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Animal Physiology/Pharmacology

High Rate of Gain Versus Cost Per Pound Austin Greve

Two very common ways to increase the weight of feeder calves quickly are grazing on wheat pasture and feeding a silage ration. The question this experiment tries to answer is which is more cost effective. To test the hypothesis that wheat pasture is more cost effective, eight heifers were divided into two groups, four of which were placed on wheat pasture ration and four of which were placed on a silage ration. The hypothesis for this experiment is that wheat pasture will be more cost effective but have a slower rate of gain while the silage will have a faster rate of gain but cost more. As hypothesized the heifers placed on a silage ration gained fifty five pounds more per head in the two weeks of eating that food source than did those on the wheat pasture food source.

Botany/Plant Physiology

Potential of the Aquatic Plant, *Salvinia*, as a Carbon Sequestration Organism in a Bioreactor Kyle Spies

The purpose of this project was to assess the potential of *Salvinia molesta*, a common water plant as a carbon sequestration organism in a bioreactor. It was hypothesized that *Salvinia molesta* would grow more rapidly in a bioreactor utilizing increased light exposure and a carbon dioxide enriched environment. It was concluded following a seventeen day test that *Salvinia molesta* would not be a particularly successful carbon sequestering agent. In fact it was determined that the samples subjected to the bioreactor environment produced less biomass than the control group grown in creek water and standard lighting. Furthermore, it was found that *Salvinia molesta* grown in a modified fertilizer base were less successful than the *Salvinia molesta* grown in creek water. One possible explanation for the lack of *Salvinia molesta* growth in the reactor could be the decrease in pH levels produced due to the carbon dioxide enriched environment.

The Effect of Environmental Enrichment on *Loxodonta africana africana* Andy White

This experiment was conducted at the Sedgwick County Zoo for a period of nine days from December 24, 2006 to January 1, 2007. During this period of time I observed the two female elephants for one hour each day from 12:00 P.M. to 1:00 P.M. Environmental enrichment was compared to an every day routine to show the effectiveness of its ability to make two female *Loxodonta africana africana* become more active. The two females had three days of a normal routine, or control, and were given two different types of enrichment for three days each. The control was the normal bale of hay spread on the floor for the girls to walk and pick up. The first enrichment was a cylinder, with holes drilled in it, filled with alfalfa, apples, carrots, and apple wafers chained around the iron bars in the indoor exhibit. The other enrichment was an alfalfa grain bag with banana smeared on the inside with alfalfa, sweet potato, and apples rolled up and hidden around the indoor holding facility. Their activity was then measured by how much they walked, foraged, drank, ate, slept, and usage of their trunk. These several different actions were based on a timing system to see how long they did each, and whether any of them were increased or decreased. The results were that the first enrichment increased the trunk usage, walking, and foraging, while the second enrichment increased foraging, walking, and trunk usage while they were looking for the bags.

Cell Biology

Tobacco's Affect on Cell Reproduction Christian Warner

My project tested tobaccos affect on onion growth and cell reproduction rate. This found the affect of tobacco on healing wounds and extra scarring from wounds. Three trials were performed with six onions per chemical (tobacco solute, water). The onions were measured every four days for a twelve day span.

Chemistry

Use of pH and/or Thermochromism to Customize Trombe Wall Energy Storage Systems Erik Lee

The purpose of the experiment is to utilize solution pH and a thermochromic panel in a unique trombe wall application to control the thermal and light environment in an enclosure. It was hypothesized that altering the pH and color of the solution in the trombe wall solution would affect the thermal storage and light blocking capabilities of the wall. Furthermore, it was expected that the addition of a thermochromic panel could further increase options for interior environmental control. Results indicate that pH and indicators resulting in darker colored trombe wall solutions have more potential for manipulation of interior environments via changes in trombe wall coloration. Thermochromic color variations can further control interior light and temperature

The Effect of Temperatures and Inhibitor on the Kinetics of the Enzyme Catalase Varsha Subramanyam

Hydrogen peroxide is a byproduct of metabolism in many living organisms. It is toxic and must be converted quickly. To manage this problem the enzyme, catalase, is released to decompose the hydrogen peroxide into harmless oxygen gas and water. Catalase is a common enzyme found in living organisms. It has one of the highest turnover rates for all enzymes. The reaction between the catalase and hydrogen peroxide is extremely rapid. This study investigates the effect of catalase on hydrogen peroxide at different temperatures and with the presence of a noncompetitive inhibitor, copper(II) sulfate. The level of froth produced when the hydrogen peroxide reacted with catalase was observed and recorded. It was concluded that the level of froth produced increased at higher temperatures, and with the presence of a noncompetitive inhibitor.

Use of Calcium Carbonate to Enhance Permanence of a Bleached, Abaca-Based Paper Kathryn Weaver

The purpose of this project was to enhance the preservation of abaca-based, hydrogen peroxide bleached paper by using varying amounts of calcium carbonate filler. It was hypothesized that the calcium carbonate filler would decrease acidity upon aging and therefore reduce paper degradation. Experimentation involved producing the paper, bleaching it, and then artificially aging it according to Library of Congress procedures. Tests were performed on both non-aged and aged paper to analyze the impact strength, load-bearing strength, color, and pH. Data analysis indicates that both impact and load-bearing strength decrease upon aging in all paper, regardless of the amount of calcium carbonate; however, all the paper containing calcium carbonate became significantly less yellow upon aging. In addition, the aged paper with calcium carbonate retained a neutral pH, while the control became more acidic. Paper with green, blue, red, and black ink was also aged, but the aging techniques used resulted in no effect upon the ink color.

Use of Nanoparticulate Additives
to Design Resin Composites
Peter DelNero

The purpose of this project is to manipulate the physical properties of epoxy resin composites through unique combinations of nano- and micro-scale fillers. It was hypothesized that unique combinations of glass microspheres, carbon nanotubes (CNT), zirconia and clay nanoparticles could enhance the relative impact resistance, load-bearing strength and thermal insulating capacities of an epoxy resin substrate. The procedure involved two phases: first, the design and testing of resins with varying concentrations of each additive. Second, the design and testing of resins with unique combinations of multiple fillers. Phase I data analysis indicated that low concentrations of glass microspheres increased the impact resistance of the composite, while the other nano-particles depressed the impact resistance. Further, zirconia consistently decreased the thermal insulating capacities of the resin, while the clay, glass and CNT's demonstrated mixed results. Phase II involved testing specific combinations of fillers in the resin. The results suggest that a combination of glass microspheres and CNT's significantly enhance the thermal insulating capacities of the composite, while glass/zirconia and glass/clay combinations significantly decreased the thermal insulating capacity. Data analysis also indicates a decrease in impact resistance for all combinations of fillers as compared to the clean epoxy control. The load bearing strength of the CNT/glass combination was less than that of other combinations.

Potential of Pine Oil to Inhibit Gelling
of Biodiesel Fuels in Cold Climates
Daniel Janvrin

The purpose of this research was to determine whether biodiesel created from pine oil possesses a lower congealing point than more traditional soy or animal fat biodiesels. The practical application of this purpose was to discover if a pine oil biodiesel could provide better cold-weather characteristics than traditional biodiesels. It was hypothesized that the pine oil biodiesel would have a significantly lower congealing point than other biodiesels. Testing was done on soy, animal fat, and pine oil biodiesel, and it included a comparative measure of viscosity at various temperatures, caloric content of each fuel, and congealing temperature of each fuel. Data analysis indicates that pine oil biodiesel does possess characteristics suitable for a colder climate fuel source. The data suggests that the heat content of pine oil biodiesel is similar to that of animal fat biodiesel and soy biodiesel, while its viscosity is significantly lower at lower temperatures (8-11°C). Moreover, its congealing temperature was significantly lower than that of soy and animal fat based biodiesels. When used alone or as an additive to other biodiesel fuels, pine oil biodiesel can successfully decrease the congealing temperature of the fuel without significantly altering other desirable characteristics the of biodiesel fuel.

Engineering Science

The Optimization of the Current
Phlebotomists' Sharps Container
Rami Zayed and Terry Sharp

Proper needle disposal is a crucial issue within health-care facilities with the increasing possibility of disease transmission. Sharps containers were developed to avoid the discarding of dangerous materials into normal waste sites and recycling centers. However, malfunctions and poor designs of sharps containers are causing health-care workers to acquire potentially dangerous sharps injuries. A prototype of the current phlebotomists' sharps container was developed to prevent direct hand access of the health care worker to the contents of the sharps container. An experiment was conducted to test the durability of this design in preventing dangerous sharps injuries. After analyzing the data from the mechanical tests and qualitative surveys, it was proven that the modified design is a practical solution to the dangers of improper needle disposal.

Environmental Science

The Human Exposure to Electromagnetic
Fields in the Home Environment
Nick Czarnecki

Exposure to electromagnetic fields (EMFs) occurs everywhere. EMFs are electric and magnetic fields produced by the generation, transmission, and use of electricity. Human studies suggest that there is a link between exposures to EMFs and adverse health conditions. Guidelines on recommended occupational limits have been offered by independent scientific institutions or organizations. It is not known if there is a safe threshold of exposure to EMFs. With the abundance of electronic devices in the average home, people are being exposed to electromagnetic radiation at home, as well as at work. Strengths of the electric and magnetic fields within a home were measured to determine a representative exposure over the time spent in the home. The experiment was to prove that the amount of exposure to EMFs was greater than the recommended allowable occupational limit. However, weak EMF fields were measured in the home and found to be well below the recommended occupational limits by several magnitudes. The strength of the field measured at the test point within each room was influenced by the distance to the sources of EMFs in the room. It was concluded that the EMF exposure within homes contributes a small amount to the overall exposure to electromagnetic radiation, but should be watched and monitored as we gain more powerful technologies.

Microbiology

The Improvement of Laundering Processes Through the Enhancement of Laundry Equipment Thao Nguyen and Esha Cheema

Bacterial cross-contamination on certain surfaces in public facilities can be difficult to detect due to the microscopic structure of bacteria, and can result in human health concerns if precautions are not taken. In a public laundering facility, cross-contamination can occur between clean and soiled laundry when customers utilize surfaces used by the general public that are assumed to be clean. A laundry basket equipped with a personal folding board and sanitizing products will be marketable to laundromat customers because it provides a sanitary surface for folding and storing laundry. A basket with a retractable laundry folding board and compartments to store laundering materials such as detergent and surface sanitizer was constructed. A durability and applied force test was conducted which concluded that the product was capable of withstanding more than the accepted value of weight and the folding board could be easily retrieved in less than the accepted value of force. A public survey concluded that eighty percent of the population would actually purchase the product.

Do Sponges Really Get Clean? Taylor Abbott and Jessie Boyer

By using three different methods, four sponges were tested on how clean they would get and which method was the most efficient with cleaning the sponges. Emerging them in Clorox Bleach, placing them in the microwave and sending them through dishwashing cycle were the methods and there was a control. Throughout the experiment, we wanted to see how each method was going to do with cleaning the sponges. The main thing we were concerned about was if each trial of the methods was resulting in what we wanted them to be. For the microwave, we had two different sections of sponges with 10 milliliters of water on them before we placed them in the microwave for a minute. The dishwasher was a normal cycle, with two more sections of the sponge, and the Clorox bowl consisted of two cups of water and three tablespoons of Clorox Bleach and the two sections of the sponge were submerged in the solution for five minutes. Then after the trials were completed, each of the two-sponge sections was stamped on the correct Petri dish and the right section according to their labeling. In the end, the result was that the Clorox Bleach solution did the best job of cleaning the sponges. For each sponge section of the Clorox Bleach the number of bacteria, colonies were consistently lower than the other methods.

The Effect of Bacteria Growth on
Bottled Water Compared With Tap Water
Linden Stirk

The purpose of this project was to determine which brand of bottled water is the purest and safest to drink. The problem was to find out which brand contains the most, if any, bacteria. The idea being that tap water would contain fewer bacteria because it has the highest regulation standards. In order to test this hypothesis, three brands of bottled water from different sources, along with tap water acting as a control, were selected for this project: Evian – highland spring water, Ozarka – lowland spring water, and Aquafina – purified tap water. Also, two batches of tests were done: one for gram negative bacteria and the other for gram positive bacteria. The first batch of tests was done using McConkey Agar, which is conducive to the growth of gram negative bacteria. The second batch of tests used Nutrient Agar to encourage the growth of gram positive bacteria. Three trials were done for each type of water. With the use of disposable gloves and ethanol, the aseptic technique was followed to make the working area sterile. Then, using a micrometer, one microliter of each type of water was collected and inoculated into the corresponding agar plates. The agar plates were then stored in an incubator at 37° C for 48 hours. The agar plates were then removed from the incubator, observed for the presence of bacteria colonies, and the results recorded. The agar plates were left at room temperature for a further two days. Observations and results were recorded at the end of each 24 hour period. No bacteria colonies were ever found on any of the gram negative plates. After the first 48 hours, no bacteria colonies were found on the gram positive plates. However, on Day 4 a total of five colonies were observed in the Evian samples, one colony was found in the Aquafina samples, and no colonies had grown in either the Ozarka or the control tap water. These results suggest that neither bottled water nor tap water contain any sign of gram negative bacteria, which includes the harmful pathogens of E-coli and Salmonella. If these results are typical, it is relieving to find that very little bacteria developed in the gram positive samples. However, due to the limited time and the number of samples that were available for testing, it is not felt that these results can be taken as conclusive. More extensive testing would need to be performed to determine whether or not these results are indeed typical.

Growth Rate of *Lactobacillus acidophilus*
in Media of Different pH
Meghana Kuppa

The aim of this research is to study the effect of extracellular acidic pH shift on growth rate of *Lactobacillus acidophilus*. The researcher predicted that, if the acidic extracellular pH shift has an effect on the growth of *Lactobacillus acidophilus*, then the maximum growth rate will occur in the control Petri dishes which have a pH of 4 while the growth will decrease in the Petri dishes, which have a pH of 3, 5 and 6 and the Petri dishes containing the pH of two will not produce any growth. To vary the pH levels of Petri dishes, buffer solutions were used. Petri dishes were swabbed with bacteria, then the buffer solutions were poured into the dishes and the dishes were placed in the incubator for five days and each day bacteria were counted using grid paper. From the data it appears that pH does affect the growth rate of *Lactobacillus acidophilus*. The control group, whose pH was at 4, had the highest growth; the next highest growth rate occurred in the Petri dishes whose pH was 5. The third highest growth rate occurred in the Petri dishes whose pH was 3. The fourth highest growth rate occurred in the Petri dishes with a pH of 6. The growth decreased in the Petri dishes, whose pH levels were 3,5 and 6, as predicted in the hypothesis. The least growth occurred in the Petri dishes containing the pH of 2, this contradicted the hypothesis.

Application and Recovery of Particulate
Silver in a Bactericidal Film
Elisabeth Cowin

The purpose of this project is to determine the antibacterial effectiveness of silver particles embedded within a biodegradable plastic film. It was hypothesized that particulate silver could successfully be incorporated into the film and that the film containing the concentration of silver could effectively control strains of E coli (K-12) bacteria. Experimentation first involved incorporating concentrations of 2ml, 4ml, 8ml, and 16 ml of Natural Path/Silver Wings Colloidal Silver (500 ppm) into a gelatin based film. Both films, with and without silver particles (the control), were tested for the ability to inhibit growth of E coli (K-12). Bacterial growth was monitored via Hach Company's m-ColiBlue24. All test groups yielded the same results; that the plastics containing silver particles were capable of inhibiting growth of E coli (K-12) bacteria. Furthermore, the plastic control exhibited the most bacteria colonies, while the plastic with the largest amount of colloidal silver, the least. The hypothesis was supported in that a biodegradable, antibacterial film could be produced. It was also found that the bactericide, silver, could be effectively extracted from the biodegradable plastic. This was supported by both the silver recovery test using the bacterial protease which yielded silver particles, and by the proposed method of dissolving, autoclaving, and re-drying the plastic film.

Use of Photocatalysis and Chelation in a
Low-Tech Filter to Remove Bacterial and
Heavy Metal Contaminants from Drinking Water
Natalie Como

The purpose of this project was to design and test a low-tech water purification system combining sand filtration, chelation, and photocatalysis in order to reduce turbidity and remove both heavy metal and biological contaminants from drinking water. It was hypothesized that a staged system could be designed to reduce the levels of turbidity, lead, and Escherichia coli present in the water to levels designated safe by the Environmental Protection Agency. The safe levels for Pb+2 and Escherichia coli are less than 15 parts per billion and zero colony-forming units per liter, respectively. The system would provide potable water by removing contaminants in 8 hours or less. Experimentation involved sand filtration of water polluted with clay particles and spectrophotometric determination of transmittance as a measure of turbidity. Next, water polluted with lead nitrate was filtered through chitin, a known chelator, and tested for effectiveness at removal of Pb+2 ions. Finally, water polluted with Escherichia coli (K-12) was placed in clear bottles containing TiO₂ coated gravel. Following exposure to sunlight, bacterial concentrations were determined and compared to controls to ascertain the effectiveness of photocatalysis at eradicating bacteria. Data analysis indicates that sand filtration and chitin-based chelation are effective at reducing turbidity and decreasing lead contamination to below the EPA's action level, respectively. Furthermore, titanium dioxide is capable of reducing the amounts of Escherichia coli (K-12) in water faster than UV light alone. With exposure to sunlight for 7 hours, the amount of bacteria present in the titanium dioxide bottles was decreased from approximately 800 to 0 colony-forming units per 30mL. It was concluded that a low-tech water filter could indeed be designed from recycled materials to bring levels of harmful pollutants under safe EPA levels. Since outside research has shown that chitin is capable of chelating various metals in addition to Pb+2 and titanium dioxide is capable of eradicating biological contaminants in addition to E. coli, the filter would likely be capable of reducing the concentrations of a wide range of pollutants.

Physics

The Pressure Braking System

Tuan Le, PJ Phachantry and Kyrouz Bou Malhab

The invention of the brake light on the automotive vehicle was to prevent rear-end collisions from following cars. A problem was investigated to find out what type of braking light would be most effective in the prevention of collisions. It was hypothesized that if drivers on the road are more informed of the rate of deceleration, of the car immediately in front of them, then the amount of collisions nation wide would decrease. A pressure sensitive system was designed to measure the deceleration of a vehicle. The pressure sensitive system proved reliable and is a system that can warn following vehicles.

Soundproofing Quality of Selected Wall Materials:

Drywall, Wood, and Glass

Molly Allison

In schools today, it is difficult for students, along with teachers, to focus on studies when there are noises coming from the hallways or adjoining rooms. If the walls of classrooms were made of a different material, perhaps students and teachers could focus more on school. The problem that was tested was the effect of a sounding alarm clock on how many decibels pass through common constructing materials, such as drywall, wood, and glass. The hypothesis that was formed was that if a small wall of drywall, wood, and glass were each placed between a sounding alarm clock and a sound level meter measuring decibels, then the drywall would absorb the most decibels due to its low density and arrangement of molecules.

Effect of Electrolytic Concentration on the Efficiency of Voltaic Cell

Dipendra Khatiwada

A total of six trials were done in order to find out the relationship between the concentrations of the electrolyte (acids) used and the efficiency of the voltaic cells. The acids used in the experiments were hydrochloric acid and sulfuric acid of different concentrations. The six different concentrations were 2.7M HCl, 1.6M HCl, 0.714M HCl, 6.25M H₂SO₄, 4.9M H₂SO₄, and 2.3M H₂SO₄. The electrical energy produced during each trial was calculated by finding the area under the power-time graph. The theoretical energy (maximum energy) that could be produced by the cell on the circuit was calculated from the amount of zinc eroded and the applicable standard cell potential. The efficiency of the cell was then calculated as the ratio of the useful electrical energy produced to the theoretical energy that could be produced by the cell in the circuit. The results suggest that the efficiency of the cell is inversely proportional to the concentration of the acid used, for both hydrochloric acid and sulfuric acid. It also shows that the efficiency of the cell depends upon the type of electrolyte used.

Resistance and Its Relation with Some
Physical Properties of Conductors
Prabesh Karki

The effects of various physical factors like temperature, tension, rigidity, and the physical shapes on the resistance of various conductors were studied. The possible reasons for the particular phenomenon have also been discussed after each experiment. The four experimental conductors were aluminum, copper and, steel, and carbon. Carbon rod has been used only once in the experiment -3 and, in experiment-5 only aluminum was used. All of these conductors were of equal dimensions in a particular experiment except the carbon rod. All of the wires were 18 gauges but the length varied from experiment to experiment, but for a particular experiment the dimensions of all the conductor wires were same except for carbon rod. The carbon rod was 5.0cm by 0.8mm. Wheatstone bridge was extensively used in the measurement of resistance.

Social and Behavioral Science

How do Students Retain Information:
Through Reading or Listening?
Lea Greenberg and Addison Frei

High school freshman students were tested to see whether they remember more words when presented orally or visually. Forty-six students (21 male and 25 female) were first shown a list of ten tri-syllabic words for ten seconds on a PowerPoint. They were then instructed through the text on a following slide to record (for one minute) each word that they remembered. Subsequently, the students listened to a pre-recorded spoken list of ten different tri-syllabic words. They were then instructed by the next slide to record the remembered words as they did in the previous step. The recording sheets were collected and results were tabulated, analyzing the percentage of words memorized between listening and reading. The percentage of words memorized in both categories was also compared between genders. The test subjects remembered, on average, 42.826% of ten words through listening and 40% of ten words through reading. Females remembered 42% of ten words through reading and 45% of ten words through listening. Males remembered 37% of ten words through reading and 40% of ten words through listening.

The Effect of Spirit Day Dress on Student Behavior
Brad Hermreck and Nick Ojile

In our presentation, we hypothesized that when students were out of uniform dress, their behavior was worse. We tested this by collecting the amount of trash left on the floor during regular uniform days and those which students are allowed to dress in "spirit day" attire. Based on the amount of trash collected on both types of days, we determined whether or not our hypothesis was correct.

The Effects of Music on Behavior

Cassie Lehr

Heavy metal, punk, and rap music were tested to show if they influence antisocial behavior and trouble making tendencies in high school students. One hundred twenty-eight students were surveyed and asked how often they listen to each of ten different genres of music, how their relationships are with six different categories of people, how many detentions and suspensions they receive in a year, and how many times they have been in trouble with the law. The results were split into four different groups: how many of the three genres (heavy metal, punk, and rap) they listed at a four or five rating on a scale of one to five. One group was comprised of those students who only gave one of the three genres tested a four or five rating, the second group was composed of those who selected three of the genres, the third group contained those that gave all three of the genres a four or five rating, and the final group was the remaining students who did not select either of the three testing genres. All the results of the survey were compiled and showed those that do not listen to either of the three genres regularly show better relationships with others and get in trouble less frequently.

Zoology

The Effects Of Different Metals on the Hatching of Brine Shrimp

Tommy Postlewait

The researcher started with the problem of how different types of metal effect brine shrimp growth. The researcher hypothesized that the brine shrimp would grow better in potassium than of zinc, calcium, sodium, magnesium, manganese, cobalt, and copper. The independent variable was the metals and the dependant was brine shrimp growth. The constant variables that remained the same were amount of salt water in each water, the amount of food, the type of food, the amount of eggs that were in the container, the amount of light each container had, amount of light used for measuring, and the area used to measure the density of brine shrimp. The researcher put together an experiment consisting of different metals after he calculated the amount that each container would need of different metals. He then added the amount of metal to the designated container that contained the amount of salt water instructed to put into each jar. The researcher then added to the jar 0.1g of brine shrimp eggs and allowed then to sit for two days over the weekend. The researcher then took measurements. The researcher then concluded that there was a difference in the brine shrimp growth when they were exposed to metals.