral's symbiotic algae. Experimentation done last year found that Neutrogena sunspray, which contains one such ingredient, killed off a species of green algae called *Tetraselmis,* but the means were unknown—whether viral infections were again the culprits or some other phenomenon was to blame. The purpose of this experiment was to determine whether UV absorption by sunscreen, and hence decreased photosynthetic rates, is responsible for sunscreen's negative effect on *Tetraselmis.*

Six different treatments were tested, including the control, the positive control (covered with mesh), Neutrogena sunscreen inside and outside the flask, and Coppertone inside and outside. All eighteen flasks (3 in each group) were placed under a UV light and population density and chloroplast production were measured for three 6-day trials.

The results showed that the average population counts for the flasks with sunscreen outside were generally higher than those for the control. A statistical analysis showed that the different variables among each treatment did not have a significant impact on chloroplast production. In addition, the index cards that were placed in the "sunscreen inside" groups turned slimy and orange by the end of the six-day period, consistent with previous results.

The hypothesis was accepted, as the results clearly showed that UV absorption is not a factor, and the slimy orange residue points instead to some chemical reaction taking place.

65
LIU, Albert
ENVIRONMENTAL SCIENCE

PROJECT TITLE: CAUSE OF THE INFLUX OF *FORFICULA AURICULARIA* IN ALTA VICENTE RESERVE

Palos Verdes Peninsula Land Conservancy is currently restoring Alta Vicente reserve. In the reserve, the site of restoration showed an increased abundance of *Forficula auricularia*, an invasive species more commonly known as European Earwigs. It is hypothesized that increased soil moisture levels in the restoration portion of the reserve drew the *F. auricularia* into the restoration portion.

To test the hypothesis, higher abundance of *F. auricularia* in the restoration area than that of the native area was first ascertained by analyzing previously collected data on arthropod abundances in the reserve. Then, soil moisture level in the restoration area and the native area was compared to ensure higher soil moisture level in the restoration than that of native's level. Lastly, *F. auricularia* preference towards "restoration" or "native" soil is tested by specifically built experimental habitats.

Results from the experiment showed both a higher abundance of *F. auricularia* and a higher soil moisture level in the restoration than those of the native. Most amazingly, *F. auricularia* prefers the "restoration" side of the habitat over 90 percent of the time, which supports the hypothesis that increased soil moisture caused the large abundances of *F. auricularia* in the restoration area.

This study provides important information to take into consideration when planning large scale restoration projects. Water irrigation systems may hinder the revival of native habitats by drawing in invasive species into the

restoration area; therefore, care should be taken to avoid any excess watering and to eliminate non-native species for a complete restoration.

66
YANG, Bronte
ENVIRONMENTAL SCIENCE

EFFECTIVENESS OF USING HYDROPONICAL METHODS TO CONTROL PHOSPHORUS POLLUTION IN WATER

Phosphorus is a common part of agricultural fertilizers and organic wastes in sewage and effluent. Though essential to plants, it can cause and accelerate eutrophication, a process which deprives the water of oxygen and negatively affects aquatic life. By using an artificial system of hydroponics, phosphorus in the water may be absorbed and subsequently controlled. This project tests the extent of phosphorus absorption through *Lactuca sativa.*

In the experiment, two basic hydroponic systems are built with Styrofoam and plastic. Phosphorus is added to both systems in the form of a common fertilizer along with hydroponic nutrients, and the concentration of phosphorus at the start is measured with a phosphorus testing kit.

Data was collected by using the kits to test the phosphorus content of the water after two months from the start of experimentation. The resulting comparison of phosphorus concentration is used to determine the accuracy of the hypothesis. The results of the experiment did show a decrease in phosphorus. The data from both systems were mostly consistent.

Although the data suggested the hypothesis to be correct in that hydroponics is effective in reducing phosphorus in water, the amount of phosphorus consumed through the process is not significant enough to be considered as an efficient method to combat phosphorus pollution.

67
Yun, Hee Kyun
Environmental Science

THE EFFECT OF PRESENCE OF CARPET ON HEIGHT BASED AIR PARTICLE DISTRIBUTION

This project was conducted to find how the particulate matter (PM), a complex mixture of extremely small particles and liquid droplets, is distributed in differing heights and how the presence of carpet affects the distribution. Because of entrapping ability of carpets, it was hypothesized that the carpet will trap the particles on the floor, so the carpeted room has higher concentration of particles on lower heights while the smooth floored room has more equal distribution of particles.

The experiment was conducted by measuring PM2.5 and PM10 concentrations on heights of 6 in, 22 in, 26 in, 40 in, 54 in smooth floored room and carpeted room using Dust Trak, an aerosol monitor. The data were graphed to find the relevance of data.

The results did not support the hypothesis. The distribution did not show increasing particle concentrations on decreasing height in any flooring and smooth floored room had random distribution of particles; however, other patterns could be determined. Regardless of height, the carpeted room had higher particle concentration than the smooth floored room; PM10, particles with longer radii than the PM2.5, showed more constant distribution in carpeted room than in the smooth floored room.

The analysis of the data concluded that bigger sized particles tend to be more equally distributed in carpeted room than in smooth floored room, that presence of carpet causes more polluted indoor air quality, and that height is not a determining factor of particle distribution.

MEDICINE & HEALTH

69
HEWITT, Victoria
MEDICINE & HEALTH

EFFECT OF QUALITY OF LIFE ON A CLINICAL CURE FOR STAPHYLOCOCCUS AUREUS

Staphylococcus aureus is a bacteria that affects various body tissues. This bacteria ranges from very treatable to extremely dangerous. This project seeks to find the effect of health related quality of life on patients enrolled in the Pfizer study at Los Angeles Biomedical Research Institute. It was hypothesized that patients with poor health related quality of life will be more likely to have a poor clinical outcome.

A series of three interviews were conducted for the Pfizer study and then were entered into a database. Variables were analyzed to determine statistical significance for health related quality of life. Using the surveys, poor health was determined by the lowest quartile meaning answers added to eighteen or lower out of forty-four. Once data entry was fully completed, data cleaning was done using programming code. By using SAS(Statistical Analysis Software), we could evaluate the true importance of the different variables.

According to the data, women as well as older patients were more likely to report poor health related quality of life. Patients using antibiotics and taking other medications for chronic conditions within the past twelve months also reported poor health more frequently. Previous hospitalizations had further effect. Having MRSA rather than MSSA shows to have a trend with patients reporting poor health. Diabetes also shows a trend of this outcome.

In conclusion, the original hypothesis was rejected. When looking at the variable dealing with relapse of infection, it was found that there was no association between the two variables. In order to be statistically significant, a variable must have a p-value of 0.05 or less, which in this case was 0.52. Though this specific question was rejected, other findings were proven to be significant. Each brings an interesting new perspective to quality of life. The quality of life for a patient is a small factor when dealing with treatment, but the effect on the general public is incredibly evident.

70
JALAN, Saral
Medicine/Health

PERIPHERAL VASCULAR DISEASE WITH KIDNEY DISEASE

In this project more statistical analysis was done trying to figure out the major clinical characteristics responsible for the improvement and the worsening of patients diagnosed with Peripheral Vascular Disease as noted through their Ankle Brachial Index ratio. Peripheral Vascular Disease refers to any circulatory system disorder outside the brain or heart. It is usually when arteries clog up so that blood cannot flow through them properly or when arteries harden so that there is not proper flow.

Data obtained from LA Bio Med was used to figure out characteristics. Baseline data used from last year was taken which was broken into three parts: those with ABIs of below 0.9, those between 0.9 and 1.4, and those with above 1.4. The p-values of this data was analyzed. There were in total 52 patients who had the disease and 115 who had normal ABIs and were healthy. From these data, statistically it was found that 16 people's ABI worsened and 8 people's Ankle Brachial Index improved to normal levels.

At baseline smokers had low p-values meaning that they had high chances of having the disease. After the analysis was done it was that 16 people's ABI worsened to noticeable levels. The coronary calcification score had a p-value of .004. Those with lower ABIs had an average of 361 and those with higher than normal ABIs had CAC of 309. The beta blockers also increased and they had p-values of .046. At the same time eight patients had improvement in Ankle Brachial Index. Coronary calcification scores went down and had p-values of .03 and sugar levels also went down among these patients.

From this study, it was found that there may be direct correlations with decrease and increases of Peripheral Vascular Disease. There is definitely a correlation between smokers and PVD. Coronary calcification scores also play a big part in getting the disease and there is a connection in sugar levels with the disease.

71

KANG, Lucy
MEDICINE & HEALTH

DESIGN AND BUILD A NEW ACCELEROMETER

An accelerometer measures the movement of the person who wears it. The purpose of this research experiment was to build a more comfortable and wearable accelerometer for the benefit of the wearer.

The experiment was mainly divided into four parts: prototyping, final designing, testing, and analyzing the results. Accelerometers were originally designed on the SolidWorks, and then the actual devices were designed. After the devices were done built, they were taken to the University of Southern California Health Sciences Campus and were tested on four healthy, non-age matched adults. A survey was given to them after a short exercise to test the devices.

The survey results reveal that the design number two which is has the flat and wide surface received the most votes as a wearable device. All four people agreed that the design number two has the best size and the best shape, and three people agreed that the design two has the most appropriate weight and the most comfortable feeling.

Concluded from the data, the flat accelerometer is the most wearable one among the three differently designed accelerometers.

72
KAWAKAMI, Nicole
MEDICINE & HEALTH

SIMULATED ORTHODONTIC TREATMENT AND THE PHOTOELASTIC EVALUATION OF NEW ORTHODONTIC ARCH WIRES

Studies show initial arch wires should have low stiffness and super-elasticity. Recently, patients are now able to use polymer based wires for their aesthetics. The purpose of this study is to evaluate the initial forces produced by contemporary wires such as translucent wires versus the more clinically available metal alloy wires such as Nickel-titanium.

In order to test this, two experiments were conducted. The first experiment was a simulated tooth evaluation where five wires differing in composition yet similar in shape and size, were tested for tooth movement in a maxillary arch tooth movement testing model. The model, with brackets fixed in ideal positions, was fixated with a wire then subjugated to a heated bath. Tooth measurements were then taken and trials were repeated for each wire. The second experiment was a photo-elastic evaluation of the wires. A photo-elastic model was fixed with brackets in ideal position with the exception of two brackets. A light was shined through polariscope testing apparatus, and a camera took four different views for the five wires tested.

The results validated that the super elastic Nitinol wire would be the ideal initial wire. The super elastic Nitinol wire demonstrated the highest average in movement, and its fringe patterns were in median range. Additionally, the translucent wire induced the least amount of movement and indicated the smallest fringe patterns.

Thus it can be concluded that the modern polymer wires have a significant difference in their functional movements in comparison to metal alloys.

73
LYOU, Elyse
MEDICINE & HEALTH

IMPACTS OF AGE, WEIGHT, AND PILL TYPE ON DISCONTINUATION RATES OF PILL USE

The American College of Obstetricians and Gynecologists warn older (age > 35), obese (BMI > 30) women to take estrogen-containing birth control pills (COC's) only with caution. Estrogen increases the risk for thrombosis, the formation of a blood clot inside a blood vessel, obstructing the flow of blood through the circulatory system. In addition, age and obesity increase the risk for thromboembolism. However, for various reasons, women who fall into this category may wish to continue their use of COC's. This project investigated the discontinuation rates of older, obese women on progestin only birth control pills (POP's) approximately three months after being initially prescribed, as well as if discontinuation was due to bleeding irregularities. To identify the impact of age on discontinuation rates, younger (age < 35), obese (BMI > 30) women on COC's were examined. To identify the impact of obesity on discontinuation rates, older (age > 35), non-obese (BMI < 30) women on COC's were examined.

A retrospective study of the three groups of women was implemented. All prescriptions were acquired from the Women's Health Care Clinic at Harbor-UCLA Medical Center. Charts were reviewed in the three groups who started oral contraceptives between January 1, 2007 and June 30, 2009. Age, BMI, parity, preferred language, and any bleeding complaints were recorded. Also collected were medical problems and contraindications to COC's.

The data did not reflect a significant difference of discontinuation rates among the three groups of women.

The use of POP's in older, obese women appears to be an acceptable alternative to the use of COC's as a method of contraception.

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Sophie Miller
Medicine and Health

GENETIC AND ANATOMICAL STUDY OF CORRELATION BETWEEN TWO SNPS ASSOCIATED WITH CREATIVITY AND DEMENTIAS

Neurodegenerative diseases can focally affect the cerebral hemispheres, causing specific cognitive or behavioral syndromes such as Frontotemporal Dementia (FTD), Alzheimer's disease (AD), and Mild Cognitive Impairment (MCI). Some FTD patients have reportedly experienced newfound creativity at the onset of the disease, producing realistic, intensely colored, and sometimes bizarre artwork. Two single nucleotide polymorphisms (SNPs) in the genes *TPH1* and *DRD2* were recently associated with creativity. The study of these SNPs in normal subjects and dementia patients could provide an insight into the genetic interplay between creativity and FTD. Furthermore, the relationship between these SNPs and brain volumes in normal subjects and dementia patients could correlate regions in the brain with creativity and modulate the risk for FTD. In this study, 552 subjects (101 FTD, 134 AD, 258 controls, 59 MCI) were genotyped for these two SNPs and, in 297 of them, imaging-genetic correlations were performed. Subjects with the minor (A) *TPH1* allele had greater volumes in the left inferior temporal gyrus. FTD patients with the major (C) allele showed a trend for increased risk for dementia when compared to controls, and for selective volume reduction of the right supramarginal gyrus, suggesting an increased risk for the minor allele. Based on genetic/imaging correlations, this study identified the left inferior temporal gyrus as a candidate brain region for creativity (which should be investigated in functional studies), and suggests a role for *TPH1* variants in the risk of developing FTD, which should be confirmed in further studies in independent cohorts.

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YEN, Leia
MEDICINE & HEALTH

BMP2/DBM VS. AUTOGENOUS BONE GRAFTS IN CLP PATIENTS

Objective: To compare outcomes of bone morphogenetic protein-2(BMP-2/demineralized bone matrix(DBM) vs. autogenous bone in patients with cleft lip and palate. Hypothesis: BMP-2/DBM is an effective substitute for autogenous bone grafts in children with cleft lip and palate. Methods**: Occlusal radiographs and high resolution conebeam tomography(Kodak) were used to compare the graft outcomes of the two treatments in 16 patients. The 2-dimensional x-rays were analyzed using the Oslo and Chelsea scales. The bone volumes of the 3-dimensional CT scans were analyzed using SCANCO bone hisotomorphometry software.** Results**: The occlusal films over-estimated bone fill compared to the conebeam CT. The BMP-2/DBM group had almost twice as much bone volume as the autogenous bone grafts in the cleft site which was significant($p<.05$ Student t-test). Neither treatment provided enough bone for dental implant placement. Cost analysis showed that savings in operating room time with BMP-2/DBM could offset cost of the bone substitute materials.** Conclusions**: BMP-2/DBM has less morbidity and is an effective alternative to autogenous bone for the alveolar bone graft in children with Cleft lip and palate.**

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ZHANG, Andres
MEDICINE & HEALTH

PROGRAM TO CALCULATE AREAS OF CALCIFICATION FROM DICOM IMAGES

Coronary arteries are blood vessels that supply the heart with blood, providing the heart muscle with the oxygen it needs to function. When low level cholesterol builds up in these arteries, calcium patches up these areas. Too much calcification reduces the amount of blood the heart receives and increases the risk of coronary heart disease, the number one cause of death in America. Patients take CT scans of their heart; from these images, doctors determine how much calcium is in the patient's heart by the Agatston Score and whether he or she should be treated.

I plan to increase the accuracy of the calcium scoring program. The brightness of each pixel that appears on the computer screen is significantly higher than the actual brightness of the calcium. The project software calibrates the pixel brightness so that the brightness of the pixels on the computer screen can be converted to the actual brightness. Because of the variability of the brightness in imaging, current calcium scores have a 20% variability.

Because the brightness on the screen is higher, the calcium score calculated by the current software is too high. The program produced calcium scores that were on average 31.88% lower than the scores by the commercial software. The more accurate calcium scoring program will allow doctors to more accurately treat a patient, and will help prevent the overwhelming number of death resulting from heart disease.

MICROBIOLOGY

77
CHAN, Michele
MICROBIOLOGY

THE EFFECTS OF NATURAL SUBSTANCES ON ENTERIC BACTERIA REDUCTION IN MARSH WATER

Enteric Bacteria, from the family Enterobacteriaceae, reside normally in the guts of many animals, including humans, and causing disease in certain animal species. One of the serious members of Enteric Bacteria is Escherichia coli, a bacterium which has been studied extensively all over the world. A recent study by Anitra C. Carr, Ph.D. at Linus Pauling Institute (2010) indicated that Tea Tree Oil and their Therapeutic Properties may help with Enteric Bacteria reduction. The purpose of this study is to demonstrate the comparative effectiveness of enteric bacteria reduction from small water bodies in marsh water by such natural resources as tea tree oil, ginger powder, and garlic powder to find a natural way instead of chemical method to improve the marsh water quality.

This research includes choice of natural resources such as Tea Tree Oil, Camper, Oregano and ginger that might work effectively on water enteric bacteria reduction, instead of the use of high-cost chemicals in Madrona Marsh. The procedure of the experiment include an addition of control amount of natural substances such as tea tree oil, ginger powder individually to pure marsh water in MacConkey plates to grow bacteria in incubator at 37° for 24 hours and count the bacteria colonies. Then, the procedure for each selected substances was tested separately with marsh water and grow the bacteria in Mac Conkey plates at various temperatures

The results suggested that tea tree oil can significantly reduce the number of enteric bacteria in the MacConkey plate while the ginger powder show relatively less effective effects on the enteric bacteria reduction in the tests.

In conclusion, the results are in agreement with my hypothesis and the scientific literatures that tea tree oil can act effectively as an antiseptic and relatively significant in enteric bacteria reduction under most conditions and temperatures.

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NOE, Niki
MICROBIOLOGY

DETERMINING THE PREVALENCE OF CHYTRIDIOMYCOSIS IN THE SOUTH BAY VIA PCR ASSAY

Chytridiomycosis is an infectious disease that is responsible for the dramatic population decline and even extinction in most of the 6,000 amphibian species worldwide. This disease is caused by chytrid *Batrachochytrium*

***dendrobatidis*, which is the only type of fungus that that is a parasite of a vertebrate animal. Researchers know that Chytridiomycosis is known to be prevalent in areas of high elevation and is more virulent in areas of cool temperature range around 54°C-73°C. This project is designed to test areas in the south bay to see if Chytrid disease can be detected in other areas besides that of high elevation.**

To determine this, treefrogs were tested for the disease. Each frog from various locations within Madrona Marsh was swabbed with sterile cotton applicators and placed in sterile tissue culture vials. The vials were then tested for the presence of *Bd* zoospores through a PCR assay. This technique compares the amount of *Bd* in the sample compared to the universal set of standards.

When the samples were tested with the PCR assay, the results were positive. Although there was not a heavy infection in the frogs tested at various locations at Madrona Marsh, there were nonetheless *Bd* zoospores detected in few frogs ranging from 2 zoospores to 65 zoospores. Out of the fifteen samples collected, six of the frogs were tested positive for Chytridiomycosis.

Based on the findings above, it can be proven that Chytridiomycosis is prevalent in areas not only in high elevation as commonly believed, but also in areas at sea level. Researchers must realize how widespread this disease is to fully recognize the effects of the Chytrid disease worldwide. In order to stop the extinction of more frog species and the rapid decline of their population, the locations in which Chytridiomycosis is present must be carefully examined.

79
TANG-QUAN, David
MICROBIOLOGY

EVALUATING THE ROLE OF THE HOG1 AND ESCRT PATHWAYS IN HOST/CELL INTERACTION AND STRESS RESPONSE OF *CANDIDA ALBICANS*

The fungus *Candida albicans* can enter the bloodstream in immunocompromised patients, infecting most organs of the body and resulting in disseminated candidiasis, which has a 50% mortality rate. It is hypothesized that the HOG1 (High Osmolarity Glycerol) pathway is important as a general stress response mechanism, and that the ESCRT (Endosomal Sorting Complex Required for Transport) pathway is integral as a protein sorting and transport apparatus in *C. albicans*. For *C. albicans* to colonize patients and cause disease, it must be able to withstand various stressors and invade host cells.

A stress assay was conducted with HOG1 and ESCRT kinase insertion mutants to determine the importance of specific genes as a defense mechanism. Stressors included: protamine (antimicrobial peptides), SDS (cell membrane), H_2O_2 (oxidative), NaCl (HOG1 pathway), Congo Red and Calcofluor White (cell wall), and $CuSO_4$ (ion). Then, endocytosis assays and cell damage assays determined which ESCRT insertion mutants were necessary for cell invasion.

Overall, early or late gene inhibition in the ESCRT pathway can severely impair *C. albicans* normal function. Most significantly, the HOG1 and ESCRT pathways play a key role in general stress response. These discoveries will help in significantly decreasing the high mortality rate of disseminated candidiasis.

PHYSICS

81
HARA, Ellie
PHYSICS

EFFECTS OF EXCESS HEAT GENERATED BY UV LASER IRRADIATION ON THE EXPOSURE PROCESS OF PHOTOSTRUCTURABLE GLASS

Glass-Ceramics are a commonly used material, such as ceramic coffee mugs, kitchen stove tops, and cook ware to name a few. The most common way to shape this material is through casting. Another way of shaping the material is via 3D lithography and a scanning laser, which gives the ability to shape microstructures and nanostructures unable to be

done via casting and heating. In the case of Foturan™, which contains the photosensitive ion Cerium (Ce^{3+}), a UV 355 nm laser can induce the Cerium to undergo a photophysical reaction to eject an electron. This photoejected electron is then trapped in the glass. When the material is then slowly heated to above 500C the electron is mobile and neutralizes incorporated silver ions. It is known that a fast heating rate, to this temperature, could potentially reverse the reaction returning the electron to reform Ce^{3+}. With additional baking to >600 C, silver ion clusters are formed which then precipitate the growth of a particular crystalline phase. Hydrofluoric acid is then used to etch or remove the crystalline phase. Precise control of patterning the trapped electron can be done using a writing scheme called a direct-write method where the laser stays in one spot and the sample is moved along the x, y and z axis according to a written pattern program.

This project investigates the effect of manipulating the applied laser energy distribution on the material exposure (formation of the trapped electrons) as measured by optical absorption spectroscopy. The energy distributions are defined as a set of 10008 points on a spreadsheet that define the amplitude profile of the deposited energy. The amplitude profile is input into an arbitrary waveform generator that controls a light valve, called a Pockels cell, which then controls the amount of energy the laser puts out per laser shot. A Cary5000 spectrophotometer is used to measure the absorption of the trapped electron over the range 250-290 nm.

Out of the seven amplitude distributions tested, two having the profile shape of, Triangle and Columns, showed signs of being more efficient that the current process used which has the shape of a Top Hat. More specifically, Columns was more efficient than Triangle. We believe Columns was more efficient because the profile has five columns dictating when the laser is turned on punctuated by spaces that lets the sample cooled down, thus making sure the activation energy for the reverse reaction $(Ce^{4+} + \Delta H \rightarrow Ce^{3+})$is not met. By knowing how to more efficiently use the laser to trap electrons, scientists can then create their complex structures more efficiently, meaning the energy from the laser would be put to the greatest use with less energy wasted by the reverse reaction occurring.

82
HO, Wesley
PHYSICS

PUTTING NONLINEARTIY TO WORK: APPLICATION OF SOLITONS FOR SECURED COMMUNICATIONS

Nonlinearity is a fascinating topic in physics that is the basis of many interesting phenomena. In particular, solitary waves, called solitons, can propagate in a nonlinear medium. In contrast to ordinary wave disturbances, solitons are able to maintain fixed shapes and amplitudes during propagation for long distances. Also, solitons can collide with other solitons and emerge from the collision retaining their individual pre-collision shapes and amplitudes. This project investigates the feasibility of utilizing these unique properties of solitons for a secured communication channel.

The proposed technique is verified using the nonlinear Toda lattice which has an analytical solution such that the Matlab numerical code can be checked. The secret message is encoded in the amplitudes of solitons that are launched onto the lattice and allowed to combine. Since the solitons combine nonlinearly, this soliton mixture cannot be reproduced by any linear combination of solitons. The probability of an interceptor decoding the secret message by correlating guesses with the soliton mixture will be very low. At the intended receiver, the soliton mixture is allowed to separate into the original constituents to yield the secret message.

Extensive numerical analysis of soliton generation, propagation, and collision in the Toda lattice was carried out. The results indicate that indeed it is possible to combine and separate the solitons on the lattice. The analysis of probability of interception showed that even allowing for a wide parameter space that included soliton amplitudes and offset, the best case correlation is less than 1%. The numerical data validates the proposed technique.

The feasibility of using solitons for a secure communication channel was studied and verified through numerical analysis. The model used for the analysis was the Toda lattice but the technique is applicable to other nonlinear lattices.

83
KIM, Jonathan
PHYSICS

SINGLE TRANSDUCER, GRADIENT-FORCE ULTRASONIC MICROPARTICLE TRAPPING

This project investigates a potential method of trapping microparticles (particles with diameter ~100 µm) with high-frequency sound (more specifically, acoustic Bessel beams, which are non-diffractive waves).

Acoustic Bessel beams focused on spherical microparticles create diffractive forces that propagate opposite to the Bessel beam. These negative axial radiation forces counterbalanced against the positive axial force of the Bessel beam itself could potentially trap microparticles.

The project sought to develop a device that would utilize this principle to trap microparticles. Two devices were tested, both of which used the same principles to potentially trap microparticles. However, only one of them worked on a consistent basis. This device, the multi-focus annular ring array, was able to trap and manipulate multiple microparticles simultaneously.

Microparticle trapping and manipulation could potentially be used to expose individual cells to novel environments to study what the effects would be. In addition, this technology and device could also be used for construction on the micro-scale, of microtechnology devices and so on.

84
SAKAKIBARA, Yuuma
PHYSICS

THE EFFECT OF A CONSTANT VELOCITY ON NEWTON'S LAW OF UNIVERSAL GRAVITATION

The project Preformed was to further extend the Newton's Law of Universal Gravitation so it can be applied to more realistic applications. Only in ideal conditions will two objects have a constant distance in between them. The idea was to figure out and simplify an equation that incorporated the possible initial velocities of the two masses, and to have a varying radius. The distance between the two masses will not be constant throughout the experiment.

To gather the control data, two solid lead cylinders were placed on the ground. Above it, a string supported a beam that had two smaller lead cylinders attached to it. The beam was placed so that the masses were parallel to each other. The angle of movement was measured by a laser that was reflected by a mirror placed on the beam. This method resulted in the most accurate measurements possible.

The initial findings were inconclusive because the smaller mass was accelerating at a faster rate than anticipated. Later, Newton's Law of Motion was concluded to be the cause of this phenomena. To prevent this, a dampener of water was placed beneath the beam, so that an extension of the beam was submerged in the water. This removed any other forces acting on the smaller mass other than the gravitational force.

The resulting data ended up to be too inaccurate to be useful in creating the new equation. Therefore, a more mathematical approach was used by integrating the distance and velocity of the two objects.

ZOOLOGY

85
BAILEY, Katherine
ZOOLOGY

VIABILITY OF MOON JELLY PLANULAE USING CRYOPROTECTIVE AGENTS

Cryogenics is the intricate procedure of cell preservation resulting from the immersion in liquid nitrogen. Previous studies at utilizing cryopreservation at Cabrillo Marine Aquarium involved abalone, grunion gametes, sea urchins, and microalgae. The purpose of this experiment is to determine the viability of moon jelly planulae after exposure to three cryoprotective solutions: dimethylsulfoxide (DMSO); 5% methanol in Hank's solution; and 10% dimethyl acetamide in Hank's solution.

Cryoprotective agents are used to provide protection for the planulae cells against the harmful effects of cold temperatures. Conventional, single-agent cryoprotectants, such as DMSO, differ from mixtures of cryoprotectants in that the mixtures tend to be more effective and are commonly used for vitrification. Vitrification is the solidification of a cell without crystal ice formation and is very important for its preservation. The hypothesis proposed was that the moon jelly planulae exposed to the cryoprotectant mixture of 5% methanol in Hank's solution would show greater viability than those exposed to DMSO or 10% dimethylacetamide in Hank's solution.

The samples of moon jelly planulae were collected after a process of centrifusion and then exposed to each cryoprotective solution for the specified interval. They were then immersed in liquid nitrogen and thawed in succession with dry ice, 0 degree Celsius sea water, and 10 degree Celsius sea water. The planulae were counted and sorted on microscope slides to record ruptured cells.

The moon jelly planulae exposed to DMSO showed the lowest percentage of ruptured cell walls than those exposed to either mixture of 5% methanol and 10% dimethylacetamide in Hank's solution. In the final analysis, the hypothesis was not supported because the 5% methanol solution did not show the greatest viability of moon jelly

planulae. These findings are significant for the determination of a successful protocol in freezing planulae or other biological cells. As a result, the data from this experiment may be used to compare with the data of previous experiments and further studies.

86
BERMAN, Diana
ZOOLOGY

THE EFFECTS OF TEMPERATURE ON YOLK CONTENT IN ZEBRAFISH (*DANIO RERIO*) EMBRYOS

Zebrafish, or *Danio rerio*, are exotic fish from the Ganges River in India and are commonly sold in pet stores. In their natural environment, the fish live with temperatures around 80°F; however, in the stores, they are kept at temperatures much lower, around 65°F. Temperature has a huge effect on the rate at which the fish develop, and I wanted to see the effect of water temperature on the amount of yolk in the embryos at the time of hatching. In order to analyze the amount of yolk, I bred zebrafish pairs and photographed the embryos at different stages until the day they hatched. I was able to calculate the area of the yolk in the picture and compare the measurements taken from embryos at different temperatures.

The results showed that the embryos kept in the warmer water had less yolk at the time of hatching than the embryos in the cooler water. The yolk provides the embryos with the nutrients they need to develop properly, so the embryos in the cooler water may have developmental problems because of their inability to use their yolk. These findings could help to illuminate some of the issues of keeping exotic fish in the wrong environmental conditions.

87
CHEN, William
ZOOLOGY

AN ALTERNATIVE TO HARMFUL INSECTICIDES IN AN AGRICULTURAL ENVIRONMENT

Insecticides are agents of chemical origin which result in the death of insects. These chemicals are applied to crops in order to decimate the various agricultural pests which inhabit it. However, great environmental consequences follow with the usage of these insecticides. Neonicotinoids, a class of insecticide, have been the leading factor in the colony collapse disorder of the honeybees, who are major pollinators in agricultural environments. The purpose of this project is to determine whether there is a viable alternative to preventing crop failure in agricultural environments.

The main agricultural pests are the homopterans, consisting of species such as aphids, mealybugs, and scales. These "plant sucking insects" share a mutualism with the Argentine Ant, Linepithema humile, who are significant invasive pests in urban, agricultural, and natural environments. Argentine Ants guard the homopterans from their natural predators; in return the homopterans will excrete honeydew, which the ants can thrive upon. Since the lifespan of the homopterans is dependent on this mutualism, a more eco-friendly solution to an agricultural crisis would be to eliminate the Argentine ant. This would leave the homopterans completely vulnerable to their main predator, the ladybug, indirectly causing their extermination as well.

To simulate this, one fish tank was filled with strawberry crops infested with aphids. The aphids were given time to infest the strawberries, then the ants were introduced to a second tank, which was connected to the first tank by a tube. After the ants began to tend the aphids, ladybugs were added to the tank, to simulate the predator attempting to eat the aphids. Finally, the ants were baited with toxic bait.

The findings show that when the ant population declined, the ladybugs were able to devour the aphids, stopping the plants from experiencing any further declination in health.

88
CHOI, Moonui
ZOOLOGY

ENVIRONMENTAL FACTORS ON DROSOPHILAE MELANOGASTER

The goal of this project was to determine if environmental factors have any effect on Drosophilae Melanogaster, socially or physically. If successful, factors such as humidity and temperature will have an effect on the Drosophilae Melanogaster, which will show a response to the applied factors either or both physically and socially.

Specimens were placed into netted tanks. The several social and physical characteristics of the Drosophilae Melanogaster were observed and recorded prior to the application of environmental factors. Different factors such as humidity and light intensity were increased. Social and physical characteristics were again observed and recorded. Each trial lasted until the next generation of flies appeared.

The Drosophilae Melanogaster matured and reproduced much more quickly in higher temperatures as compared to lower temperatures. Drosophilae Melanogaster showed negative responses to increasing light intensities. The hypothesis was proved because the specimens showed very visible differences when placed under varying environmental factors such as heat and humidity.

The data showed that environmental factors did affect the Drosophliae Melanogaster physically and socially. Another study might study the possible relationship between genetics and these social and physical changes.

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KIMURA, Julian
ZOOLOGY

COPEPOD CULTURING: CONDITIONS FOR MAXIMUM YIELD PER GENERATION

Today, it is not possible to keep certain marine animals for research due to their specialized diet on micro-organisms known as copepods. This hardship is due to the copepod's unusually long period of sexual maturation (about one month). The reproductive rate of the copepods cannot keep up with the demand for food, forcing laboratories to keep multiple cultures. This project aims to eliminate the need for the excess cultures and maximize the productivity of copepod reproduction through the manipulations of culture conditions.

This study tested three variables of food, light, and water temperature. Each trial measured one variable at a time, and lasted four weeks. Cultures were five gallon buckets hooked up to an air stone for water circulation. Each culture started off with 100 gravid female copepods of the species Tigriopus Californicus. Every two weeks, water was agitated to keep copepods in even suspension, and three random 20ml samples were taken. Next, the average of the three samples were used to estimate the population.

Results showed that of the three types of algae paste used, Isochrysis yielded a net increase of 360% in the first trial and 150% in the second trial compared to the control. Temperature trials showed that copepods will not survive in temperatures above 75 degrees Fahrenheit, and a room temperature of about 69 degrees was ideal. Finally, the light trial did not have as dramatic an effect as the food trial, but a high light intensity of 75 watts did produce a slight overall increase in population.

The data shows that Tigriopus Californicus cultures produce the most individuals per generation when fed with Isochrysis algae paste, kept at a temperature of 69 degrees Fahrenheit, and kept under higher light intensities of 75 watts. With this data, a wider variety of marine animals such as non-photosynthetic corals would be able to be kept for both research and conservational reasons.

91
LEE, Annabel
ZOOLOGY

MAGNETIC EFFECTS OF JELLYFISH TISSUE REGENERATION

To analyze the advancing technology that is placed in the oceans and how they affect animals, this experiment set out to observe how different levels of magnetic fields affect jellyfish tissue regeneration. The initial idea was to explore the influence of electromagnetic fields, similar to power engines and record how it might benefit the jellyfish in tissue regeneration. In comparing three jellyfish placed in tanks with varied sources of strong magnets, the organism's tissue regenerated with high influence from the magnetic fields.

In the three trials that were conducted, the initial punch was made by a constructed CVC pipe for the first trial and rectangular plastic razor blades for the other two. Placed in significantly distant areas of the room, the control jelly grew without exposure to the magnetic fields, while the other two had fairly strong levels of four magnets and eight magnets. Regeneration rates were measured by uploading pictures of the jelly to measure the hole accurately via Image J.

In all three trials, the largest magnetic field caused the last jellyfish tissue to regenerate faster than the others in the beginning time after the initial punch. The three jellyfish holes closed up approximately around the same day, but the rate of regeneration was increased in the higher levels of magnetism.

As confirmed in the three trials, the jellyfish exposed to the larger magnetic field regenerated faster in the beginning, but leveled out and closed up with the rest of the jellyfish. The four magnet jelly also regenerated faster than the control jelly, but not as fast as the eight magnet influenced jellyfish, proving that new magnetic technology may affect animals as it does in jellyfish tissue regeneration.

92
PELL, Lauren
ZOOLOGY

THE EFFECTS OF BODY SIZE ON THE GENDERS OF RED ROCK SHRIMP

Red Rock Shrimp, specifically *Lysmata Californiensis,* are believed to be simultaneous protandric hermaphrodites, like other species of *Lysmata*. While scientists do know that age has an effect on what genders these shrimp can be, it is not known whether the shrimp's physical size in relation to its partner's size has any effect on their genders. So the experiment put one small gender neutral shrimp in a tank alone with a large gender neutral shrimp and observed their genders over time. The large shrimp were found to be female, then neutral, then transitional/female, and finally male, in descending order. The small shrimp were: neutral, female, male, and then transitional/female. (Refer to the pie charts for more detailed data.) This indicates that both genders show a preference toward being females; this makes sense considering that more females are necessary than males for rapid reproduction. The data also shows that the shrimp required less time to switch to male than they needed to become females, which also makes sense when one considers the increased amount of required energy that goes into the making of eggs verses sperm.

93
VAISH, Manu
ZOOLOGY

THE EFFECT OF THE RHOPALIA ON THE REGENERATION AND OVERALL HEALTH OF THE AURELIA AURITA

The purpose of my project is to determine whether the removal of the rhopalia of the Aurelia Aurita affects or even controls the organism's regeneration and overall health. The hypothesis of the project was that when a certain rhopalia was removed the jelly would cease to function properly.

In order to do this project, two adult medusas and six ephyra were obtained. Then using a pair of fine knives and a microscope an incision was made to reduce the amount of bell torn. The jellies were then kept in individual tanks and cylinders. All had daily feedings and fresh water flowing through. Once the jelly or ephyra regenerated one or two of its original rhopalia, the next two were cut out.

The results garnered from this experiment were that in all of the medusa jellies removal of the rhopalia resulted in either death or horrible regeneration. In all cases at least one of the rhopalia did not come back and the bell reformed all the way past the original point of cut. In most of the cases the rate of regeneration was the same showing that the effect of multiple cuts was very minimal. The ehphyra all died within the first cuts mostly; however, one ehphyra managed to survive and regenerate all of its rhopalia. Two times out of six the ehphyra lost the arms that the rhopalia were removed from.

The conclusions drawn from this project are that removing a rhopalia definitely affects the organism. Whether there is one rhopalia or multiple rhopalia controlling the rhopalia is still up for question; however, in the end the rhopalia truly has a massive impact on the organism from ehphyra to medusa stages.