2013 ABSTRACTS – PALOS VERDES PENINSULA USD SCIENCE & ENGINEERING FAIR – MARCH 2013

BEHAVIORAL & SOCIAL SCIENCES

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Amini, Maziar
Behavioral Science

The Effects of Long Term Exposure of Color on Test Results

Many teachers use different test colors in order to differentiate tests from one another. This experiment tests to see if the long term exposure of the test colors have a significant effect on students test scores, and if students who take a test on a certain color have a statistically significant disadvantage in comparison to the other colors.

An AP Psychology class at Palos Verdes Peninsula High School was given 3 math tests, each roughly of the same difficulty. Each test was printed in a different color – red, blue, and green respectfully. Students were given 2 minutes per test. After all the tests had been completed, the tests were collected and the results were analyzed by computing a test of significance for a chi-squared test and finding the relevant p-values to see whether the results were statistically significant.

The null hypothesis for the experiment was that all 3 tests would have roughly equal results and that there would be no difference between the colors. After calculating the results, however, it was found that the p-value of the chi-squared test was less than the predefined level of alpha (0.05). The results were therefore found to be statistically significant, and the null hypothesis was rejected. There was enough evidence to conclude that there was a significant difference between the test scores. After further analysis, it was found that the red tests showed the largest deviation from the other two tests, and had the largest disadvantage.

The final results showed that there is enough evidence to conclude that there was a significant difference between the test colors and that the red tests had the largest disadvantage.

3

Ekanayake, Ru
Behavioral and Social Sciences

Determining Correlations between Indicative Dominant Sense and Comprehension Aptitudes

The purpose of the study was to conclude whether people's "dominant" sense can be determined through tests pitting several frequently-used senses against each other. The study also determined whether this "dominant" sense has any correlation to the person's comprehension aptitude, better known as "learning style".

To determine the subject's dominant sense, the visual, auditory and tactile influences on their perception were tested. Students from Palos Verdes Peninsula High School were given visual-vs.-tactile, tactile-vs.-auditory, and visual-vs.-auditory tests to determine which sense extended the greatest influence over their perception. Comprehension aptitude was determined by three procedures. They utilized visual, tactile, and auditory cues. The test the subject performed the best on was dubbed their comprehension aptitude.

The data collected showed that 100% of subjects showed a clear inclination towards a particular sense as their dominant sense. In the comprehension aptitude test, 75% of subjects displayed an inclination towards a particular sense as their most favored learning cues. 67% of subjects' first comprehension aptitude directly correlated to their first dominant sense. 58% of subjects' first dominant sense directly correlated to their primary comprehension aptitude. However, 25% of subjects' second dominant sense corresponded with their primary comprehension aptitude.

The results displayed that humans do tend to favor one sense which provides the most input for their perception. It also supported the hypothesis for the most part: most of the subjects had direct correspondence between their dominant sense and comprehension aptitude. However, a significant percentage had correlations between their second dominant sense and primary comprehension aptitude. These results provide important knowledge about the senses as well as valuable information for educators to better instruct their students.

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Kim, Sarah
Behavioral and Social Sciences
2013

The Proustian Experience: The Effect of Taste on Memory

The purpose of this experiment was to determine if taste sensations could help recall memories more accurately. The hypothesis is that there is a correlation between taste and memory in which taste strengthens the memory. Of the five main taste sensations, the assumption is that the sour and bitter flavors will increase the ability to recall memories better than the other sensations due to their distinctive tastes.

To begin experimentation, 54 students from Peninsula High School were gathered to be volunteers. Each volunteer and his or her parents were required to sign a consent form to allow him or her to participate. Next, Trial #1 began with the subjects studying an original painting for one minute. After 48 hours, the subjects were given a memory quiz based off of the first painting. Trial #2 began after a few weeks. The students were asked to draw a slip of paper from a bag that had what their taste sensation would be on it. Students with saltiness were given 5 potato chips, those with sweetness were given 5 chocolate chips, those with umami were given half a piece of cheese, those with sourness were given 1 Warheads candy, and finally, those with bitterness were given a small cup of decaffeinated black coffee. Once they have received their substances, they studied a second original painting for one minute while eating or drinking their food or coffee. After 48 hours, they were given the same food or drink and took a new memory test based off of the second painting and were instructed to eat their food or drink while taking the test. The time limit for both tests in Trial #1 and Trial #2 was 3 minutes.

Changes in scores were compared and analyzed using a test of significance. Trial #2 scores were found to be better than Trial #1 scores. The hypothesis was proven correct since the P-value of 0.0001 was less than alpha at 0.01. Five other tests of significances were carried out, one for each taste sensation, to determine which flavor improved memory the most. In order from which helped the most to the least, the tests resulted with this order: sweetness, umami, sourness, saltiness, and bitterness.

Using the matched pairs t-test test of significance to analyze the data, the null hypothesis was rejected, thus making the experiment successful in proving that taste helps improve memory. If this experiment is done again, it would be beneficial to increase the sample size so that there are more people within each taste sensation group. This would make the data more accurate when deciding which flavor helps improve memory recall skills the most.

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Lee, June
Behavior and Social Studies
2012/2013

Memory Conformity on People Involved in the Event.

The objective of this project was to analyze memory conformity in teenagers, both male and female. The main purpose of this experimentation was to determine whether more people were likely to conform to false claims than not, even if they were involved in the event.

In order to test this, twenty teenagers from Palos Verdes Peninsula High were needed. Four other teenagers were also needed to help to try and get the volunteers to conform to false claims. The volunteers were told to shoot balls into a hoop. After, they were engaged in a conversation with the four teenagers trying to get the volunteers to conform to false claims for five minutes. They were asked questions and the amount of questions that were conformed to was recorded. The results were anonymous. After, the percentage of questions conformed to was found.

The data collected showed that 42% of the questions were conformed to while 58% of the questions were not conformed to. Therefore, if people are involved in the event, people are less likely to conform to false claims than not.

The results show that people are less likely to conform to false claims than not if they are in an event, even though Asch found that people are more likely to conform than not. This means that the fact that people are involved in the event changes whether people conform or not.

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Murty, Nikhil
Behavioral and Social Sciences
2012/201
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Correlation of Hand-Eye Coordination and Memory

The objective of this project was to test and learn if increasing hand-eye coordination also caused and increase in memory. Research done before shows that aerobic exercises like walking doesn't cause cognitive response, but this is testing if increasing hand-eye coordination causes cognitive response.

The parietal cortex controls hand-eye coordination and the temporal lobe controls memory. This could help people because increasing memory could help everyone from students to adults. Tennis is a known sport to increase hand-eye coordination because people have to look at the ball and then hit it in a matter of seconds.

Two articles from the New York Times, a tennis court, tennis equipment (racket and balls), pencils, and the tests based off of the article were used for experimentation. This project was tested by making eight 9th grade students (4 boys and 4 girls) read an article, either play tennis or sit around for 1 hour, then come back and take a test on the article they had read.

The results showed that people who played tennis scored an average of 55% on their tests and people who didn't play tennis scored an average of 47.5%. The people who played tennis had their memory increase by 7.5%. These results proved the hypothesis true. This knowledge helps people because know they can play sports (increasing their fitness) and improve their memory. This also proves that there is a link between the parietal cortex and temporal lobe.

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Park, Robin
Behavioral Sciences

Discrimination in Ants: Effects of Population Size on Interspecific Aggression in *L. humile* and *P. impairs*

Like any social animals, ants practice nestmates discrimination. Cuticular hydrocarbons (CHCs), derived genetically and environmentally, provide the main chemical cues used for discrimination between nestmates and intruders; aggressive behavior will manifest if the ant feels threatened. Previously, it was demonstrated that habitat plays a key role in the level of aggression between *Linepithema humile*, the Argentine ant, and *Prenolepis imparis*, the winter honey ant. In this research, the effect of population size on aggressive behavior was tested. Unequal numbers of ants were injected into the environment: 20 *L. humile* and 5 *P. imparis*. In the control experiment, the food was scattered throughout the entire container and the ants were placed at random. There was no evident case of aggression, but intentional avoidance by the smaller, *P. imparis* population. While the *L. humile* ate, the *P. imparis* traveled up to the ceilings of the container, only coming back down to touch the food and ascend again. In the first experiment, *L. humile* were placed in a separate, food-filled container that was placed into the bigger habitat, while *P. imparis* were placed at random away from the food. Every time an *L. humile* ant would venture into the *P. imparis* territory, the *P. imparis* would target the small ant. Over a period of four hours, however, aggressive behavior diminished overall. Results support that in a situation in which a larger group of *L. humile* and a smaller group of *P. imparis* are made to cohabitate, initial hostilities will lead to peaceful cohabitation.

9

Kristi Sakai
Behavioral and Social Sciences

The Correlation Between Third Molars (Wisdom Teeth) and Dizygotics and Monozygotics (Fraternal and Identical Twins) and Non-Twins

The objectives of this project are to determine whether or not twins, who have the same genetic make up, share the same number of wisdom teeth, extra teeth that humans develop; whether or not the number of wisdom teeth in families with strictly two offspring is hereditary; and whether or not wisdom teeth will no longer be a part of the human body system. The hypothesis is as follows: though siblings do not necessarily share the same number of wisdom teeth, twins -- identical or fraternal -- do.

This experiment requires large sample sizes in order to ensure accuracy. Thus, it requires data from both 100 sets of twin-bearing families and 100 sets of non-twin-bearing families.

The data collected showed that out of 100 sets of twins, both fraternal and identical, sixty-nine pairs of twins shared four wisdom teeth and twenty-four pairs of twins shared zero wisdom teeth. Therefore, ninety-three pairs of twins shared the same number of wisdom teeth. From the 100 sets families with two children, fifty-eight siblings shared four wisdom teeth and twelve shared zero wisdom teeth. Therefore, seventy pairs of siblings shared the same number of wisdom teeth.

Ultimately, both the hypotheses were proven correct in which twins most likely share the same number of wisdom teeth and non-twins only have the same number of wisdom teeth 70% of the time. However, the question of whether or not wisdom teeth will no longer be a part of the human body is inconclusive because most siblings have wisdom teeth and the number is not faltering from generation to generation.

10

Shim, Kaitlyn
Behavioral & Social Sciences

Conformity on Adolescence

The objective of this experiment is to test and analyze the ability of 15-18 year old adolescents to resist the social norm and not conform to their peers. The main purpose of this project was to see if 15-18 year old teenagers would conform to the pressure given by their peers or choose to oppose the norms of society, universally understood laws that dictate how people behave and how people are expected to act.

In this test, 20-30 fifteen to eighteen year old adolescents in AP Psychology classes from Palos Verdes Peninsula High School were given a simple perception test. The tests for this experiment were anonymous. They were lead to believe that they were being tested on their perception abilities, when in reality their conformity resistance was being experimented on. Three-quarters of the room was given instructions to influence the other quarter of the room with the wrong answer. The influencers took the perception test, but their results were not being evaluated. This ensured that no suspicion from the actual participants would arise. From this peer-pressure, the teenagers were predicted to give in and chose the incorrect answer choice, despite the easiness and simplicity of the test.

The control group had an average of 1.60 questions missed and 12.97 questions correct out of 15 total questions. The experimental group had an average of 2.30 questions missed and 12.70 questions correct.

These results show that fifteen to eighteen year old adolescents do not conform to their peers when given a simple subject test. The subjects were not influenced by the answer choices given by the influencers and were individuals in their own choices no matter what their equals thought.

BIOCHEMISTRY

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BANARJEE, Somdeb
BIOCHEMISTRY
2013

CAN P. FLUORESCENSX BE USED TO REDUCE NITRATE CONCENTRATION IN MARSH WATER

The nitrate concentration of the water in the Madrona Marsh Preserve has been a contributing factor to the occasional late season blooms of *Spirogyra* algae and *Azolla* water fern. Because current methods of denitrification either require long periods of time or have the potential to unbalance the natural nitrogen cycle, this project was developed to see if a naturally occurring bacteria, *Pseudomonas fluorescens*, can be used to reduce nitrate concentration in marsh water.

The study began by determining the natural levels of Pseudomonas bacteria in the water and in Carolina Biological *Pseudomonas fluorescens* 10 mL broth in conjunction with BioScreen Labs through membrane filtration. Using the results as a baseline, a test was setup in which five differing dilutions of the broth were added to the marsh water. The solutions were then sent to Associated Labs which then determined the nitrate concentration through ion chromatography.

The changes to the original level of nitrate in the water, 23.4 mg/L, were monitored when solutions of 10, 20, 40, 80, 160 times the naturally occurring levels of *Pseudomonas fluorescens* were added. When adjusted for the dilutions with distilled water, the 40x, 80x, and 160x levels of bacteria reduced the nitrate concentration with increasing success.

In conclusion, my hypothesis was supported because *Pseudomonas fluorescens* bacteria did reduce nitrate concentration in marsh water.

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DOKKO, Rachel
Biochemistry
2013

EXPRESSION AND IDENTIFICATION OF GNS: A POTENTIAL ERT DRUG FOR SANFILIPPO SYNDROME D

Mucopolysaccharidosis IIID (MPS IIID or Sanfilippo syndrome D) is a genetic lysosomal storage disorder caused by an absent lysosomal enzyme, N-acetyl-glucosamine-6-sulfatase (GNS), which breaks down long sugar chains called glycosaminoglycans (GAGs). The accumulation of these GAGs in the body may cause severe cognitive impairment and skeletal deformity. There is currently no cure for MPS IIID, but an enzyme replacement therapy (ERT) treatment may be one of the potential treatments that may attenuate symptoms for MPS IIID patients.

In order to obtain enough enzyme for the ERT, the human *GNS* gene was transfected into Chinese hamster ovary (CHO) cell lines, and the protein was purified from the culture medium. A sulfatase activity assay was used to isolate the highest expressing clones out of 58 original clones, after which, the GNS activity assay was run to confirm the expression of these clones. After the highest expressers were isolated, they were re-cultured and their activities were monitored over two weeks. Then two cell lines of MPS IIID deficient fibroblasts were incubated with the rhGNS CHO cell culture medium and tested for GNS uptake.

Nine clones showed the highest sulfatase activity, and when monitored over two weeks, their activities all increased. After the screening with the GNS assay, however, these clones showed minimal GNS activity, suggesting that another CHO cell line needs to be transfected with the human *GNS* gene to acquire greater expression of the enzyme.

Because optimization of the GNS assay and confirmation of a functioning GNS protein were achieved, in the future, the GNS produced by the transfected CHO cells may be used in ERT to treat patients with Sanfilippo Syndrome D.

13

HUANG, CHRISTINA
BIOCHEMISTRY
YEAR 2

Formulating a Novel Hyaluronic Acid and Fibrin Hydrogel for Use as a 3D Scaffold for Neural Stem Cells

Before stem cells can be applied in disease-curing therapies, it is necessary to address issues such as culturing cells *in vitro*. To resolve this issue, properties of a newly formulated three-dimensional hydrogel were determined.

The final gel used in the majority of the experiment was a combined fibrin and hyaluronic acid gel with concentrations established through preliminary testing. Two forms of the gel, one with crosslinked hyaluronic acid, and the other without, were used and contrasted with a commonly used fibrin gel. Cell proliferation within the gel was measured with the Click-It EdU Cell Proliferation Assay. To determine reasons behind results of the mentioned test, the polymerization rate was measured using absorbance readings from a spectrophotometer, and the gel's stiffness was estimated using a piezoelectric probe.

Cell proliferation was measured in these gels, and after a one-hour period, the combination gel had a 7% higher proliferation rate than the fibrin gel, supporting the hypothesis that the combination gel would promote proliferation. Absorbance rates of these gels revealed the combination gel with crosslinked hyaluronic acid to have the highest absorbance and density, followed by the second combination gel, and then the fibrin. Rheology stiffness tests proved that the combination gels were firmer than the fibrin gels.

The combination gel's increased proliferation rates and stiffness create an environment neural stem cells thrive in. This result and the flexibility of neural stem cells suggest the feasibility of *in vivo* application of these gels in therapies to mend cortical deficiencies and heal an overabundance of prominent neural diseases.

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NASRALLAH, Leane
BIOCHEMISTRY
2013

EFFECTS OF INDUCED DIABETES ON DEVELOPMENT AND MIOX EXPRESSION IN FRUIT FLIES

The objective of this project was to analyze the developmental patterns and MIOX expression of developing embryos of *Drosophila melanogaster* when induced with diabetes. MIOX (myo-Inositol oxygenase) is related to an isomer of inositol that is used in insulin regulation, and a deficiency of this isomer has been linked to Type 2 Diabetes.

In order to examine MIOX expression, in situs were preformed in order to analyze the protein content in the developing embryos. Development of flies when induced with diabetes was also monitored by recording the number of eggs laid, then the number of those eggs that hatched after 24 hours. A control group of flies not induced with diabetes was also monitored. Growth of flies induced with diabetes (and flies not induced with diabetes) was observed by placing a specific number of flies in a controlled environment and recording the number of deaths each day for 10 consecutive days.

After pooling data from 3 separate trials, there was no evidence that the flies had been induced with diabetes. The in situs performed did not show a consistent pattern in protein expression.

Preliminary data show that flies grown under an increased sucrose concentration showed substantial developmental delay. This developmental delay might be due to the disruption of insulin-like proteins (Dilps) that are involved in growth and metabolic homeostasis.

BOTANY

16

Christman, Alyson,
Botany
2013

Comparing Plant Growth Rate and the Viability of Mass Aquaponics Use in the Future

With a rapidly growing population and diminishing resources, efficiency is becoming increasingly important in all aspects of life. Traditional soil methods of farming are incredibly wasteful, and it is vital that we find new methods of food production. On top of that, famine in third world countries is a topic of major concern and it is essential that we explore methods of feeding masses of impoverished people. By building an aquaponics system, plant growth rate in an aquaponics system can be compared to plants grown in soil, and an educational deduction may be inferred about the viability of aquaponics becoming a future main source of food for our planet.

17

CHOI, Julian
Botany

The Effects of Trimethylxanthine on Transpiration Rates of Nasturtium Plants

Transpiration is vital for a plant to access carbon dioxide (CO_2) for photosynthesis and to cool itself. In addition, plant transpiration provides humans and other oxygen-breathing animals with a clean source. For every ton of healthy plant mass that transpires, about 1.07 tons of O_2 is supplied and 1.47 tons of CO_2 is removed from the atmosphere. Previous studies have suggested that trimethylxanthine, more commonly known as caffeine, stimulates the central nervous system by increasing energy metabolism in humans. Plants are essential organisms to the earth's ecosystems and much importance has been placed on maintaining their health, especially as forests and other woody environments are destroyed for the development of urban cities.

Trimethylxanthine was tested on Nasturtium plants in differing amounts to determine its effects on the transpiration rates of the plants. Fifteen plants were divided into four groups of three and each group of plants was watered with a different amount of trimethylxanthine. The first group was watered with 0 grams, the second with 0.10 grams, the third with 0.50 grams and the last with 1.00 grams of trimethylxanthine. Plastic, which was weighed in advance, was placed over the stem and leaves of each plant and secured to the bottom of the stem before they were watered. After watering them, a period of 24 hours was given for transpiration to occur. After the wait period was over, the plastic was removed, and weighted. The difference in mass indicated the amount of H_2O that transpired from the plant.

Initially, I made the hypothesis that the plants watered with a moderate amount of trimethylxanthine (0.50 grams) would transpire the most and the plants watered with 0 grams of trimethylxanthine would transpire less since trimethylxanthine has been shown to increase energy metabolism. However the results of this study show that any amount of trimethylxanthine added to the plant's system has negative effects on the rate of transpiration.

It was found that the more trimethylxanthine was added to a plant's source of nutrition (the soil), the less transpiration occurred. Trimethylxanthine also seemed to play a role in plant structure; Nasturtium watered with trimethylxanthine withered and were unable to support themselves. The leaves of Nasturtium watered with trimethylxanthine yellowed as well.

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Ellison, Eric
Botany
2013

Biomass Sequestration

The objective of this project was to determine a direct coloration between the volumes and total dry weights of *Eriogonum cenereum* individuals. The main purpose of this study is to determine whether or not the hypothesis "If various sizes and proportions of scrub individuals are collected and weighed, then biomass totals will reflect a direct relationship with characteristic sizes," was accurate and if humans may influence or utilize these numbers.

Twenty individuals' heights, circumferences, diameters, aspects, locations, GPS coordinates, and gross weights were measured prior to the removal of the most representative percentage of each scrub. The samples were then separated into three bags labeled "flowers," "leaves," and "wood" based on the tissue type and were then baked at UCLA to yield a total dry weight for each plant.

When data was placed into a Microsoft Excel spread sheet, plant number 7 displayed a total dry weight of 693 grams, a corresponding height of 0.850 meters, and two perpendicular diameters of 1.97 and 1.60 meters. The largest dimensions of the sampled hectare, some of them belonging to plant 7, did in fact correspond with the larger than average total dry weights and vice versa for smaller individuals.

The hypothesis that size and form would relate directly to amounts of biomass was supported and suggests that larger sage scrubs should be planted in greater numbers and may thus provide the Palos Verdes community and habitat with many geochemical benefits.

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JUNG, Seung Hea
Botany
2012-2013

Effects of Oxygen Flow and Phosphate Reducer on the Necrosis of Cladophora Algae

The uncontrollable growth of algae has been recently emerging as a major problem at the Madrona Marsh Preserve. Last year, to solve this problem, I used a combination of Copper sulfate and Citric Acid to precipitate Phosphate ions, the cause of algal growth. However, use of heavy metal Copper on the environment may cause other problems that can harm aquatic life at the marsh (Pagenkopf). Therefore, I sought more harmless and non-chemical way to control the algae.

First, the pretest is done. 2 L of obtained water and 5 g of algae are put into each of the 4 containers. 0.106 mL, 0.53 mL, and 1.06 mL of Phosphate reducer and each oxygen tube (8.4 ppm, 8.5 ppm, 8.6 ppm Oxygen) are put into containers 1,2, and 3 respectively. Phosphate level is tested regularly using the low range Phosphate test kit, and Oxygen level using the Oxygen level test kit. Observations of the necrotic tissues of algae are made regularly to observe change in color, texture, etc. According to the results, base line for the main test is made for possible PhosphateMinus level and Oxygen flow level.

The main experiment is done using the base line from the pretest. More dynamic differences in the amount of PhosphateMinus in containers 1,2, and 3 and the rate of Oxygen flow of containers 1,2, and 3 are tested. Same observations and tests are done as they were done for the pretest.

This experiment demonstrated that if too much of the PhosphateMinus is put in, it passes the supersaturated point and creates precipitate around the algae, consequently preventing the algae from necrosis. Therefore, I concluded that 0.53 mL of PhosphateMinus is the most suited amount of put in to control the algae.

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LEE, AMANDA
BOTANY
2013

Effects of Different Concentrations of a Nitrogen Based Fertilizer on Aquatic Aquarium Plants

This project represents the effects of different concentrations of fertilizer on Amazon Sword Plants (Echinodorus Amazonicus). The results will help educate people on the negative effects fertilizer runoff has on aquatic plants. According to other scientists, the higher the concentration, the more negative effects it has. The health of the plant will deteriorate faster as the concentration increases.

A ten gallon tank was used with nine gallons filled. A 15-watt light was on for twelve hours a day. The plants were measured in inches and weighed in grams every Sunday and Thursday for three weeks. The following fertilizer amount was placed in each tank: one tablespoon for 6%, one half tablespoon for 4%, and one fourth tablespoon for 2%. The experiment was tested in four trial with one being the control with no fertilizer. All conditions stayed the same except for the concentrations of fertilizer.

The plants in the 6% concentration portrayed the most negative effects. The Amazon Sword Plants immediately stopped growing by the first measurement. The 4% stopped growing too, but at a slower rate than the 6%. The 2% mostly maintained the same length and weight.

From what is known, the higher the concentration, the more negative effects it causes. The hypothesis is supported by the results. It would be informative to repeat the experiment with different plants.

CHEMISTRY

26

Celeen Hu
Biochemistry
2013

Sucrose to Glucose Conversion Rates

This project concerns the digestion of sugar. Sugar is not directly absorbed by the digestive system. It must first be converted into glucose and fructose. This conversion of sugar often alters the amount of sugar actually absorbed into the body. The purpose of this experiment was to determine the rate of which sugar was converted and if it was able to apply the conversion rate to other foods. Thus, we can find if the amount of sugar initially consumed effects how much sugar we digest.

The enzyme invertase was used to convert the table sugar to fructose. A graph was used to determine the rate of the sucrose conversion to time. The rate of the conversion from start to finish formed a mostly linear line until the conversion rate slowed down to an insignificant amount. The midpoint of that line was obtained, and the time of which it occurred was used to test other foods.

The results that occurred did not follow that of the hypothesis. The rate of conversion did not follow the same pattern, as the foods tested did not have the same slope.

In conclusion, the experiment did not support the hypothesis that sucrose is converted at a steady and constant rate. This seems to be caused by difference in the initial concentration of glucose. Ultimately, the altered amount of sugar absorbed into the body still depends on how much sugar initially consumed.

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IRAWAN, Isabel
CHEMISTRY
2013

The Effectiveness of Washing Rice on Arsenic Levels

Rice has recently been found to contain an unhealthy, elevated level of arsenic. This project strived to determine whether rinsing rice would decrease the level of arsenic.

The project involved rinsing rice with tap water. Afterwards, the water used to rinse the water was tested for arsenic. The water was tested using a Quick Rapid Arsenic test kit. The inorganic arsenic compounds in the water sample were converted to arsine gas by the reaction of zinc dust and tartaric acid. To accelerate the reaction, ferrous and nickel salts were added. The arsine converted the mercuric bromide on the test strip to mixed mercury halogens that appear with a color change from white to yellow. To oxidize the hydrogen sulfide to sulfate, potassium peroxymonosulfate was added.

The levels of arsenic after each rinsing decreased by .1 mg/L. After the fourth rinsing, the level decreased by .02 mg/L. After the fifth rinsing, the level decreased by .01 mg/L. These results were repeated for three rounds.

The experiment indicates that the hypothesis was correct. Rinsing rice with tap water decreases the level of arsenic.

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LIN, Jenna
Chemistry
2013

Heating Foods with Plastic Wrap can Leach Dangerous Chemical DEHA

The project tests whether heating plastic wrap can cause a harmful chemical, diethylhydroxylamine (DEHA), to leach out into water or foods. DEHA is a teratogen that can cause reproductive health issues as well as cause potential endocrine effects. By discovering if DEHA can travel from plastic wrap to the foods humans heat in the microwave, people can avoid health issues that may arise from ingesting the harmful chemical.

Three brands of plastic wrap were compiled, Kirkland, Glad, and Safeway, and each were wrapped around one cup of water to be heated in the microwave for two minutes. Three trials were performed for each brand, and the plastic wrap was placed in such a way that the top surface area of the water was covered completely by the plastic. After heating, the system was allowed to cool until it reached around $20^{O}C$ to be tested using a CHEMets testing kit.

Findings from the experiment data demonstrated that no DEHA had leached from the plastic wraps to the water for any of the brands. Thus, the hypothesis was not supported by the data collected.

Due to the testing of these brands to see if any dangerous chemicals had leached into its surroundings, it can be concluded that plastic wrap can be safely heated in the microwave with food without worrying that the harmful chemical, DEHA, will leach into the food or liquid. No DEHA will travel from plastic wrap to food or water when heated.

30

Park, Sung Jae
Chemistry
2013

COMPARING HYDROGEN PRODUCTION OF C. RENHARDTII BETWEEN COPPER AND NICKEL

This project is designed to compare the hydrogen production of Chlamydomanas Reinhardtii, a type of algae between one with copper ions and another with nickel ions.

5 stations of algae are set up by concentrations of copper and nickel ions. They were 0.8ppm and 1.6ppm copper and nickel ions, and the remaining one becomes the control station, not containing any copper or metal ions. Copper ions were added by solution of copper sulfate pentahydrate, and nickel ions were added by solution of nickel sulfate hexahydrate. Before the metal ion solutions were added, the algae is grown for 3 days. After metal ions are added, water displacement is used to measure hydrogen production of each station. Then the water level difference is measured as the production of hydrogen gas and hydrogen is identified by flame.

The data showed that from 0.8ppm copper ions, 13.1 mL of hydrogen is produced, from 1.6ppm copper ions, 20.3 mL of hydrogen is produced, and from nickel ions and control, no hydrogen was identified. Therefore, nickel ions did not lead to production of hydrogen.

The hypothesis states that algae with nickel ions will produce as much hydrogen gas as one with copper; however, algae with nickel ions did not produce any hydrogen gas, which does not support the hypothesis. Next time, different metal ions can be substituted to see which ions can lead hydrogen production of algae.

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RAMAYYA, Shreya
CHEMISTRY
2013

Increasing the Bioefficacy of Artemisinin through Trifluoromethylation

The application of fluorine in pharmaceuticals has been widely recognized. Due to its structural similarity to hydrogen and high electronegativity, fluorine has been extensively employed to modulate such biological properties of drug molecules as acidity, basicity, protein binding affinity, and lipophilicity. There is an urgent need for capable protocols to efficiently incorporate fluorine into complex organic molecules. This study has specifically focused building the process to trifluoromethylate artemisinin to increase its bioefficacy and make the currently available drugs for malaria even more potent and cost effective.

$TMSCF_3$, the Ruppert- Prakash reagent, has become very popular for nucleophilic trifluoromethylation of carbonyl compounds. Before attempting trifluoromethylation of a complex molecule like artemisinin, aldehydes, esters, and ketones were used as substrates to devise a possible reaction mechanism for the process. The reactions required a simple catalyst, such as potassium carbonate to achieve the maximum yield.

Using NMR (Nuclear Magnetic Resonance) analysis, the results show that the trifluoromethylation of the substrates produced high yields of the desired products with the Ruppert- Prakash reagent. With yields of products ranging from 65-95%, the method of trifluoromethylation proved successful.

The results of this study suggest that it is possible to include fluorine and the trifluoromethyl group into substrates with structures similar to that of artemisinin by using the Ruppert- Prakash reagent. Therefore, it is possible that trifluoromethylation may increase the bioefficacy of artemisinin to treat a variety of diseases, including malaria and cancer, in the future.

COMPUTER SCIENCE

32

Tambe, Arjun
Computer Science

Improving Security By Modifying the Allocation of Security Resources

Security is a nearly ubiquitous concern; a wide range of locations including tourist sites, natural reserves, and airports, require protection from crimes like theft, terrorism, or smuggling. However, since security resources may be limited, it is necessary to make the distribution of those resources more efficient. Any fixed strategy for resource allocation is predictable and easily exploited by criminals, so strategy based on randomness offers the most security. Since different targets are of different value, it would be unwise to protect each target evenly. Game theory allows us to find the stochastic strategy that optimizes resource allocation. Most previous game-theoretic algorithms that generate stochastic strategies have assumed perfect rationality among human adversaries. More recently, a few algorithms have been developed that account for the imperfect decision-making capacities of humans. This study attempts to modify one of the two most effective algorithms, named MATCH, to improve its effectiveness. To model the security domain, subjects took the role of the criminal in an online game in which they played against a security force whose strategy was determined by either MATCH or the new algorithm. While the new algorithm outperformed MATCH in only one case, this study contributes some interesting findings about adversary strategy selection that will inform the creation of new algorithms in the future.

33

Wathugala, Samantha
Computer Science

SINGING IN SINUSOIDS: ANALYZING QUALITIES OF SINGING USING FOURIER TRANSFORMS

Speech recognition, a well-researched field, takes the music out of the voice. Thus, computers cannot understand vocal music apart from its similarities to speech. Being able to use signal processing to recognize purely musical elements of the voice would advance singing research by making its studies more rigorous and objective.

Therefore, this study aimed to relate resonance area (head/chest voice), tone (vibrato/straight), breath support (strong/weak), timbre, gender, and voice part (soprano, alto, etc.) to the sound waves vocal music causes. To this end, seven choral singers of both genders, four parts, and various timbres each sang eighteen one-second “Eeee”s into a microphone, varying their resonance, tone, breath support, and pitch as directed.

The recordings’ Fast Fourier Transforms (FFTs) made several trends apparent. Vibrato had consistently wider peaks than straight tone, an understandable result as vibrato by definition alternates between pitches near the intended pitch. Weakly supported notes tended to show a lesser amplitude difference between intended (harmonic) frequencies and unintended frequencies. Chest voice clearly differed from head voice by employing its harmonics more evenly, using more higher-order secondary frequencies. Due to the small number of singers, the effects of other variables could not be attributed specifically to one trait or another.

Using these relationships, computers could conceivably be programmed to identify and compare amounts of vibrato, head voice, and breath support in vocal music. Future study would include analyzing phase changes and using more singers to reach conclusions on the quantitative effects of timbre, gender, and preferred range.

34

HA, Chris
COMPUTER SCIENCE
2013

THE ANALYZATION OF THE EXECUTION OF THE JAVA-BASED SOURCE CODE

This project was initiated in hopes for helping beginner computer programmers to understand the process of java-based program's execution and the role of individual lines in the source code. The project would produce a program analyzer, which would assist a novice programmer to comprehend the purpose and the program's execution.

The project was created using a java program compiler and a feeding program, which was a simple java source code generated by the programmer. Then, the program analyzer, the actual java code used to run the fed program, would take the fed program as an input, analyze the fed program line by line, and print its outcome in a .txt file.

The program analyzer, after processing a sample feeder program, produced a .txt file that was written in comprehensible English, and displayed to the reader the complete analysis of the input java source code.

The program analyzer allowed the 3rd person reader to understand the execution of the input program, allowing him or her to understand the basic rules, grammar, and syntax of Java source code. Also, the program analyzer would allow the program beginners to solve basic errors in their source codes to assist their debugging process.

EARTH & SPACE SCIENCE

35

Hu, Richard
Environmental Science

Efficiency of Chicken Wire in Preventing Audubon Cottontail Rabbit Herbivory of Deerweed

The Palos Verdes Blue Butterfly, *Glaucopsyche lygdamus palosverdesensis,* is one of the rarest, if not the rarest, species of butterfly in the world. The Palos Verdes Blue is a highly endangered species, and thus, numerous habitat restoration efforts have been taken to create native habitat suitable for the butterflies to inhabit. One of the key components of a such a habitat is a host plant for the butterflies. The butterfly is very selective, and will only use two specific plants as host plants: deerweed, *Acmispon glaber*, and milk vetch, *Astralagus trichopodus*. Because of this highly specific demand for host plants, it is key that the host plants for the butterfly stay healthy and retain a sufficient population for the butterflies' reproduction. The Audubon cottontail rabbit, *Sylvilagus audubonii*, is a persistent problem for the newly transplanted deerweed plants, since the cottontail rabbits frequently eat the young plants before they have an ample opportunity to establish themselves.

The conducted research aims to assess the efficiency of keeping these Audubon cottontail rabbits from herbivorizing restored deerweed plants. A field study was conducted, with data collected from 20 plants fenced in with chicken wire, and 20 plants without. Cylindrical canopy volume was measured weekly, standard deviation was calculated, and the data was run through a Mann-Whitney Rank Sum Test.

The results drawn from the conclusion indicate that the chicken wire is a highly inefficient method of plant protection, as well as that the cottontail rabbit is not the only species responsible for herbivory of deerweed.

Knowing this, restoration efforts can focus on more efficient methods of restoring Palos Verdes Blue habitat. The tremendous amount of funding and effort that goes into the raising of deerweed plants in nurseries can be put to a greater efficiency, knowing that the traditional chicken wire fencing is highly inefficient. This knowledge should make habitat creation a cheaper and less labor-demanding project, allowing for more butterfly habitat to be created with less waste.

36

KURUPPU, Praveen
Earth and Space Science
2012/2013

THE CONTROL OF INVASIVE PLANTS AT THE MADRONA MARSH

The purpose of this experiment is to ascertain if Concern, a pre-emergent, in granular form can control invasive plants. Additionally, we wanted to ensure native buckwheat (Polygonaceae), Dune Lupine (Lupinus Chamissonis) and Deer Vetch (Lotus Scoparius) would continue to grow with the pre-emergent being applied.

The procedure for this experiment started out with four 12'X12' plots of land containing four buckwheats approximately 2' in diameter, two dune lupine approximately 1.25" in diameter, and two deer vetch approximately 5" in diameter (on each plot). For the first plot, we applied 1.5lb's of Concern around the dripline of the plot. Then, for the second plot, we again applied Concern around that dripline. In the third plot, we applied Concern evenly throughout the plot. The fourth plot was the control (unaltered). Next, we watered all the plots using bucket watering once every two weeks, for eight weeks. The plots were watered three inch deep. After eight weeks, we checked to see if the pre-emergent was successful.

The buckwheats at the beginning of the project started out with a diameter of 2'. The lupine was 1.25" in diameter, and the deer vetch 5" in diameter. The height of the buckwheat was 20", the lupine was 1", and the deer vetch was 4''. After application the diameters of the buckwheat was 29", the lupine was 2", and the deer vetch was 8". At the experiment's end, there were numerous weeds that started to grow within all four plots. However, the dripline plots were effective. The plot with Concern evenly applied throughout the plot was partially successful. As the data shows, this project partly met the objective of this experiment. We are developing a plan to further overcome the growth of invasive plants during next year's project.

37

Portiz, Patrick
Earth and Space Science

Determining the effects of Inland and Coastal Environments on Coliform and E. coli

The goal of this project was to determine whether there was a correlation between Coliform Bacteria and E. coli Bacteria levels in Recreation Parks and whether those levels are attributed to the geographical location of the parks. My hypothesis is that if water from Inland parks is compared to water from Coastal parks, then the water from Inland parks will have a greater Coliform and E. coli count.

During testing, a Snap Pack of nutrient-indicator was opened, then added to a one hundred mL room temperature water sample in a sterile vessel. The sterile vessel was then capped, and was shaken until the solution dissolved. Afterwards, it was poured into a Quanti-Tray, the Quanti-Tray placed into a molder and then the IDEXX Quanti-Tray Sealer. The sealed tray was stored in an incubator at 35=/-0.5 C, for 18 hours. Then, the tray was taken into a dark room with a UV lamp.The UV lamp was turned on, and examined the color and count for the MPN count.

The experimentation proved the hypothesis correct. The parks that is close to a city does have a higher Coliform and E. coli count versus the other coastal water parks sampled. Ernest E. Debz water park was located on a hill, compared to Harbor Park which was at sea level and smoggy area. The results prove that there is a strong connection between the location of the park water, the area around the park, and animals that come into contact with the park.

ENGINEERING

38

CHEN, Alexander Lee
Engineering
2013

A Foldable Solar Panel with an Improved Hill Climbing MPPT Circuit

This project aimed at developing a compact, foldable solar panel with an improved hill climbing (HC) maximum power point tracker (MPPT) to address the need for efficient and portable power generators. The solar panel could be reconfigured to produce different currents and voltages.

Instead of using low efficiency solar films, this project employed more efficient Si solar cells to construct the foldable solar panel. Two 6”x6” cells were serially connected and enclosed in a thin, transparent Plexiglas case to form a module. Eight modules were mounted on a fabric to form a panel. Modules were connected to one another by bullet connectors which made the panel reconfigurable. An MPPT circuit was design and assembled to control the solar panel voltage. It included a boost converter and a microcontroller which executed the improved HC algorithm developed in this project.

Two solar panels were constructed. Each had a size of 3x7.5x14 cubic inches and weighed less than 8 pounds. They produced >60W of total power. The MPPT circuit achieved >98% of electrical power that could be achieved by manually optimizing the converter duty cycle. It showed fast and robust maximum power point tracking under rapidly changing light intensities.

The results were significant because the solar panel design addressed many practical needs and the improved HC MPPT algorithm addressed the deficiencies of the popular perturb-and-observe algorithm with simple modifications. The solar panel can be used as power generators for outdoor events, campers, and dwellers in remote areas where grid power is not available.

40

Emily, Kim
Engineering
2012/2013

NOVEL DESIGN CONFIGURATION FOR MAGNETIC FIELD REDUCTION IN OVERHEAD TRANSMISSION LINES

Electromagnetic fields can be produced by numerous objects, but this experiment focuses on overhead transmission lines. This project was designed to reduce the range of magnetic fields by changing different factors such as spacing and the ordering of phases.

By calculating the average sagging, the placement of insulators (height and distance), phase current, phase angle, and starting and ending “x’s”, a program, MFields, was used to graph the magnetic fields in two different towers. In the first test, a single-circuit pole was placed in the center of the Right of Way (ROW) that was 20 feet long but was extended 50 feet on either side. The pole configuration changed to a new delta configuration. For the second test, a transmission tower was placed in the center of a 75 foot ROW which was extended 100 feet on both sides of the ROW. Originally starting with a configuration of ABC-ABC, the phasing was changed to an ABC-CBA configuration as well as other combinations (ABC-ACB, ABC-ACB, ABC-BAC, ABC-BCA, and ABC-CAB). By entering information into MFields, a graph showing the reduction of magnetic fields was shown.

The results showed that there was a 32% reduction on the left side of the ROW and a 29.6% reduction on the right side of the ROW when there was a change in the design configuration of a single-circuit pole. Also, an ABC-CBA phasing was most optimal as there was a 49.1% reduction on both sides of the ROW compared to the other reductions in the double circuit transmission tower.

After viewing my results, I saw that with this experiment, I was able to support my belief that there would be a reduction in magnetic fields by changing their configuration. In the future, a possible experiment could be placing multiple transmission towers in a ROW and see how the magnetic fields are affected.

42

Nam, Sean
Engineering
2013

The Drag Efficiency of Grooved Arrows

The objective of this project was to find whether grooves on arrow head will make the arrow fly faster and create less drag. The main purpose of this experiment was to improve the flight of the arrow by decreasing the time it is in the air through giving it more spin, thus more speed. Using the ideas of spin wing fletching and the grooved barrels of guns, the experiment predicted that the arrow would fly faster because there was less drag than before.

In order to test the flight of an arrow, a X10 Easton arrow was needed along with a ruler and a Computational Fluid Dynamic software. The experiment used Caedium Professional, but other CFD softwares are acceptable. Knowing that everything in the work isn't perfectly smooth, the 3D models were constructed in layers of decreasing cylinders.

The data collected do not show specific numbers rather show how the model would react when it is in certain boundaries. In this case, the arrow with the grooves proved to have more surface tension. Even though the pressure on the tip of the arrow was equalized throughout the grooved arrow, the increase in surface area created more surface tension thus more drag.

The results proved the hypothesis wrong and showed that even though there is an increase in spin, the amount of surface tension overcame that and made the arrow go slower. Even though enough velocity is given to the grooved arrow, it did not achieve greater speed.

44

Shi, Cynthia
Engineering
2012 / 2013

Designing a Low-Pass Filter With Transmission Lines

In satellite design and development, it is important to minimize signal interference. One way to do so is by running the signal through a transmission line filter, which uses 'stubs' at right angles to the main line to reflect certain frequencies.

Using Ansoft HFSS, different designs were built and tested with in order to determine which combination of stub lengths, spacing, and other factors would create the best low-pass filter. The minimum requirement for a successful filter was to have an at least 40dB reduction for signals between 2GHz and 40GHz, and those that met the requirements were judged based on their size and signal reduction.

Using a combination of trial and error and mathematical analysis, this project found the best filter to be a line with forty stubs spaced 5 mil apart, with a semi-linear slope ranging from 10 to 20 mil difference per stub.

45

WONG, Ryan
Engineering
2013

Microcontroller Controlled Active Solar Panel Position Optimization

The purpose of this project was to help solve the problem of optimizing solar cell position for maximum output under varying light conditions that impact the solar panel power output. Previous work in this area mostly utilizes photo detectors that search for a position of the solar cell where the outputs of the two photo detectors are equal. An indirect method like this is prone to errors due to mismatches in photo detector responsivity, and does not directly optimize the actual output of the PV panel. The method utilized in this project is expected to be a more direct approach as it adjusts the solar cell based on its direct measurement readings.

The materials chosen were an Arduino Uno microcontroller board based on an Atmel ATmega328 microcontroller and a stepper motor with 1600 microsteps in 360 degrees. An algorithm was written for the measurement and analysis of the solar cell outputs, the positioning of the stepper motor, and the continuous monitoring of the output. This algorithm was implemented onto the microcontroller to control the 1600 microstep stepper motor.

The microcontroller measured the solar panel voltage output continuously as the solar panel moved through a 360 degree rotation. It recorded both the position and the value of the highest output. After completion of a full cycle of measurements, the stepper motor moved the solar panel in the reverse direction back to the position of the highest recorded output. The microcontroller continuously monitored the solar panel output while it remained at the position of highest output, which can change due to varying light conditions, and compared it against a user chosen percentage drop (in this example a 10% decrease in output was used). If the output dropped below this threshold, it triggered the algorithm to move back to the starting position and repeat the process.

By measuring the output current of a solar cell at various positions and using a microcontroller to analyze and digitally control the position of the solar panel via a stepper motor, it was determined that the solar panel position could be continually optimized under varying light conditions, thus helping to solve the problem of solar cell position optimization.

46

Wu, Juliana
Engineering
2012-2013

The Potential for Thermoelectricity as Alternate Source and its Comparison to Solar Energy

People are increasingly more interested and attracted to use more environmentally friendly sources of energy. Currently solar and wind energy are the more widely used types of renewable energy, but the area in the United States that can efficiently use solar panels or wind mills is limited. Using thermoelectric devices that run on a thermal gradient to generate electricity would be an alternative form of green energy.

An apparatus was designed using a commercially available thermoelectric chip to extract energy from the surrounding environment. It was placed in three different surroundings-the pool, snow, and soil. In each situation, the current potential of the chip was measured by a volt meter, and then the total amount of power could be calculated. A solar panel was also there to compare the relative amounts of energy generated.

As a result, among the pool, soil, and snow environments, the apparatus of the thermoelectric cooler was shown to have the best results for the pool environment. Based on the trends for the data collected, a relation of the difference between temperatures and the amount of power generated was formed. Using data from National Renewable Energy Laboratory (NREL) station, the estimated energy formed was mapped and depicted. The predicted data showed that this form of energy can be used at higher latitudinal areas and less sensitive to seasonal changes.

In conclusion, thermoelectricity has a great potential to work as an alternative for solar energy with a more expansive application area.

ENVIRONMENTAL SCIENCE

47

ANAND, Saahil
Environmental Science
2013

THE RELATIONSHIP BETWEEN THE TURBIDITY OF WATER AND THE AMOUNT OF DISSOLVED OXYGEN

Turbidity is the murkiness of water caused by foreign particles suspended in the water. This project was designed to find the relationship between the turbidity of water and the amount of dissolved oxygen. If the turbidity and dissolved oxygen of sea water were to be measure, then the samples with the lowest turbidities will have the highest amount of dissolved oxygen.

A dissolved oxygen meter and a turbidimeter were used to collect data in this experiment. Twenty-four samples were collected from two ocean locations and turbidity, amount of dissolved oxygen, and temperature were measured. The results were compared to see a possible correlation between the sets of data.

The RB(Redondo Beach) samples had an average oxygen reading of 9.17 PPM. They had an average turbidity of 3.07 NTU, with an average temperature of 15.18 degrees Celsius. The Terrenea Cove(TC) samples had an average oxygen reading of 9.04 PPM. They had an average turbidity of 3.86 NTU and an average temperature of 15.73 degrees Celsius. The RB sample had a higher oxygen reading and a lower turbidity and temperature, and the TC samples had a lower oxygen reading, and a higher turbidity and temperature.

The results supported the initial hypothesis since the RB samples and TC samples followed the expected results; the amount of dissolved oxygen in water varies inversely with the turbidity of ocean water.

48

Alison Bartkowski,
Environmental Science
2013

Effects of PH on Tide Pool Biodiversity

The objective of this project was to see if fluctuating PH conditions in the Intertidal zone had an effect on the concentration of different animals in various pools.

In order to find out, three species were picked from different phyla: gastropods (Mollusca), sea anemones (Cnidaria), and hermit crabs (Arthropoda). All three animals could be affected by pH as gastropod shells are made of calcium carbonate, sea anemones have soft and exposed bodies, and the hermit crabs vulnerable and soft abdomens. Three different locations, Malaga Cove, Abalone Cove, and White Point, were visited on the Palos Verdes Coast line to count the animal density(animals/ m3) and to measure the pH of each pool. After research was concluded, statistical analysis was done on the data using ANOVA to compare density pH and distance from the ocean.

For the sea anemone and hermit crab, both the un-transformed and log transformed data were not significant ($p>0.05$). However no hermit crabs were found at or below the pH of 7.4. Snail data was significant when log transformed ($p=0.018$).

As the sample size consisted of 40 pools there were some outliers that adversely affected the results, also causing a low critical level that was hard to by pass. Snails were probably affected due to the difficulty of forming calcium carbonate shells in acidic water. Ideally, the project would be expanded by visiting more sites along the california coast, gathering a larger sample size, and counting other species.

49

Dojiri, Stacey and Woo, Kelly
Environmental Science

The Response of a Coastal Phytoplankton Community to Hyperion Treatment Plant's Effluent: An Environmental Study

For decades, phytoplankton blooms caused by eutrophication from anthropogenic nutrient pollution have been a concern to the global community. Sewage outfalls that release effluent, or treated sewage, into the ocean increase the available nutrients in the water, possibly leading to phytoplankton population growth.

In 2014, the Hyperion Treatment Plant will divert its effluent from the 5-mile outfall to the 1-mile outfall. This diversion may cause increased phytoplankton growth, therefore disrupting the surrounding environment. So, our experiment will test whether it is best to divert in the spring or in the fall to minimize the potentially negative effects of harmful phytoplankton growth.

In both our spring and fall trials, seawater was collected and different dilutions of seawater and effluent were made. After 6 days of incubation, the phytoplankton were preserved and samples were taken for chlorophyll and domoic acid analysis.

We hypothesized that a certain harmful species, *Pseudo-nitzschia seriata*, would be more prevalent in the spring. However, our results showed that this species was more abundant in the fall. Furthermore, both the domoic acid and the chlorophyll levels were much higher in the fall. Based on these results, we concluded that Hyperion should divert its effluent in the spring of 2014.

50

Ghanian, Ryan
Environmental Science
2013

A SUSTAINABLE FUTURE FOR PVPHS-
ACHIEVING THE ECONOMICAL AND ENVIRONMENTAL BENEFITS

This year's science research project in its present form is the result of an ever-increasing global demand for energy coupled with a limited quantity of non-renewable natural resources. Peninsula High School uses electricity to run its day-to-day operations. But are members of the Panther Society using energy wisely? Last years research proved that PVPHS could reduce its consumption of electricity through the implementation of energy efficient program and simple behavioral changes.

A baseline energy audit for Peninsula High buildings was analyzed to determine where energy savings technologies could best be implemented. Energy education was in the form of flyer sent to faculty and staff, electronically. Student education on energy awareness was conducted monthly in form of a student-run energy club (Peninsula Sustainable Energy) on campus.

I analyzed the cost verses savings option of employing lighting upgrades from current fluorescent to more energy efficient LED lighting. Also using the information from last years complete energy audit of all buildings on campus, I was able to determine where best to reduce phantom load (standby power). With a grant from the Peninsula Education Foundation, a total of twenty power strips were purchase and implemented into various classrooms and offices on campus.

The contributions of this project are two fold. First, establishing a method and a forum to help raise awareness within the Panther society regarding energy conservation and practical ways to achieve it. Secondly, the research and implementation of energy-saving technologies to help reduce energy costs.

51

LEE, ANISSA
EVIRONMENTAL SCIENCE
2013

The Wetlands: Decreasing Numbers of Biological Pollutants

This project addresses if the wetlands are functioning properly in decreasing numbers of biological pollutants (antibiotic resistant bacteria). This research is important because the bacteria may pose a serious, long term public and ecosystem health threats.

From the Ballona Wetlands, flood, ebb tide, and sediment samples were taken. Also, up steam urban runoff samples were collected from Ballona Creek and secondary effluent samples were collected from Hyperion Wastewater Treatment. The bacteria was then extracted and plated. After plating, standard method was used to replicate colony growth, and the TSA plates were infused with antibiotics. After replicating, photos of replica plates were taken, and on the computer, bacteria colonies were color coded and circled. Then, the antibiotics were tested for insensitivities using the Kirby Bauer Method.

From what is known, the ebb tide (low tide, where UV rays should be reducing bacteria) and flood tide (ocean water coming into the wetlands) data are very similar. With the ebb and flood tides being compared with the Hyperion effluent, the Hyperion effluent should have had the most ABI's (antibiotic resistance colonies). However, a huge count of bacteria was evident in the sediment samples.

The wetlands are not functioning properly as ABI's are not being reduced during ebb tide. The results do not support the hypothesis that there would be a lower count of bacteria from the ebb tide than the flood tide.

52

Lee, Grace
Environmental Science
2013

The Relationship of the Sand vs. GAC Filtration and Its Flow Rate

The objective of this project was to study the effectiveness of the sand vs. GAC filtration. The main purpose of this experimentation was to see if the flow rate of fluids determines the effectiveness of sand vs. GAC filtration system.

The experiment was preceded at home with a burette, Indigo dye, sand, GAC, filtering paper, and clear containers for samples. In the actual lab, the experiment was carried out in two different ways. In one experiment, sand was used in filtration and the flow rate was controlled, at slower flow rate; 4.3ml/min and at faster flow rate; 14ml/min. Then, GAC was used and repeated the same procedure. The samples were taken after 0, 5, 10, 30, 60, 120,180 min. from each set and the Absorbance and the concentration of the dye were evaluated using UV/visible spectrophotometer.

When all the samples were compared, the samples taken from sand had higher concentration than the samples of GAC. Also, the results showed that the concentration of dye was less at a slower flow rate than at a faster flow rate. This shows that dye is filtered more effectively through GAC at a slower flow rate. The smaller the number of absorbance is the smaller the number of concentration (intensity) of dye. The Maximum absorption wavelength was determined by scanning UV/visible spectrophotometer. However, the intensity became stronger because GAC or sand lost its capacity in absorbing the organic molecules as time passed.

The hypothesis that solution would be filtered more effectively through GAC at slower flow rate was strongly supported by the results. It would be beneficial if we were to improve and apply this method to make cleaner water in our future generation.

53

SKERKAVICH, Valerie
Environmental Science
2013

OCEAN ACIDIFICATIONS AFFECT ON MUSSEL SHELLS

As we release more carbon dioxide into the atmosphere via burning fossil fuels, etc., the oceans are becoming more acidic. The oceans absorb ⅓ of the carbon dioxide in the atmosphere and once the CO_2 touches the water, it becomes carbonic acid, which is caustic to the shells of mussels. As acidity in the ocean increases, the population of mussels decreases. By taking sea water from Torrance Beach, putting it into jars and changing the pH of each jar of sea water, then proceeding to place Mytilus californianus shells in the jars to show the affect of a pH on the mussels, I was able to demonstrate how more acidic pH levels cause the density of the California mussel shells to decrease. This shows that ocean acidification is a major problem we should be concerned about, as it will affect our future in a negative way. Anthropogenic carbon dioxide emissions increasing will cause the pH of the oceans to decrease, therefore causing the shells of California mussels to be less dense, more fragile, and leave mussels with less defense against predators, which will negatively affect the entire food web and have a noticeable effect on fisheries and the economy.

54

Wang, Annie
Environmental Science
2012/2013

The Effect of *Parastichopus parvimensis* Feces on Calcium Hardness and pH of Salt Water

The ocean pH is slowly decreasing getting as more carbon dioxide is emitted into the atmosphere due to pollution and causing the delicate balance of nature to be tipped off. Since ocean organisms are extremely sensitive to even the slightest change in pH, I wanted to see if sea cucumber waste can help buffer against ocean acidification. A study in 2011 in Australia showed that sea cucumbers waste may have a buffering effect on low pH levels. Since sea cucumbers can be found almost anywhere in the ocean, from shallow tropical waters to deep, low-temperature waters, I wanted to test to see if the *Parastichopus parvimensis* will impacts the changing ocean. My hypothesis is that the when *Parastichopus parvimensis* eats more calcium, their feces will bring up the pH of the water.

In this project, four adult *Parastichopus parvimensis* was used. There were two 8-gallon tanks, filled with washed sand obtained from Cabrillo beach. The waste was collected from the tanks from using a net to sift through the sand, capturing the waste. Afterwards, waste is left on paper towels to dry for five minutes. After the waste is dried, it is weighed by a gram scale then put into a 250 mL E. flask filled with 250 mL of salt water. The feces is then left in the flasks for a week before the water is tested. After one week, the pH and calcium hardness of the waste water is taken using a pH test strip and calcium hardness test kit and data is recorded.

The results were that when the cucumbers had a regular gel food diet with no calcium carbonate supplements, the pH and calcium hardness levels of the waste water were inversely proportional while the cucumbers with the calcium carbonate added in their diet, the waste water pH and calcium hardness was directly proportional. .

After the as much data as possible were collected, I found that when there are calcium carbonate introduced into the cucumbers' diets, the water has a higher calcium and pH level, supporting my hypothesis. However, when the cucumbers had a regular diet, the calcium hardness level was high but the pH level was low. This shows that if there are more calcium carbonate in the ocean, the cucumbers might prove to be a useful organism to reverse ocean acidification.

55

Emily Yan
Environmental Sciences

Comparing the pH of Non-Aerated and Aerated Compost Tea to That of Liquid Organic Fertilizer

The objective of this project was to compare the pH values in non-aerated compost tea and aerated compost tea to the pH value of a store-bought liquid organic fertilizer. The main purpose was to see which of the two, non-aerated compost tea or aerated compost tea, had a pH that was more similar, and thus the better replacement for liquid organic fertilizer. Determining the better replacement would benefit these home gardeners in deciding which type of compost tea to use for their gardens.

To make the compost, leaves, branches, and vegetable and fruit kitchen scraps were composted for about 3 months. The compost pile was turned once every week to aerate the compost pile, which is beneficial for the aerobic microorganisms. After three months, the compost was then measured into two 1-cup portions. One of the portions was submerged into a 5-gallon bucket filled with 4 gallons of water. This set up was left alone for 10 days. The other was submerged into the same set up, but was aerated with an aquarium air pump to further keep the aerobic microorganisms alive. This set up was left to aerate for 48 hours. After the time needed for the set up to finish, the pH was taken from both set ups using pH strips with a range of 4.5-9.0. These values were compared to the pH of a store brand of liquid organic fertilizer, which was taken with the same pH strips.

The data collected showed that the non-aerated compost tea had a pH of 6.75, the aerated compost tea had a pH of 5.5, and the liquid organic fertilizer had a pH of 6.5. This shows that the non-aerated compost tea had a more similar pH value to the liquid organic fertilizer than the aerated compost tea did.

In the end, the results did not support my hypothesis that the aerated compost tea would have a more similar pH and show that the non-aerated compost tea would be a better alternative to the liquid organic fertilizer. Next time, testing other characteristics in the compost tea would be helpful as well in determining the one that's most similar to the liquid organic fertilizer.

56

Zhang Brian
Environmental Science
2013

Formulating a Method to Measure Salt Marsh Health by Various Factors

Salt marshes are an important ecosystem, providing services to many species, but are declining due to factors such as global warming and pollution. This investigation attempts to formulate a method to measure the salt marsh health. First, 3 125mL samples were removed from the salt marsh by use of a plankton net. 10 drops of acetone was spread across a paper filter by use of a glass pipette, and the first 125mL sample was ran through the filter, where the acetone extracted the chlorophyll. Chlorophyll absorbance was found by using a spectrophotometer. Plankton density was found by counting the number of plankton in a certain volume and dividing the number of plankton by volume. The number of algae was counted by use of the hemocytometer.

From analyzing the data, an increase in one of the variables was matched by an increase in the others. Total numbers of birds were higher when the densities and numbers of the other factors such as plankton density were higher. Over time, the average number of birds dropped due to winter migration, but relative rises and increases were still possible to observe.

The conclusions of this investigation demonstrated a number of concepts. Salt marsh health relies upon stability, so health cannot be measured by the success of just one organism. High tide results in an influx of organisms due to water gain, attracting higher numbers of birds, while low tide reduces productivity because producer organisms are lost with the water draining back to the ocean. Overall, salt marsh health is evaluated by multiple factors.

MEDICINE & HEALTH

57

Benedict, Braeden
Medicine and Health
2013

Development of an EEG Device for Evaluation of Mild Traumatic Brain Injury

This project aimed to develop and test a low-cost device potentially capable of detecting a concussion based on brain wave data collected from a simple electroencephalography (EEG) device. A secondary objective was to determine the effects of physical stress, age, and gender on brain wave activity.

The device was built by integrating a Mindflex game EEG headset with an Arduino microcontroller. A program was written for the microcontroller, and the various components, including an LCD display and LED array, were housed within an electronics box. Brain wave data was recorded on a laptop computer connected to the microcontroller. Data for eight brain wave frequencies was obtained, as well as proprietary calculated "Attention" and "Meditation" values created by the Mindflex developers. Sixty-one pre-concussion subjects were tested while at rest and twenty-eight of those subjects were again tested after physical activity. For each subject, brain wave data was recorded both while the subject was in a state of attention and in a state of relaxation/meditation. Subjects who received concussions were given the same test over successive days in order to track his or her recovery.

Experimental results showed that concussions indeed influenced brain wave activity in several ways. First, the "Attention" readings while the concussed subjects were meditating/relaxing were significantly lower than when the same subjects did not have concussions. These same readings were also lower than they were for the majority of other non-concussed subjects. In addition, the amplitude of beta and alpha waves for each concussed subject appeared to be lowered as a result of the brain injury. As the subjects recovered, these wave amplitudes increased toward normal levels.

The results of this project were supportive of the original goal. This device may one day provide an easy, inexpensive, and quick sideline concussion test.

58

CHOE, Justin
Medicine & Health
2013

Role of Hydrocortisone in the Maturation of Pancreatic Beta-like cells from Embryonic Stem Cells

Type 1 diabetes is a disease that affects around 1.7 million individuals in America alone. This disease is brought about by an autoimmune attack to pancreatic, insulin-secreting beta cells. Transplantation of mature beta cells from pancreatic donors to end-stage patients represents a possible cure; however, this approach is hindered primarily by the lack of cadaveric donors each year offset by the increasing incidences of type 1 diabetes annually. Embryonic stem (ES) cells, which can self-renew *in-vitro* and differentiate to any lineage, represent a potential unlimited source for these much needed beta cells for transplant. Earlier ES to pancreas differentiation protocols have yielded immature beta cells unable to respond to glucose levels. To enhance the safety of transplanting ES cell products, it is imperative that we are able to obtain post-mitotic mature cells.

In this study, murine ES cells were induced to pancreatic beta-like cells using a protocol developed in my mentor's laboratory. The cells were induced to differentiate and form embryoid bodies in suspension culture for 6 days. These embryoid bodies containing precursors similar to pancreas development were then plated in attachment culture for an additional 12 days. By this stage, pancreatic genes were expressed in these cells. Hydrocortisone dissolved in a DMSO vehicle was then administered in concentrations of either 1 or 10 μM, and the cells were incubated for 3 hours. At the end of treatment, relative gene expression of beta cell maturation markers (*Insulin 1*, *Glucose transporter 2*, and *Glucokinase*) was determined by real time RT-PCR analysis.

The results revealed enhanced gene expression for *Insulin 1*, *Glucose transporter 2*, and *Glucokinase* by hydrocortisone.

These results suggest that hydrocortisone is a potential compound capable of maturing beta cells derived from murine embryonic stem cells *in vitro*. This holds future implications for cell replacement therapy for type 1 diabetes patients.

60

Entin, Nicholas
Medicine & Health
2012-2013

Development of OsiriX Plugin to Aide in Calculation of Bone Mineral Density

The objective of this project was to design a software plugin for OsiriX, an open source DICOM viewer. The plugin allows users to more easily and accurately calculate data regarding the patient's bone mineral density. In doing so, doctors can diagnose osteoporosis earlier and with more certainty than before.

Initially, a simple plugin template was created. At that point, features were added on one by one until all desired functionality had been achieved. First, the ability to select which images from the CT scan would be used. Next, the ability to select regions and edit their size. Finally, the ability to generate statistics based on the selected regions.

The project was a success, in that all features were implemented fully and work as expected. The accuracy of the plugin is equal to that of the software itself, which is greater than or equal to the accuracy at which a human could calculate based on this data. In regards to ease of use, many fewer actions are required from the end user while using the plugin than while using the program alone.

Only time will tell how the plugin performs in the field. However, based on the final result, the project appears to have succeeded in its goal to produce a plugin that adds both accuracy and ease-of-use to the bone mineral density calculation process.

61

GRZYWACZ, Sara
MEDICINE AND HEALTH (2012/2013)

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

Retinitis Pigmentosa (RP) is the leading cause of inherited retinal blindness worldwide. This disease is characterized by loss of rod photoreceptors followed by slow, progressive reorganization of the retinal circuitry, especially of the mosaic of cone cells. The reorganization follows the remodeling of the processes of the glial Müller cells. I previously showed that transient disablement of Müller cells allowed for the re-engineering of the cone mosaic. However, Müller cells are important for the health of the cones, by releasing Ciliary Nerve Trophic Factor (CNTF). This study tested the hypotheses that transient disablement of Müller cells caused a reduction of the number of cones, but that application of CNTF reverted this impairment.

Müller cells were transiently disabled by injection of the drug DL-alpha-aminoadipic acid (AAA) into the eye of a rat model of RP (S334ter-line-3). CNTF was administered to the retina with the new Encapsulated Cell Technology from the company Neurotech. Cones were marked immunohistochemically in control, RP, RP-with-AAA, and RP-with-AAA-and-CNTF conditions, and whole-mount retinas were photographed with fluorescence microscopy. The geometries of the photographed cone mosaics were analyzed statistically using MATLAB programs.

The data confirmed the result of previous studies showing that the cone mosaics in RP retinas were abnormally inhomogeneous, displaying an array of rings. Analysis of the cones' nearest-neighbors-distance distribution revealed that AAA treatment restored the spatial homogeneity of their mosaic. Similar results were observed using other statistics of the cone mosaic, such as its autocovariance function and the distribution of hole sizes. However, the density of cones fell with AAA. In contrast, simultaneous application of AAA with CNTF resulted in the benefits of AAA but with much less cone death.

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

62

Dustin Kee
Medicine and Health Sciences
2013

Factors Leading to Disparities in the Prevalence and Treatment of Coronary Artery Disease

The objective of this study was to characterize the patient-centered biases and beliefs that may contribute to the discrepant outcomes in the treatment of Coronary Artery Disease.

A questionnaire focusing on patient demographics, beliefs, scenarios, and knowledge of Coronary Artery Disease was administered to patients at the Harbor-UCLA Outpatient Cardiology Clinic. It was used to assess fund of knowledge regarding Coronary Artery Disease and its treatments. A total of 43 study subjects were interviewed. After, the results were inputted into a Microsoft Access database, tallied, and then analyzed.

Minorities were found to have biases that might account for delayed hospital presentations and reduced care compared to the whites. They were not aware of the proper response to angina and a possible myocardial infarction. In addition, the minorities were also more inclined to refuse recommended procedures or not comply with their prescribed medications.

The hypothesis that minorities' inherent perception and lack of understanding about Coronary Artery Disease and treatment was reported by the study findings. Patients are apprehensive and unaware of the benefits from medical care. As a result, many do not visit physicians, decline procedures, or are noncompliant with their prescribed medication. However, religious and cultural beliefs as well as alternative medicines did not display any detrimental effect on the patients as previously speculated. This issue is ultimately a result of poor viewpoint and misunderstanding by the patient.

63

Kumar, Divya
Medicine and Health
2013

Muscle oxidative function and vasoreactivity using near-infrared spectroscopy in COPD

The purpose was to compare the muscle oxygenation of both Chronic Obstructive Pulmonary Disease (COPD) patients and age-matched controls using near-infrared spectroscopy on the calf. It was hypothesized that muscle oxygenation would be slower in COPD patients than healthy subjects.

The procedure involved recording how numerous blood occlusions in the lower thigh affected the muscle oxygenation in the calf muscle. Subjects were asked to do flex and point the toes in order to provide a light exercise.

16 out of 19 participants completed the protocol. Three subjects could not complete the procedure because of pain caused by the blood pressure cuff. Overall, COPD patients had a slower recovery of oxygen compared to their healthy counterparts.

The results strongly supported the hypothesis. The slower oxygenation could be the cause of breathlessness, one of the symptoms of COPD. This experiment proved that near-infrared spectroscopy produces similar results to those of muscle biopsy. Since muscle biopsy is very invasive while near-infrared spectroscopy is not, near-infrared spectroscopy will be more widely used.

67

Yuuma Sakakibara
Medical
3/1/13

Accurately Locating and Classifying Calcium Deposits in the Cardiovascular System

Calcium deposits in the arteries of the heart are said to be the number one indicator of heart problems such as heart attacks and strokes. Previous studies have proved that calcium deposits shown by CT scans of the heart can indicate the risk of a patient. The inner wall of the artery can be damaged, and later calcified because of smoking, diabetes, high blood pressure, or high cholesterol levels. Excessive intake of fat can also lead to calcification of the arteries. Until now, doctors had to simply "eye" the amount of calcium deposits around the heart, and had no exact numerical value. This was an estimate at best, and there were many opportunities for a human error. Therefore, an exact numerical value would help doctors both cut down on analyzing time as well as potential for human errors.
The purpose of this project is to create a program that accurately locates calcium deposits in the cardiovascular system. It uses the Osirix DiCom reader to read and scan CT scans. The program itself is written on xCode for the Mac, and is written in Objective C. It locates the four arteries of the heart and then detects calcium pixels, with a pixel density of 330 or above, within ten pixels of the center of the artery. The program uses two loops to measure each pixel within ten pixels of the center of the artery, and then later lists the number of calcified pixels on a chart. The resulting project first locates the four arteries and then lists the number of ROI(Room of Interest) points on each slide on a table. Next to it, the number of calcified pixels near the arteries are also listed, resulting in an easily accessible table.
In conclusion, my program was able to do what it was intended to, but there are many ways on improving this program. For example, there are many algorithms that one can run these numbers in to give one number that shows how much a person is at risk for certain diseases. Another improvement can be giving different levels of calcification to pixels with densities much over 330.

68

SUH, Daniel
MEDICINE AND HEALTH
2013

Determining the Number of Captured Circulating Tumor Cells

There are over 12 million people in the US that live with cancer. However, many cases of cancer go undetected because of the diagnosis procedure that is invasive and is lengthy in procedure. Capturing circulating tumor cells (CTCs) are an ideal source of cells for detecting primary and metastatic cells due to the non-invasive method of collection from the patient's blood. Acquisition of the CTCs could aid in the detection of the cancer tumor in its early stages. However, capturing CTCs is difficult because of the low number of cells present within the bloodstream and the low viability of the collected cells. The viability of the cells is essential to further analyze and characterize the cancer cells.

To detect CTCs, a microfluidic device with polymer-grafted silicon nanostructures was developed. Biotinylated polymer brushes coated with anti-EpCAM were grafted onto a unique silicon nanowire substrate to capture the CTCs. Breast and prostate cancer cell lines were cultured and detected in the device through immunocytochemistry.

Cells were detected at a 70-90% capture rate, which is higher than the rates of currently approved methods. The viability of the captured cells was 90% and could be used for additional molecular assays.

Using the silicon nanowire device to capture the CTCs will be an efficient way to detect tumor cells from the blood, allowing for a more effective and non-invasive method for diagnosing cancers.

MICROBIOLOGY

69

Microbiology
Ruipeng Bai
Jennifer Choi

Development of KPC-vaccine against K. pneumonia

This project is to detect the amount of antibodies against KPC (K. pneumonia**)** by the use of ELISA (**E**nzyme-**L**inked **I**mmuno**S**orbent **A**ssay: test that uses antibodies and color change to identify a substance). For this experiment, three types of buffer are needed to be prepared. From TBS-1Liter, we created TBS 3% BSA, and TBS 0.05% Tween 2 0. In order to test KPC-vaccine, a 96-well plate was coated with KPC protein and added the control, KPC, and IgG1 isotype (Immunoglobulin G). The experiment shows that the KPC titer (a measurement that shows how much antibody an organism has produced) is higher than the control group which means that the vaccine was successful in producing antibody. Infection caused by KPC-producing *K. pneumoniae* is independently associated with in-hospital mortality (≥50%). Developing a KPC vaccine have great beneficial. This vaccine has the potential to synergize with carbapenem antibacterial therapy (restoring antibacterial effectiveness by antibody-based blockage of carbapenemase activity), which can prolong the useful lives of some of the post powerful antibiotics that have ever been developed. KPC vaccine would have a tremendously beneficial impact on public health.

71

CHAN, Victoria
Microbiology
2013

THE ANTISEPTIC EFFECTS OF NATURAL SUBSTANCES ON *ESCHERICHIA COLI*

The main purpose of this continuation experiment is to compare the antiseptic effects of different natural substances on the bacteria *Escherichia coli*. Another goal of this study is to observe the various effects of pure natural substances extract (oils) on *E. coli* in comparison to effects of natural substances in the original state. The last objective of this research is to test possible ways to improve the water quality of bacterially contaminated water through natural means. For these purposes, a broth containing pure concentrations of *E. coli* was used. The broth was diluted with 4000 mL of distilled water and incubated on nutrient agar plates for 24 hours at 37°C. Then Thyme leaves, Lavender leaves, Tea Tree Oil, Eucalyptus Oil, Lavender Oil, Thyme Oil, and Aloe Vera Gel were added into each of the agar plates, and data was collected over a two weeks period.

72

Filler, Elan
Microbiology

Investigating an Outbreak of *Cryptococcus gattii* Infection

When inhaled, the fungus *Cryptococcus gattii* causes life-threatening meningitis and pneumonia in humans and animals. Two species of Cryptococcus, *C. neoformans* and *C. gattii*, cause infection, which are not distinguished in a clinical laboratory. There is an outbreak of *C. gattii* infection in California. Previously, I discovered that *C. gattii* grows on two species of trees. This year, my hypothesis was that *C. gattii* grows on trees that are near the homes of outbreak cases. My objectives were to 1) define patients with infection caused by *C. gattii*; 2) map the location of patients with *C. gattii* infection; and 3) further delineate the environmental sources of *C. gattii*. I analyzed 48 patient isolates of *Cryptococcus* for the presence of *C. gattii* by plating them onto CGB agar. Of these patient samples, 25% were positive for *C. gattii.* Surprisingly, the majority of the outbreak cases were tightly clustered within a two kilometer radius in South Los Angeles. Next, I swabbed 56 trees and collected 39 soil samples from 17 different sites in South Los Angeles near the *C. gattii* outbreak cases. I plated these samples onto NGS agar and then onto CGB agar. *Cryptococcus* species was detected in 23 samples from 11 locations. Of these samples, 6 contained *C. gattii*. Notably, all were from locations that were close to the outbreak cases. In conclusion, there is a cluster of *C. gattii* cases in South Los Angeles. *C. gattii is endemic in this region and is the likely source of the outbreak.*

73

KUMAR, Raya
MICROBIOLOGY
2013

DETERMINATION OF AMOUNT OF ENTEROCOCCUS IN WATER VERSUS SAND AT INNER CABRILLO BEACH

For years Inner Cabrillo Beach has been graded as an F beach according to water single-sample limits for *Enterococcus*. Millions of dollars have been invested into projects to improve water quality, such as sand replacement, installing water circulation pumps and bird exclusion devices, and removing the rock jetty, yet *Enterococcus* densities continue to exceed water quality limits. The experiment would compare densities in sand versus water, as well as predict a source of the *Enterococcus*.

Samples were collected at five locations in Inner Cabrillo Beach for sand and water and analyzed for *Enterococcus* by the chromogenic substrate method. Sand samples were processed by the method established in the Bight'08 Regional Monitoring Program. Bacterial results were analyzed for any correlation between the bacterial densities of the sand and water.

Results showed that water contains higher *Enterococcus* densities than sand, contradictory to recent scientific findings. The site with the consistently highest levels of *Enterococcus* was CB2, a site located directly in front of a restroom. In addition, weather seemed to play a large role in *Enterococcus* levels; as temperature dropped during winter, fewer *Enterococcus* densities were retrieved. Also, sand at the shoreline wave wash may potentially harbor elevated *Enterococcus* concentrations and may have contributed to the *Enterococcus* exceedances

The experiment concludes that water, rather than sand, hosts the highest Enterococcus densities, and that the restrooms near site CB2 may be the source of the *Enterococcus*.

76

Yamauchi Mia
MICROBIOLOGY
2013

Development of Bacteria Resistance after the Exposure to Dilutions of Disinfectants

This project was designed to determine the effects of exposing different dilutions of disinfectants on the development of bacteria resistance. The bacteria used were from a human mouth and the disinfectants used were antibacterial soap, mouthwash, and cleaning bleach.

Two different methods were used to obtain an accurate set of results: measuring the zone of inhibition and measuring the surface area of the bacterial growth. The size of the zone of inhibition is usually related to the level of antimicrobial activity present in the disinfectant- a larger zone of inhibition means that the antimicrobial is more potent. Zone of inhibition testing was well suited for determining the ability of water-soluble antimicrobials to inhibit the growth of microorganisms. After the surface areas of bacterial growth after being exposed to disinfectants were measured, results were collected and the bacterial resistances of the disinfectants were compared.

The data collected from measuring the zones of inhibitions showed that the mouthwash diluted with 100 ml had largest zone with 1.2 cm while the bleach diluted with 10 ml had the smallest zone with 0.01 cm. However, from measuring the surface areas of each disinfectant, the bacterial growth in the mouthwash plate was the largest with 40.12 cm and the bleach had no bacterial growth.

Ultimately, the scientific question was answered and the hypothesis was supported with the results of the zone of inhibition. Though the two outcomes state different results, the knowledge gained from this project may effect which cleaning solutions people prefer to use.

PHYSICS

77

Edwards, Eric
Physics

COEFFICIENT OF RESTITUTION OF AN ALUMINUM BASEBALL BAT

This project was designed to discover the effects of hitting baseballs on a BBCOR bat's coefficient of restitution.

I used 38 feet of ¾" PVC pipe to build a structure capable of holding a baseball in place while a bat swung down to hit it. Before each swing, the aluminum bat was held perfectly horizontal to let gravity pull the bat to the baseball. The bat rotated on a pivot point six inches from the knob-end of the bat before making contact with the ball on the barrel of the bat. Each collision and flight of the ball was recorded at 60 frames per second in front of a scaled background made of 1" vertical stripes. Analyzing each recording for the inches traveled over frames elapsed gave the horizontal speed of the ball after the collision. This process was repeated multiple times for the bat after it had been exposed to certain levels of usage.

The coefficient of restitution of the bat collisions changed noticeably after the bat was exposed to different amounts of hitting: 0 balls, 200 balls, 1,000 balls, 5,000 balls, and 20,000+ balls. The coefficient of restitution values stayed similar until tests with 5,000 and 20,000+ balls yielded a much lower value.

My findings confirmed my hypothesis that the coefficient of restitution value will decrease as the bat is exposed to more usage. With thousands of high school and college athletes in America, this study will be a valuable source for helping buyers come to an educated decision when purchasing a BBCOR baseball bat.

78

Hashimoto, Mark
Physics
2013

Altering Liquid-Substrate Interface on Polished Copper Surfaces

The objective of this project was to analyze the effects of surface roughness on the hydrophobic properties of polished copper. The purpose of the experiment was to see if an increase in surface roughness, carried out by etching, would cause a decrease or increase in the contact angle of a water droplet on a copper surface. By measuring the contact angle, the degree to which the copper surface attracts or repels water can be determined.

To test the effects of the etching treatment, 9 polished copper discs, 1 inch in diameter and ¼ inch in width, were divided into 3 groups, each consisting of 3 discs. In every group, the first disc would receive an etching treatment in ammonium peroxidisulfate for 30 seconds, the second would receive 60 seconds, and the last would receive 120 seconds. Before and after treatment, the roughness and reflectance of each disc was measured, using a scatterometer, and a goniometer was used to measure 3 contact angles on every disc before and after treatment.

The data collected shows that as etching time increased, the surface roughness increased as well, and as etching time increased, the contact angle had decreased. There is an inverse relationship between surface roughness and contact angle for all of the 9 copper discs which were measured.

Results show that surfaces with a lower roughness level had larger contact angles than those of surfaces with higher roughness levels, therefore it can concluded that by increasing surface roughness with the use of an etchant, the hydrophobic ability of copper is decreased.

79

Kim, Kijung
Behavioral & Social Science
2013

ANALYSIS OF SOUNDS OF ANNOYANCE FROM DIFFERENT URBAN AND RURAL AREAS

The project was designed to test to see if Sounds of Annoyance of different cities are closely related to one other in terms of dB levels.

A survey was made which had people jot down ten sounds they found the most annoying in the cities. Then, the top three were chosen and recordings were taken from eight different cities. The recordings were analyzed to see if there is extraneous noise, and then they were compared to ones from different areas. This was repeated numerous times to make sure of the dB levels.

Out of the samples of sounds that were recorded, it was found that on average, many sounds have exhibited similar slopes and graph behaviors when displayed on a spectrograph. It was shown that the ambient noise of the cities were not that much different from each other, as the recordings, which contained the targeted sound and the ambience, were similar to one another.

After reviewing my results, I have found that this has supported my hypothesis greatly, as my hypothesis was that these sounds were similar to one another in terms of dB levels. It would be interesting to repeat this experiment with not only the top three annoying sounds, but also with the top three “less” annoying sounds that were obtained from the survey.

80

LESSER, Jamie
PHYSICS
2013

KINETIC MONTE CARLO SIMULATION ON ATOMIC DIFFUSION ON A CU-SN SURFACE

Under applied electric current, interconnects in integrated circuits are known to fail when lack of resistance to electromigration causes directional diffusion and the formation of voids as a consequence. The goal of this project is to study the influence of alloyed Sn atoms on resistance of Cu to electromigration by focusing on the migration paths of a single Cu atom (adatom) as it moves along the surface.

We model the diffusion of an adatom on the Cu (111) surface in the presence of Sn impurities using a computational simulation. The Sn impurities deform the potential energy surface and create obstacles that block the adatom migration. The Kinetic Monte Carlo method (KMC) is employed as a randomization technique to generate the migration paths of the adatom.

The results confirm that the Sn impurities create areas to which the adatom cannot migrate and that these areas change in size with temperature.

Since the Sn impurities significantly affect the potential migration paths of the adatom, it can be concluded that the Sn impurities would increase resistance of copper to electromigration. This supports a future improvement of interconnects by coating them with a Cu-Sn alloy surface, therefore allowing the material to last longer under applied electric current. A stronger interconnect would also allow for the production of smaller integrated circuits.

82

NGUYEN, Ryan
Physics

THE EFFECT OF VARYING DC-DC CONVERTER CONFIGURATION ON SUPERCAPACITOR OUTPUT EFFICIENCY

My experiment's objective is to improve the ability to extract useful power from supercapacitors by using two different DC-DC converter configurations and determining their power efficiency. First, I decided to use a step up and a step down converter to compare because of their significantly different topology and operation.

Two sets of test hardware were constructed, one for each type of converter. Each set of hardware consisted of a set of supercapacitors, a DC-DC power converter(one step up and one step down), and an LED load that was used in both test set ups. For the step up converter, the initial supercapacitor output voltage of 2.50 volts was "up- converted" to 3.27 volts. The step down converter was run with an initial supercapacitor output voltage of 9.80 volts and "down- converted" to 3.27 volts. In both cases, the converter output was connected across the LED load, and the converter was run for 80 minutes with measurements being taken every minute.
For each test run, the voltage and current were measured at the output of the supercapacitor and at the input of the load, which allows the efficiency of the converter to be calculated.

The data shows that the power efficiency of the step up converter is initially greater than that of the step down converter by 10- 14%. However, towards the end of each run, the step down converter efficiency surpasses that of the step up converter. This observation can potentially be exploited to improve energy efficiency.

83

SUNG, Mina
Physics
2013

USING THERMOBIMETAL AS A SMART STEAM RELEASE VALVE.

In order to create a "smart" cooking lid design, this research project proposed the use of thermobimetal as a valve material that would release the pressure of steam vapor to prevent a pot from boiling over and harming the user. Thermobimetal, a lamination of two alloys of metals with different coefficients of expansion, automatically curls when heated. In this project, the curl was designed to pull a plug off of a hole on a cooking lid, allowing hot air to escape from the chamber of boiling water.
In order to test this idea, two types of saucepan lids were created. The first type had a single hole; the second type multiple holes. Several shapes of thermobimetal, singularly and in multiplicity, were tested to determine variations in performance. As the water temperature increased, the curl, temperature and time were measured and video recorded.
The thermobimetal performed well on both types of lids. Certain shapes (like the hourglass one) worked best. Additionally the lid with multiple openings prevented the highest level of boiling over, as anticipated.
The success of this experiment is not limited to thermobimetal's ability to release hot steam from a boiling pot, but can lead to other applications in the kitchen such as venting foils for baking or roasting. Continued research is necessary to resolve issues of metal compatibility, toxicity and general safety. But, certainly, the future for thermobimetal in the kitchen is promising.

ZOOLOGY

85

Darling, Elisabeth
Zoology
2013

CURIOSITY VS HABIT IN CONSUMPTION BY THE PRAYING MANTIS

This project was designed to establish if the curiosity in an intelligent insect, such as the praying mantis, strikes its prey based on preference to consistency of a repetitive meal, or if it becomes curious of a new prey. Many similarities are found between some insects and humans, and curiosity in insects is not commonly tested.

Ten living environments were assembled to house ten living praying mantises. The nymphet mantises were purchased and shipped to their new living environments to complete the experiment. The mantises were then fed nymphet flightless fruit flies for approximately fifteen days to create a habit of the species of prey for consumption. On the sixteenth day, the mantises were individually removed from their habitat and given the option between striking the flightless fruit flies, or nymphet silk worms.

The data collected proved that the nymphet praying mantis would favor the newer choice of prey, the silk worm, every time the option was given.

The results provide that the praying mantis may obtain some curiosity towards the flavor of the new prey, causing it to strike. This provides the knowledge that the praying mantis uses both its intuition and intelligence before striking, as opposed to striking any insect that wanders into the nymphet mantis's strike zone.

86

FURUTA, ANNA
ZOOLOGY
2013

SOCIALLY MEDIATED GENDER CHANGE IN *LYSMATA CALIFORNICA* IN VARIOUS DENSITIES

Caridean shrimp display a diverse variety of sexual systems, including the newly discovered protandric simultaneous hermaphroditism. This sexual system is unique in that unlike a majority of the hermaphrodritic species, those that exhibit protandric simultaneous hermaphroditism retain the male and female reproductive capacity. This characteristic is documented in the shrimp *Lysmata californica*. Shrimp with the protandric simultaneous hermaphroditism hatch and develop as male-phase individuals, but with sexual maturity have the potential to change genders and become female-phase individuals. This experiments test how the density of male-phase individuals influences the number and frequency of gender changes.

Fourteen adult male-phase shrimp were divided into three pseudokreisel tanks with densities of eight, four, and two shrimp per tank. The shrimp were checked several times a week for gender changes, which were determined through observing the anatomy of the shrimp. Sex ratio between male-phase individuals and female-phase individuals, number of gender changes, and number of molts were recorded. The data of the three tanks with varying densities were compared.

The number of gender changes in comparison to the density of each tank was calculates and compared to other tanks. The tank with a density of eight shrimp had the largest percentage of gender change; while the tank with four shrimp had the second largest percentage of change and the tank with two shrimp had the least.

The data presented show that the number of male-phase individuals does stimulate more gender changes. Increased allocation to the female function, or more rapid change from a male-phase individual to a female-phase individuals, is prominent when male mating opportunities are lower.

87

Kim, Anthony
Zoology
2013

The Interactions between Different Habitats for the Coastal Cactus Wren

The objective of this project was to analyze interactions between the different coastal sage scrub habitats (habitats that consist of cacti) and the Coastal Cactus Wren (*Campylorhynchus brunneicapillus*). The main purpose of this experiment was to determine whether the Coastal Cactus Wrens would interact between the different habitats: mature (more than 30% coastal sage scrub), burnt, and restored.

In order to properly view the cactus wrens, a pair of binoculars, ranging at 8x42 magnification, was needed in order to provide a suitable and wide viewing window. The survey was recorded at each site for a duration of thirty minutes. Each survey was split into thirty second intervals in order to easily record what occurred at a specific time. This process was repeated three times (three habitats) to conclude the survey and this was repeated on a weekly basis from November 2012 to end of data collection at February 2013. The data collected showed that the majority of cactus wren sightings were at the mature habitat at frequent occasions. The data was affected by variables such as bad weather, wind speed, and the cacti habitat itself preventing some survey dates and sightings. The results show that my hypothesis was correct in that the wrens interacted with the mature habitat the most between the three. This project gives insight that cactus wrens will only interact with habitats with suitable coastal sage scrub habitat coverage.

88

LEE, Lauren
ANIMAL BIOLOGY
2013

THE EFFECTS OF PRESSURE ON THE SPAWNING AND HATCHING PROCESSES OF *HALIOTIS RUFESCENS*

The objective of this study was to observe changes in the spawning and hatching processes of *Haliotis rufescens*, commonly known as red abalone. The main purpose of experimentation was to determine that pressure can help induce spawning and hatching of abalone species. If proven successful, the same induction techniques can be applied to the endangered *Haliotis sorenseni*, or white abalone, in hopes to restore their populations in captivity.

Six abalone were divided into three groups of two and each group was treated with either pressure, desiccation, or no stimulus to induce spawning.

Initial experimentation included a fourth temperature treatment, which did not induce enough spawning abalone for conclusive results. Upon spawning, the gametes of subjects were gathered and fertilized. Results were recorded the week after fertilization. Pictures were taken of larvae after hatching. Additionally, experimental subjects were observed a week later to ensure health and eating habits.

The data collected shows hatching and development is delayed immediately after being put in the pressure chamber. Control larvae (without pressure) hatched after 24 hours. Additional data shows that pressure had a slight impact on the spawning processes of the abalone. The experimental group proved to have a greater success rate of spawning in contrast to the control group.

The results show that pressure affects the hatching and spawning of *Haliotis rufescens* and the same information can be applied to other deep-water species, including the endangered white abalone.

89

SHIM, Ashley
Zoology
2013

The Effect of Humidity and Temperature on the Development of *Vanessa cardui*

The objective of this project was to analyze how humidity effects the developmental stages of the Painted Lady butterfly, *Vanessa cardui*, when the temperature is lowered from the optimal growth temperature. The hypothesis was added humidity in a lower than optimal temperature will quicken the growth of *Vanessa cardui* compared to growth in the same temperature without humidity. The goal of the experiment was to get a better understanding of the correlation between climate change and the development/habitation of butterflies in certain parts of the world.

Three containers were set up to simulate 3 microclimates. Container 3 was the control where there was no added humidity and was room temperature. Container 2 had no added humidity, but the temperature was lowered to 18-20 degrees Celsius. Container 1 also had a temperature of 18-20 degrees Celsius, and also had humidity that measured 10-20% higher than Containers 3 and 2.Measurements of the humidity and temperature were taken daily for 4 weeks and observations were made on each butterfly's developmental stages.

The butterflies in Container 1 took an average of 16 days to form cocoons. The butterflies in the same container took an average of 25 days to form into butterflies (from the larva stage). In Container 2, the butterflies took an average of 16.8 days to form cocoons and 27.2 days to form into butterflies. In the control container (3), the butterflies took an average of 15 days to form cocoons and 22.5 days to transform into butterflies.

The results confirm the hypothesis. Added humidity can assist the developmental processes of Painted Lady butterflies if the temperature is lower than optimal temperature, especially in the pupa stage of development.

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UETRECHT, Madison
ANIMAL SCIENCES
2013

Hormone-Induced Developmental Changes in *Aurelia aurita* Ephyrae

The common moon jellyfish, *Aurelia aurita,* undergoes a complex metamorphosis. The first pelagic stage in its life cycle is called ephyra, which begins with a star-shaped body and appendages called lappets. While in development, the ephyrae become more circular as bell tissue fills in the gaps between the lappets. Two chemicals that can potentially influence ephyral maturation are tyrosine, an amino acid, and thyroxine, a tyrosine-based hormone. The purpose of this project is to test whether exposure to these chemicals affects ephyral development.

This project compares three groups of 15 jellies. One group of ephyrae was fed brine shrimp enriched with squid ink, a source of tyrosine. Another group was placed in a solution of seawater containing the thyroxine hormone. These two experimental groups were compared to the control group, which was fed unenriched food and kept in ordinary seawater.

The results show that metamorphosis was suppressed in the thyroxine group more than in the other two groups. Also, the squid ink group showed an accelerated growth rate.

These promising results suggest that thyroxine plays a role in jellyfish metamorphosis. This research contributes valuable information to the study of jellyfish development and strengthens our understanding of how the physical and chemical environment could affect cnidarian communities, including coral reefs. Also, this research suggests possible evolutionary links to amphibians, whose metamorphosis is known to be controlled by thyroxine.

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WEI, Wendy
Zoology
2013

EFFECTIVENESS OF VARIOUS SPECIES' MUCUS ON INDUCING SETTLEMENT *IN HALIOTIS RUFESCENS* LARVAE

Aquariums have been trying to restore the *Haliotis rufescens* abalone population that once dominated the Pacific Ocean. A crucial stage in the larvae's develop, known as settlement, results in a tremendous mortality rate. In order for the abalone to settle and survive, the right chemical signaling cues must be present. Last year, it was determined that mucus contained a chemical, y-aminobutyric acid (GABA), which allowed the abalone larvae's chemical receptors to perceive the presence of an adult. This project aims to find whether the chemical cue of mucus is species-specific, and the interaction of abalone larvae with the mucus of predators.

The first part of this experiment tests three different types of mucus from *Haliotis fulgens, Haliotis sorenseni,* and *Haliotis rufescens.* After fertilization of *Haliotis rufescens* eggs, a food source of diatoms were cultured on acrylic plates and placed in small trays with UV filtered water. In each of the 3 trays, a different species of abalone mucus was rubbed onto the plates. A fourth tray was left empty as a control. After the larvae hatched, approximately 1,000 larvae were transferred into each of the trays and left to settle. The number of settled abalone on the plates was counted through a dissection microscope. This procedure was repeated for the second part with mollusks *Aplysia californica* and *Megastrea undosa* mucus to see if other molluscs contained similar settlement cues. For the third part, carnivorous snail mucus from *Buccinum undatum* and mellibe was used to study predator-prey interaction in abalone larvae.

Results revealed that *Haliotis rufescens* mucus induced the most settlement at 22%, suggesting that settlement is species-specific and that there are other chemicals involved in signalling cues. For part two, data showed that settlement in tanks with mollusk mucus was almost 5% more than settlement in the control tank. This suggests that other snail species also contain similar chemical signalling networks for their larvae. For the carnivorous snails, larvae showed almost no settlement compared to the control, proving that a predatory defense system could be present in larvae. No defense system has ever been detected in larvae a few days after fertilization.

This data gives greater previously unknown insight to the chemical makeup and workings of larvae that could greatly improve the endangered abalone's survival rate. The results can be applied to any organism during its early life stages, and can even help explain the chemical signalling and adaptation of the human fetus at its very beginning.

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Wu, Tiffany
Zoology

Pigeon Memory and Sound

Pigeons have long been renowned for their remarkable memory, as they are able to navigate hundreds of miles of unfamiliar territory. Sometimes, however, outside auditory factors such as sonic booms or infrasound have been shown to have negative effects on their ability to navigate, hindering them to the point where they cannot find their way home. For racing pigeons, this can be a significant problem, as they often travel over varied terrain where they have a high possibility of encountering such sounds. This project aims to determine if sounds on either end of the frequency intensity spectrum have any discernable effect on a pigeon's memory and thus, navigational ability, in an attempt to gain more insight into how homing pigeons are affected by sound.

In this study, an eight-armed radial maze was used to test the pigeons. Three different audio samples were used as variables: high frequency sounds (at 18000 Hz), low frequency sounds (at 120 Hz), and white noise, as well as a control (no sound). Four pigeons were involved with the testing, and each bird was tested with each variable. The overall maze completion time for each pigeon/variable was averaged and compared. From start to finish, the total experimentation time lasted about five weeks.

Results showed that low frequency sounds had the most marked effect on the pigeons' run times, slowing them down by approximately 25%. This was followed by high frequency sounds, which slowed them down around 16%. Finally, white noise was shown to slow down the pigeons' times by approximately 10%.

The data shows that low and high frequency sounds negatively affected the speed at which the pigeons could navigate a maze, proving how sound can influence how well a pigeon can orient itself in an unfamiliar environment. In the maze, the pigeons tended to revisit maze arms and come to a stop more often when exposed to high/low frequency sounds compared to the control, suggesting that these sounds impact their ability to make sense of their surroundings. In the wild, this would translate to the pigeons having difficult maintaining their correct bearing during a race where these sounds were present. With this data, more insight is gained into these birds' cognitive processes, and hopefully will contribute to unlocking exactly how they navigate, as well as decrease the number of pigeons lost during competitions.

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YONG, Stephanie
Zoology

Observation of Threatened California gnatcatchers in various locations of California Sagebrush

My project was set up to find if the *Polioptila californica californica's* abundance would increase along with the growth of *Artemisia californica*. The purpose of doing this project is to see if the California gnatcatcher is able to recover from that title with the help of newly installed California sagebrush. Therefore, I hypothesize that with the growth of newly installed California sagebrush; there will be an increase of California gnatcatchers as well.

When collecting data, I exploited PVPLC's newly installed canopies and measured the canopy's height, and two diameters. To do this, I went on surveys with volunteers of PVPLC to Three Sisters Reserve and collected data from the site which had the habitat of the California gnatcatcher. Also, I have collected data at two sites within Vicente Bluffs as well as Alta Vicente.

Due to the non-normal distributed data, I used the Kruskal-Wallis test to statistically compare the variance of the maturity of Three Sisters Reserve, Vicente Bluffs, and Alta Vicente sites. After completing the test, it was reported that the median values among the three sites were greater than would be expected by chance ($P=<0.001$). To investigate the numerical data of the California gnatcatcher, I calculated the observational rate for each site. Overall, from comparing the three observational rates, the number of California gnatcatchers is greatest in Alta Vicente.