Name(s)
Haley L. Brooks

Project Number
S1301

Project Title
The Effect of Heteractis magnifica on the Cell Viability of Multicentric Canine Lymphoma: Year II

Abstract

Objectives/Goals
Venom from the sea anemone, Heteractis magnifica, has bioactive and cytotoxic compounds. In this study, cytotoxicity induced by Heteractis magnifica venom was investigated using a hemocytometer and a trypan blue solution to determine malignant canine lymphoid CLL-1390 cell viability.

Methods/Materials
Heteractis magnifica venom was obtained by the milking technique. This process is proven not to be harmful to the animal. The CLL- 1390 cell line was obtained from the Leukocyte Antigen Biology Laboratory at UC Davis. The cell line was supplemented with a hybridoma media.

Results
If the Heteractis magnifica venom is introduced to the multicentric canine lymphoma cells, then multicentric canine lymphoma cell viability will be significantly reduced, appears to be supported. The result of the experiment was a reduction of cell viability to an average of 12.82%.

Conclusions/Discussion
Overall, H. magnifica venom was highly cytotoxic to CLL-1390, and the phenomenon could be the killing phenomenon via the death receptor- mediated and the mitochondria-mediated apoptotic pathways.

Summary Statement
I investigated and examined a novel aproach to reduce malignant cell viability through sea anemone venom.

Help Received
I conducted all work independently although received extensive support from Dr. Stan Kunin, Dr. Sue Downing, and Kristy Harmon.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Stephany R. Brundage

Project Number
S1302

Project Title
Using the C Locus Color Alleles to Prove that Oryctolagus cuniculus Ovulates Extra Eggs with a Subsequent Covering

Abstract

Objectives/Goals
The object of this project is to use color genetics to prove that rabbits will either ovulate more eggs when bred a second time 12-24 hours later or that the unfertilized eggs will be fertilized during the second breeding. This is proved using two separate sires that service the does 12-24 hours apart.

Methods/Materials
To prove my hypothesis, I used a set of nine Californian does (female rabbits) bred to a group of three Californian bucks (male rabbits) and an English Spot buck. Each doe was covered by a buck of one breed, then 12-24 hours later bred to a buck of another breed. I retested and re-bred one Californian doe in the same manner, then used Britannia Petites to test this theory. I was able to isolate the C locus on the Britannia Petites by using a ruby eyed white buck, a seal marten buck, and four ruby eyed white does. The genotype of each rabbit used in this experiment was tested using the conclusions of a previous science fair project.

Results
My first set of results shows litters from only one sire in all 8 tests. The second set of results shows litters from only one sire in all 5 tests. Of the 13 does that had litters, each one had a litter from the first buck they were bred to. Overall, the results were inconclusive.

Conclusions/Discussion
The results of this project proved that it is not common for does to ovulate a second time. With my results, I was able to prove that less than 8% of does ovulate extra eggs or have unfertilized eggs left over. To establish a proper control, all does were completely unrelated and of two different breeds. This project can be applied to rabbits being raised to preserve an endangered breed or for a food source, where access to viable sperm is limited. Using this project, I was able to conclude that it is more effective to breed more does with the same buck rather than servicing the same doe multiple times.

Summary Statement
I attempted to prove that the domestic rabbit will ovulate extra eggs when bred a second time 12-24 hours later, but was proven negative.

Help Received
None. I designed and coordinated the experiment myself.

Name(s)
Maggie S. Chen

Project Number
S1303

Project Title
Nanotherapeutics Enhanced Artificial Liver against Antibiotic Resistant Bacteria

Abstract

Objectives/Goals
With the pressing issue of antibiotic resistant bacteria, anti-virulence therapies have emerged as a non-antibiotic strategy for bacterial elimination through removal of bacterial toxins. Usage of antibiotics has also provoked serious liver diseases, with the liver unable to metabolize large quantities of drugs. I aimed to develop a synergistic 3D bioprinted artificial liver platform containing cell membrane coated nanotherapeutics surrounding a liver cell scaffold. This artificial liver platform has the ability to eliminate antibiotic resistant bacteria through anti-virulence therapy and to reduce antibiotic toxicity through liver cell metabolism.

Methods/Materials
I started with the design of a hydrogel-based tubular platform with concentric cylinders. The inner cylinder contains HepG2 liver cells, while the outer cylinder encompassing the liver cells is a hydrogel wall embedded with red blood cell membrane coated nanoparticles (RBC-NPs). The RBC-NPs were synthesized through self-assembly methods and incorporated into the hydrogel monomer solution. Solutions containing cells and RBC-NPs were photopolymerized layer-by-layer using a light-based 3D bioprinting method, allowing for multi-layer printing of the cells surrounded by the nanoparticles.

Results
Through extensive 3D printing optimization, materials characterization and proof of concept testing, I have successfully 3D-printed the nanotherapeutics-enhanced artificial liver. The size and surface properties of the RBC-NPs can be well-controlled, while their function is maintained after the 3D printing process. I found that my platform promoted liver cell survival and neutralization of bacterial toxins. The liver cells successfully metabolized the drug rifampicin, while the RBC-NPs absorbed hemolytic toxins, demonstrating the ability for anti-virulence therapy and subsequent bacterial elimination.

Conclusions/Discussion
The nanotherapeutics-enhanced artificial liver platform demonstrates broad spectrum detoxification of bacterial toxins. It is time and cost efficient, and supports liver cell growth for enhanced drug metabolism. The 3D bioprinting method allows for rapid manufacture of the micro-liver scaffolds, while the combination of nanotherapeutics with liver cells provides a powerful platform to clear antibiotic resistant bacteria.

Summary Statement
I created the first nanotherapeutics-enabled artificial liver to enhance drug metabolism and eliminate antibiotic resistant bacteria.

Help Received
Used the lab equipment of Dr. Liangfang Zhang at the University of California, San Diego

Name(s)
Tarun S. Chiruvolu

Project Number
S1304

Project Title
Point-of-Care Detection of Mutations: A Lateral Flow Assay for Detecting NSCLC in Humans

Abstract

Objectives/Goals
Lung cancer (NSCLC) causes >200,000 deaths in US annually. Mutation detection costs 1000s of dollars and takes days. Rapid, low-cost point-of-care (POC) devices for cancer mutation can aid treatments, and with new therapies reduce mortalities. Lateral flow assays (LFA) commercialized for pregnancy/glucose tests offer a low-cost option for mutation detection. Combining microfluidic flow, and precision of nucleic acid hybridization, this project aims to show T790M mutation detection in NSCLC using model oligonucleotides (ON). The goal is to develop a simple, easy to use, and repeatable LFA by validating basic streptavidin-biotin binding assay for test strip (TS) design and use it to show ON hybridization assay for point mutation detection.

Methods/Materials
Various TS designs, and >20 tests were used to optimize a 4mmx40mm strip and assay conditions on Whatman (1CHR chromatography paper). 40nm Au-nanoparticle-streptavidin (SG) reporter, biotin-bovine serum albumin (B-BSA) capture molecule, and 1xPBS wash buffer were used to show site-specific binding from 5ul of SG to B-BSA. This was applied to small oligos-wild type(Control-CO,1mM), T790M with a point mutation (Test-TO,1mM), and biotin-ON probe (PO, 1mM) complimentary to TO and CO in 1xPBS. PO was incubated with SG as reporter in the assay to bind to test(TL) and control lines(CL). Different concentrations of PO and TO were tested to identify conditions for reporter binding to TL and CL. Negative control with SG only (no PO) was used to show binding was specific. Tests were done to get repeatable results. Actual tests needed <1hr (<1min to blot PO-SG reporter, <1hr for wicking, signal).

Results
SG-B-BSA LFA successfully showed repeated high-level binding. From over 100 ON LFA tests, several showed binding to both TL and CL, but further research can fully validate the assay at lower detection limits.

Conclusions/Discussion
This project expands utility of LFA from clinic to the field by successfully mimicking a lab test and allowing mutation detection at ~0.5mM. Further development of a complimentary probe for cell's genome would enhance this method's success and utility.

Summary Statement
By detecting point mutations, this project lays foundation for advancing POC for lung cancer diagnosis and allows cross-application to other epithelial cancers or hereditary diseases, streamlining treatment methods.

Help Received
Dr. Debjani Roy for guidance, support, and parents for help with supplies, printing, board.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Jennifer Cruz; Jenifer Najera

Project Number
S1305

Project Title
Impact Force of Martial Arts

Abstract

Objectives/Goals
The objective of this study is to measure the force of Taekwondo strikes between one experienced and one inexperienced person with similar body mass.

Methods/Materials
Two wood cutting boards, hot glue gun, glue sticks, ruler, five springs (3.2in), slow-motion camera and a 1.5kg weight. Build a board with all these materials to measure out the force of each Martial Art strike.

Results
The trained person in Taekwondo has more force in each strike that the untrained person.

Conclusions/Discussion
The trained person in Taekwondo had more force in each strike even though both female test subjects had similar body mass.

Summary Statement
A board was created to measure the force of Taekwondo strikes.

Help Received
Our science teacher gave us ideas of some different types of boards to build.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Rohan R. Datir

Project Number
S1306

Project Title
A Breathing Solution Which Does Not Cost Any Money, but Can Cure Millions of Humans Who Suffer from Respiratory Issues

Abstract

Objectives/Goals
Respiratory illnesses and other such medical complications in humans account to a loss of $58 billion annually, and nearly 7% of all deaths are accounted to respiratory illnesses, including but not limited to: COPD, Asthma, Pneumoconiosis, and Pulmonary Sarcoidosis. I hypothesize that the use of respiratory exercises in a specific order will dilute the symptoms of such medical complications, potentially saving $58 billion annually and preventing 7% of deaths.

Methods/Materials
Data was collected from 25 subjects, 20 of which would be the Experimental Group (Group A: 14, Group B: 6), and 5 controls. Both Group A and B were given 4 respiratory exercises, but Group A conducted Sound Breath, Breath Retention, Bellows Breath, and Deer Seal in that specific order while Group B did the same exercises in no particular order. The Control Group was asked to not exercise. A spirometer measured the inhalation in Cubic Centimeters per Second (cc/sec).

Results
Group A and B expressed an increase of 80 cc/sec and 60 cc/sec respectively while C showed a decrease of 20 cc/sec. Also, a 116.22% mean change in cc/sec was observed in the Experimental Group while the Control Group showed a 2% mean decrease in cc/sec. The Mean Absolute Deviation (MAD) was 19.871 for Experimental and 6.1 for Control. Subsequent analysis found the statistical significance to be between 0.05 and 0.02, conclusively proving statistical significance. This proves the hypothesis correct.

Conclusions/Discussion
This study is the first of its kind to incorporate the use of respiratory exercises and its effects on the diaphragmatic strength with the order in which such respiratory exercises were conducted daily in addition to the calculations of their statistical significance. Respiratory exercises have the potential to save $58 billion in the US and prevent 7% of annual deaths. In addition, such exercises can alleviate the symptoms of respiratory illnesses. Subsequent analysis of the results of this study have found there to be a 116.22% change of cc/sec in the Experimental Group as well as a 2% decrease in cc/sec of the Control Group. Furthermore, the MAD of this experiment data was 19.871 for the Experimental and 6.1 for the Control, leading to the statistical significance between 0.05 and 0.02, proving the data collected from this experiment statistically significant. These findings have great potential to change the world.

Summary Statement
The use of respiratory exercises in a specific order will dilute the symptoms of medical complications related to respiratory illnesses, thereby potentially saving $58 billion annually and preventing 7% of deaths.

Help Received
My STEM academy Director Dr. Kim Lawe (Ed. D.) & teachers provided guidance as needed. Dr. Prajakta Deshpande (M.D.) and Dr. Abhijit Deshpande (M.D.) reviewed my analysis.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Ariel M. Fernandez

Project Number
S1307

Project Title
A Comparative Study of the Tensile Strength and Elastic Modulus of Mammalian Ventricular Tissue

Abstract

Objectives/Goals
The objective of this project was to determine the tensile strength and elastic modulus of mammalian ventricles in order to compare these values between hearts of different mammals as well as between biologically-preserved and natural hearts. Based on the Frank-Starling Law of the Heart, calculating the elastic modulus should assist in predicting the stroke volume, cardiac output, and efficiency of the heart.

Methods/Materials
3 biologically-preserved heart specimens from cows, pigs, and sheep and 3 fresh cow hearts were obtained from commercial sources. Each heart was dissected to obtain the dorsal and ventral sides of each right and left ventricle. These specimens underwent a gravity tensile test, in which they were suspended in the air using wire and a stepladder. A pail was attached to the base of each specimen, and coins were added to the pail until the specimen fractured. Using the kilograms held, cross-sectional area, and the gravity acceleration constant, engineering stress-strain could be calculated and plotted into Microsoft Excel. This allowed for the determination of the tensile strength and elastic modulus of each specimen.

Results
Researched Body Mass of Each Mammal: Sheep (55.5 kg), Pig (192 kg), Cow (465 kg)
Averaged Results for All Mammalian Ventricular Specimens:
Kilograms Held: Sheep Heart (5.85 kg), Pig Heart (12.61 kg), Fresh Cow Heart (15.76 kg), Preserved Cow Heart (25.85 kg)
Tensile Strength: Pig Heart (79,699.22 Pa), Fresh Cow Heart (83,984.76 Pa), Sheep Heart (111,514.41 Pa), Preserved Cow Heart (114,278.17 Pa)
Elastic Modulus: Sheep Heart (1,360,251.74 Pa), Fresh Cow Heart (3,414,779.54 Pa), Pig Heart (3,874,009.29 Pa), Preserved Cow Heart (5,510,009.27 Pa)

Conclusions/Discussion
A correlation was discovered between body mass and elastic modulus, which supports the idea that mammals with larger body mass need a greater stroke volume and cardiac output to fit their needs. This correlation could not be extended to tensile strength, which could be explained through the comparative anatomy of the mammals. Additionally, biological preservatives did increase the potential efficiency of the heart but would be impractical to test in living organisms due to invasive chemicals. Ultimately, researching the biomechanical properties of the heart will assist cardiologists in engineering biomimetic heart transplants and scaffolds that may be able to replace or support defective heart tissue.

Summary Statement
The tensile strength & elastic modulus of various mammalian ventricles were calculated experimentally in order to draw comparisons between these values and determine a relative stroke volume/cardiac output for each heart.

Help Received
My parents purchased the materials; however, I designed and performed all of the dissection and experimentation by myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Nikhil Gargeya

Project Number
S1308

Project Title
Characterizing North Atlantic Whale Calls Using Acoustic Data

Abstract

Objectives/Goals
Whales are the sentinels of the health of marine environments. Because whales are at the top of the food pyramid, they have a vast impact on marine health. My research is focused on North Atlantic right whales, the most endangered species of large whales with only around 450 remaining. The goal of this project is to study the specific vocal characteristics of these whale species to contribute to effective conservation efforts. I am focusing on the up-call of the right whale, which is the vocal sound they make when they are about to surface. By analyzing acoustic sounds signaling surfacing behavior, I hope to help animal scientists better understand the social behaviors of this whale species, track whale counts when they surface, and correlate surfacing patterns with shipping routes to prevent unnecessary whale deaths.

Methods/Materials
I used an online public dataset from the Marinexplore institute containing 84,503 samples of oceanic acoustic sounds. Each 2-second sample was tagged as positive (a right whale up-call) or negative (not a right whale up-call). I converted each acoustic data sample into a spectrogram which is an image representing the whale sound. Using the Sci-Kit learn library, I input each image with an associated tag (positive or negative) into a random forest classifier; Furthermore, I also visually inspected each spectrogram and compared my visual findings to known research in whale animal behavior.

Results
The accuracies are 87% on a training set of 40,000 samples and 81% on a testing set of 44,503 samples, indicating correlation in up-call acoustic samples to North Atlantic whale behavior. Potentials for decreased performance include difficulty differentiating other marine sounds that are similar to the up-call. In the future, collecting longer samples may encode more information for better results and analysis.

Conclusions/Discussion
I combined my interested in understanding animal behavior with software research to visualize and better model vocal acoustic patterns in North Atlantic whales. Future applications of this research include developing enhanced detection software to prevent ships from colliding with North Atlantic whales.

Summary Statement
I synthesized my understanding of animal behavior with software tools to visualize and better understand North Atlantic Right whale communication for conservation efforts.

Help Received
I designed and completed the project by myself.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Adriana E. Golden

Project Number
S1309

Project Title
Effects of Gastric Mucous with Chemically Raised pHs on Lumen Mass Retention

Abstract

Objectives/Goals
This project investigated whether or not gastric mucous with chemically raised pHs would better protect the stomach's lining from gastric acid damage and mass loss, as a potential surgery-free treatment of Zollinger-Ellison syndrome.

Methods/Materials
Uniform pieces of beef, modeling the stomach walls, were coated in gastric mucous models with varying levels of basicity: pH 7, 9, 11, and 13, as well as a control group with no mucous. The pieces were soaked for 50 hours in a .01 M HCl solution to model the acidity and environment of the human stomach; afterwards, the percentage of original mass retained was calculated.

Results
The pieces with no gastric mucous experienced the most corrosion, retaining only 59.4% of their original mass; the group that experienced the least corrosion was the group with pH 13 mucous, retaining 84.8% of their original mass. The emerging trend suggested a more basic gastric mucous better protects the lumen walls from being corroded and losing mass.

Conclusions/Discussion
The concept of chemically enhanced gastric mucous is worth serious thought and exploration; it would allow the excruciating lumen corrosion experienced by Zollinger-Ellison syndrome patients to be mitigated without complicated surgeries or chemotherapy.

Summary Statement
The project determined that a more basic gastric mucous better protects the lumen (stomach cavity) walls from peptic-ulcer associated acid corrosion.

Help Received
A chemistry teacher prepared the acid concentrations from stock; I consulted with a doctor for background information about the stomach; I borrowed a scale, beakers, and tongs from the school science department's supplies.

Name(s)
Shayle Gupta

Project Number
S1310

Project Title
Nanoparticles Improve Duration of Sunblock Protection while Maintaining Efficacy

Abstract

Objectives/Goals
Recent studies have demonstrated that topically applied sunblock may enter both the bloodstream and breast milk with unknown consequences. The purpose of this experiment is to evaluate the effectiveness and duration of action of a novel skin protectant product developed from the mixture of Zinc Oxide, a bioadhesive, and nanoparticles that prevent absorption through the skin. This experiment will employ a simple, inexpensive, edible silver nanoparticle to encapsulate a physical block to create a more durable, effective sun protectant. Common bacteria from the mouth and pig skin serve as proxy for human skin.

Methods/Materials
A series of mixtures of Zinc oxide, the cellulose-based bioadhesive, and silver nanoparticles were formulated at different concentrations to determine the minimum required to block UV-A and UV-B rays. Petri dishes with agar were inoculated with sun sensitive bacteria and allowed to grow for one week in the dark. A colony count was performed and one of the UV protectants was applied. The protected bacteria were then exposed to UV radiation and colony counts of the bacteria were made at three and seven days following UV exposure. The second stage of the experiment assessed the duration of the protection conferred.

Results
In all six treatment groups, bacteria grew as expected prior to colony count I. In the Zinc oxide group with bacteria and sun exposure, the colony count nearly doubled. The Zinc Oxide plus bioadhesive group demonstrated strong protection of the bacteria as the colony count doubled. The further addition of nanoparticles increased this level of protection further. Zinc Oxide was protective for five hours, and then began to lose its shielding effect. The addition of the bioadhesive to zinc oxide maintained the irradiance below the threshold of 30 W/m2) until the nine-hour mark, while the addition of nanoparticles further extended the duration.

Conclusions/Discussion
This project determined that combining the most effective sun protection with a nanoparticle produced a more effective and durable protection. The addition of the nanoparticle allows the product to persist and provide reflectiveness for a drastically increased duration. Extending this experiment to cultured human skin will confirm these findings and potentially reduce skin cancer rates while employing a product that reduces absorption of the chemicals into the body.

Summary Statement
This project assessed the ability of a novel nanoparticle encapsulated sunblock to add durability to the protective effects of sunblock without reducing efficacy.

Help Received
My father helped with confirming some of my colony counts, and my mother helped prepare my board.

Name(s)
Krystal Horton; Tanner Packham

Project Number
S1311

Project Title
Enhanced Alzheimer's Treatment via External Gamma Brain Wave Stimulation

Abstract

Objectives/Goals
MIT researchers stimulated gamma waves in mice brains with flashing lights to trigger microglia to clean up beta amyloid plaques (the cause of Alzheimer's Disease). The lights would be uncomfortable for humans and may trigger seizures. We built an EEG with some spare parts and an Arduino and tested whether sounds and vibrations at the same frequency (40 Hz) would cause the same result in humans without the side effects.

Methods/Materials
We built an EEG using a MindFlex headset and Arduino. We modified code found on instructables.com to filter out low quality data, look only at gamma waves, and record data to a memory card. We built our own stimulation devices using an Arduino, LEDs, a stepper motor, a function generator, and a cell phone. We are currently working on using a real EEG to compare to ours. We collected baseline rates of gamma wave activity in a quiet room. Then we turned on either a blinking light, sound, or vibration at 40 cycles per second, the frequency of gamma waves and measured the response in the brain. We used these stimuli at other frequencies to use as a control.

Results
We found a very strong response to the 40 Hz vibrations and little or no response to the light and sound. We hypothesize that this is because our EEG only has one sensor and it is on the forehead. Visual and auditory processing happen near the back of the brain. Sensory processing happens in the top/mid brain which is picked up by our sensor. We cannot prove that this increase in gamma brain waves also reduced amyloid plaques, but Dr. Tsai at MIT proved that relationship. Therefore, we can assume that if we increase gamma activity, it will result in reduced beta-amyloid plaques.

Conclusions/Discussion
Although we experienced limitations in our self-made equipment, we were able to show a strong relationship between 40 Hz vibrations provided by our vibration vest and gamma waves in the brains of our subjects. We anticipate that as we continue our tests with a real EEG, we will be able to show that the light and sound also produce a strong response that we were unable to measure with our equipment. Combined with the research of Dr. Tsai at MIT, we can conclude that it is possible to reduce beta-amyloid plaques with 40 Hz vibrations and we anticipate that we will soon be able to prove the same with flashing lights and clicking sounds.

Summary Statement
We are trying to treat Alzheimer's by using external stimuli to increase gamma waves in the brain as measured by our home-made EEG machine.

Help Received
n/a

Name(s)
James J. Kim

Project Number
S1312

Project Title
The Effect of Unilateral Visuomotor Adaptation Training on the Untrained Limb

Abstract

Objectives/Goals
The goal of this experiment was to identify whether visuomotor adaptation training, performed on one side of the body, positively affected the contralateral side. It was observed through previous research that physical unilateral training, such as lifting weights and stretching one side of the body, had a positive correlation to the performance of the untrained half of the body. If physical unilateral muscle training can strengthen the contralateral side, then unilateral visuomotor adaptation training should accordingly fortify the opposite side as well. Although the trained side may likely outperform the contralateral side, the untrained side may perform better than it would have without the contralateral training.

Methods/Materials
To test this hypothesis, subjects performed a reaching task in which they reached to visual targets on a computer screen. The visual feedback of the position of the hand was displayed as a circle icon. Subjects needed to maneuver this circle icon into the targets with the computer mouse within a certain time limit, but the visual feedback was perturbed during repeated trials to see if the untrained hand would show an improvement in performance. Therefore, the materials used for this experiment was the visual feedback computer program, one laptop computer, and one computer mouse.

Results
The subjects who trained their left hand showed an average of a 126.42% increase in performance for the untrained hand, subjects who trained their right hand showed a 98.42% increase, and the total average of both left and right training averages combined showed an increase of 112.42%. The results demonstrate the occurrence of interlimb transfer of motor learning, indicating an improvement in performance of one limb following training with the other.

Conclusions/Discussion
Because the unilateral visuomotor adaptation training did in fact fortify the opposite side, the hypothesis was confirmed. However, the speculation that the trained hand may likely outperform the untrained hand was rejected. This project was able to answer questions regarding interlimb transfer of motor learning in the brain.

Summary Statement
I found that unilateral visuomotor adaptation training did in fact fortify the performance of the opposite limb.

Help Received
My father helped in creating the logistics of the experiment. He also helped to design the computer program used during testing.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Kristen Schiavon; Addison Williams

Project Number
S1313

Project Title
Can Odocoileus hemionus Adapt to Topography Changes within a Major Migratory Route?

Abstract

Objectives/Goals
Our objective is to prove that if you change the topography in a major migrator route for mule deer, they will adapt over time.

Methods/Materials
1. Check trail cameras
2. Remove cameras from security box
3. Check the battery percentage
4. Turn off the trail camera (the switch is in the corner to the top left).
5. Take out the four batteries (if below 50%) replace with (4) new batteries.
6. Put the used batteries into your backpack.
7. While the camera is off take out the SD Card (it is sticking up at the bottom left corner).
8. Take the new SD card from your backpack and insert it into the SD location on the camera.
9. Turn the camera back on.
10. Place the camera back into the security box facing the same direction
11. Lock the trail camera security box (make sure the trail camera is facing the proper direction).
12. Write the information in field log book.
13. Repeat for the remaining (59) trial cameras.
14. Once you have checked all of the trial cameras, take the SD cards collected and transfer all the images onto a flash drive.
15. Condense the camera images taken by the trial cameras 226 and 227 from years acquired onto a flash drive.
16. Begin evaluation and analysis of image data on flash drive containing trial camera 227 and 227 image data.
17. Once done logging all the images from all years, look at data to evaluate the numbers of deer walking all the way through the under crossing
18. This information will help determine if deer movement is being manipulated or controlled by topography change to area and evaluate whether deer are adapting to the changes.

Results
Over time the mule deer were able to get use to the change in the topography and use the under crossing.

Conclusions/Discussion
After completing our investigation on whether a migratory meal deer herd movie can be manipulate or

Summary Statement
Our project is proving that if there is a major topographic change within a migratory mammals major travel route, they can and will adapt over time to reduce the number of fatal car collisions.

Help Received
Michael DeLasseux helped answer any questions on the undercrossing. Sara Holm answered any questions abut the deer herd.

CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)
Aditi T. Venkatesh

Project Number
S1314

Project Title
The Effect of Exercise on Thermogenesis in Brown Adipose Tissue

Abstract

Objectives/Goals
This study was performed to understand the relationship between exercise and thermogenesis in Brown Adipose Tissue. Many researchers believe that studying BAT in addition with other energy expenditure processes, such as exercise, could lead to a cure or a better understanding of obesity.

Methods/Materials
Six mice were used and randomly split into two groups: interscapular and mid back. Temperature of interscapular was measured to find temperature of the Brown Adipose Tissue and temperature of the mid back was measured to find core body temperature. Temperature was measured using the Anipill, a novel telemeter, or temperature reading device. Mice were acclimated on an exercise treadmill for three days, staying at rest for twenty minutes and then exercising for two minutes at 5 m/min on Day 1, 7.5 m/min on Day 2, and 10 m/min on Day 3. On the fourth day the SPRINT protocol was executed. The mice were placed on the unmoving treadmill for twenty minutes and then speed was increased by 1 m/min starting at 10 m/min per minute until the mouse was deemed exhausted.

Results
During the SPRINT protocol, the temperature of the Brown Adipose Tissue decreased as the temperature of the mid back region increased and stayed above baseline. After the average exhaustion point both regions returned to baseline temperature.

Conclusions/Discussion
Due to the role of Brown Adipose tissue in thermoregulation, it is likely that the increase in temperature of the surrounding muscle tissue caused the BAT to gradually decrease its thermogenesis to preserve thermal homeostasis in the mouse. It is also most likely that the BAT was selectively downregulated by the sympathetic nervous system during exercise.

Summary Statement
During exercise the reduced thermogenesis in Brown Adipose Tissue shows that lipolysis is decreased in BAT during exercise.

Help Received
Used lab equipment and IACUC and Animal Care facilities at the University of Iowa under the mentorship of Dr. Benson, Participant of the SSTP Iowa Program.