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03. Biology

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Abstracts from the 2015 Oklahoma Research Day

Held at Northeastern State University

05. Mathematics and Science

03. Biology

05.03.01 Effects of Fluoxetine on Corticosterone-Induced Neurotoxicity in PC12 Cells

Baylee, Holbert *Southeastern Oklahoma State University*

Jonathan, Newsome *Southeastern Oklahoma State University*

Ning, Wu *Southeastern Oklahoma State University*

Sarah, Reagan *Southeastern Oklahoma State University*

Major depressive disorder (MDD) is a common and life-threatening mental disorder over the world. Although the exact pathological mechanism of MDD has not been identified, some studies demonstrated that cellular mitochondrial defects might play a role in cell dysfunction or even death, which could relate to MDD's cognitive incapability and motor slowness. Some antidepressants such as amitriptyline and tranylcypromine can reduce such pathological effects. However, the mechanisms of such pharmaceutical effects are still unclear. This study investigated the cellular effects of Fluoxetine, a major serotonin reuptake inhibitor (SSRI) antidepressant, by using corticosterone-induced neurotoxic PC12 cells. The results showed that Fluoxetine could effectively protect cells from toxic environment by significantly reducing the numbers of cell conformational changes and cell death comparing to that of control group. The study provided the evidence that Fluoxetine might be not only a SSRI, but also a cytoprotective agent.

05.03.02 Effects of Fluoxetine on Corticosterone-Induced Neurotoxicity in PC12 Cells

Danielle, Khoury *Southeastern Oklahoma State University*

Heather, Wyrick *Southeastern Oklahoma State University*

Ning, Wu *Southeastern Oklahoma State University*

Patrick, Sharp *Southeastern Oklahoma State University*

Stephanie, Gunter *Southeastern Oklahoma State University*

Major depressive disorder (MDD) affects many people around world. Although there have been a large number of experiments tested dealing with animal depression model, only a small few can be credited as useful MDD research tools. The purpose of this study is to develop and validate a chronic unpredictable mild stress (CUMS) mouse model to facilitate future studies in MDD mechanisms and antidepressant drug development. The pure breed mouse strain was employed for this study. The mice were treated by 9 different stimulations with one randomly picked stimulation per day and no same type of stimulation in continuous days. After 5 weeks treatment, the mice were tested by a series of experiments to validate their CUMS status. The results showed that CUMS mice demonstrated weight loss, voluntary movement reduction, sucrose solution intake reduction, and swimming immobility time increasing. In addition, CUMS mice showed significant reductions of serotonin (5-HT), dopamine (DA), and norepinephrine (NE) in brain prefrontal cortex and hippocampus regions comparing to that in normal control animal group. The results suggested that a successful mouse CUMS model could be established through 5 week continuous treatment. The CUMS model showed the similar biochemical changes in MDD patients.

05.03.03 An Ecological Survey of a Freshwater Bog in South-Central Oklahoma

David, Bass *University of Central Oklahoma*

Kinsey, Tedford *University of Central Oklahoma*

An unusual wetland pond, known as a quaking bog, is located on the Oka' Yanahli Preserve in Pontotoc County. A quaking bog possesses a false-bottom composed of a thick layer of vegetation floating beneath the water surface. There is little known about these ecosystems, and none have been described in any published studies in Oklahoma. The objectives of this study included determining basic water quality, identifying macroinvertebrates present, estimating population sizes, calculating species diversity, and comparing macroinvertebrate samples from different areas of the bog. In June of 2014, water samples were collected from the pond to determine basic water quality parameters. Six biological samples were collected using a petite Ponar bottom grab in a transect (center, middle, outer) across the bog. These samples were preserved and returned to the laboratory for sorting, identification, and counting. Results have shown high water quality exists in the wetland. There were 28 different taxa identified out of the 2,930 macroinvertebrates collected, 334 of the organisms being insects. Annelids and fingernail clams were the most abundant taxa. When comparing sampling areas, the center contained the largest number of individuals and middle samples had the greatest diversity. Shannon-Wiener Species Diversity results are as follows: center (1.67), middle (2.46), outer (2.11), and collectively (1.76).

05.03.04 Nasal Carriage of Staphylococcus aureus and Methicillin Resistant Staphylococcus aureus (MRSA) in College Students

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Mohamed,Fakhr *University of Tulsa*

Rachael,Baalman *University of Central Oklahoma*

Yuhang,Shang *University of Central Oklahoma*

Nasal carriage of Staphylococcus aureus has been identified as a significant risk factor for subsequent infections and is a target for decolonization approaches; it is critical to understand the epidemiology of S. aureus and methicillin-resistant Staphylococcus aureus (MRSA). Investigation into the dynamics of MRSA carriage will be valuable in the development of strategies to control this emerging pathogen. The efficacy of these methods may be dependent on the load and type of S. aureus present in the nose. The hypothesis is that carriage levels and types of S. aureus and MRSA are highly variable in a healthy student population. To test this hypothesis, nasal swab specimens were collected from University of Central Oklahoma students and cultured onto blood agar plates for quantitative analysis. Methicillin resistance was determined with cefoxitin disk diffusion and PCR for mecA. Clonal similarities were determined by PCR amplification of the spa gene and sequence typing. Staphylococcus aureus prevalence was 21.5%, with a geometric mean of 1,820 Cfu/swab. MRSA prevalence was 2.4%, with a geometric mean of 412. spa typing results showed a variety of sequences, supporting the hypothesis.

05.03.05 Green Tea Extract antioxidant inhibits tension generation by Dupuytren's disease myofibroblasts

Chelsea,Spencer *University of Central Oklahoma*

Melville,Vaughan *University of Central Oklahoma*

Dupuytren's Disease is a deforming disorder of the palmar fascia due to myofibroblast contraction. Epigallocatechin gallate (EGCG) is a chemical extracted from Green Tea. Antioxidants such as EGCG have been shown to inhibit myofibroblast-like cells. I hypothesize that EGCG will suppress the myofibroblasts phenotype and contraction of Dupuytren's Disease fibroblasts. To test this, I grew fibroblasts on coverslips to study cellular structure and in collagen lattices to study contraction ability. In order to mimic in vivo environments, I added TGF- β to promote myofibroblast formation. To reverse TGF- β effects, a dose response curve of EGCG was added to TGF- β treated cells. EGCG inhibited collagen lattice contraction in a dose dependent fashion. It seems that EGCG reduced the number of cells stained with Immunofluorescence staining procedure, and previous studies have shown that contraction is reduced when fewer cells are present. This study suggests that myofibroblasts can be reduced by the addition of EGCG, thus providing a possible treatment for Dupuytren's Disease.

05.03.06 How Staphylococcus Aureus Biofilm and Planktonic Secreted Products Affect Myofibroblast Differentiation

Alain, Komeni *University of Central Oklahoma*

Melville, Vaughan *University of Central Oklahoma*

Preston, Hall *University of Central Oklahoma*

Robert, Brennan *University of Central Oklahoma*

Wounds often become chronic by staying in the inflammatory stage of the healing process for an excessive time periods. The ability of fibroblasts to differentiate into myofibroblasts is key for the normal progression of wound healing. Recent experimental evidence has shown that products secreted by planktonic *S. aureus* and *S. aureus* biofilms differentially affect viability and inflammatory cytokine production by human fibroblasts, along with human keratinocytes. Our goal was to determine whether media conditioned by *S. aureus* affected myofibroblast differentiation by utilizing immunostaining techniques. We grew normal human fibroblasts on coverslips in media containing 1ng/ml TGF- β plus or minus 100 μ L/ml of the planktonic *S. aureus* secretions or the *S. aureus* biofilm secretions; these were compared to media-only control. We found that products secreted by *S. aureus*, especially planktonic *S. aureus*, significantly decreased myofibroblast differentiation in three separate experiments which suggests that wound healing won't progress to the myofibroblast phase if the cells are being inhibited. Bacterial biofilms are currently difficult to treat, so being able to promote myofibroblasts may aid the healing of chronic wounds. These findings should also spark future studies related to wound healing.

05.03.07 Evaluating Genetic Diversity and Structure of a Mediterranean House Gecko (*Hemidactylus turcicus*) Invasion at the University of Central Oklahoma

Allyson, Fenwick *University of Central Oklahoma*

Audrey, Matheny *University of Central Oklahoma*

Laura, Kimmel *University of Central Oklahoma*

Exotic species are excellent models for understanding ecological and evolutionary processes because they spread and adapt to new habitats across short periods of time that can be directly observed. At UCO, Mediterranean house geckos (*Hemidactylus turcicus*) were repeatedly introduced to Howell Hall from 1963 to 1965 and 1985 to 1997. In contrast to most invaders that expand quickly over short geographic areas, this species has only spread to 20 buildings over 18–52 years. Our hypothesis, based on previous work on this species in other regions, is that each building hosts a genetically isolated population of geckos and that populations will show an overall pattern of decreasing genetic diversity with increasing geographic distance from the original site of introduction. To date we have collected over 100 individuals from ten buildings across campus. We are optimizing amplification of microsatellites; genotyping these extremely variable loci should help us analyze genetic diversity and genetic structure over short time periods and restricted geographic ranges. Our results will help inform studies of invasion genetics and of evolution over very short geographic distances.

05.03.08 Algae: The Key to Unlocking Multicellularity Abstract

Joseph-Michael,Fields *Langston University*

Cancer, a devastating disease that results from the breakdown in the pathways that lead to multicellularity potentially making genes associated with multicellular evolution defective. This suggests that cancer results from errors in the cell cycle regulatory pathway. The hypothesis for my project is modifications in the cell cycle regulatory pathway in Volvocine algae has resulted in multicellularity. So, the goal of this research project is to use the Volvocine algae as a model system to study multicellular evolution using candidate genes from the multicellular organism *Gonium pectorale* and transforming them into the unicellular organism *Chlamydomonas*. The methodology to this project was to take cloned candidate multicellularity genes from *Gonium* and functionally test them looking for a gain of function in the *Chlamydomonas* cells. The transformed *Chlamydomonas* cells were then plated, grown, picked and examined under a microscope for evidence of transformation. The *Chlamydomonas* cells that were electroporated with the cell-cell adhesion gene from *Gonium* were successfully transformed; the unicellular *Chlamydomonas* became multicellular with the insertion of the *Gonium* gene. With these results it is possible to further our research by taking the next step and performing a RNA-seq on the transformed multicellular *Chlamydomonas*. Using this we hope to one day transition our knowledge from the algae model system to vastly improve our ability to detect and treat human cancers.

05.03.09 Autofluorescence in *C.elegans* can be Used as an Indirect Measure of Pore-Forming Toxin Activity Laci LeFlore, Brad Ludrick **Southeastern Oklahoma State University**

Laci,LeFlore *Southeastern Oklahoma State University*

The nematode *Caenorhabditis elegans* contains lysosome-like gut granules within the intestine that strongly emit blue autofluorescence when exposed to ultraviolet light. We believe this can be used as an indirect measure of intestine damage caused by pore-forming toxins by measuring intestinal autofluorescence intensity using ImageJ and Excel software. We used transformed *E. coli* that can be induced with IPTG to produce the pore-forming toxin, Cry5B. Cry5B is a native crystal protein of certain *Bacillus thuringiensis* strains and is toxic to *C. elegans*. *C. elegans* and transformed *E. coli* were cultured according to standard techniques. Transformed *E. coli* without the pore-forming toxin insert were used as the control. Using a single-well assay (96-well plate), synchronized L4 individuals were placed in wells containing *E. coli* bacteria (toxic and control) and S medium. Individuals were grown for 24 hours at RT, immobilized with 500 mM ethyl alcohol, and then examined under a fluorescent microscope. Based upon our results, fluorescence intensity of the intestine is greatly reduced in *C. elegans* fed transformed *E. coli* (toxic). These results indicate that intestine damage caused by pore-forming toxins may be quantified using fluorescence intensity as an indirect measure.

05.03.10 STUDIES OF BIOFILM FORMATION BY BACTERIA ISOLATED FROM DRINKING FOUNTAINS

Taylor, Waugh *Northwestern State University*

This research was done to identify and determine the presence of bacterial species in drinking water fountains, and to determine if these species were potentially pathogenic, and could actively form biofilms with other species. Once isolation was achieved the different species of bacteria were grown in different combinations of two and growth was measured and compared to the growth of each of the species individually. Bacterial species were isolated and identified by using standard isolation and identification protocols. The amount of growth was measured by spectrometry. The results conclude that different species react differently with other species. Synergistic (to make biofilms) and antagonistic relationships were found to be present with certain mixtures of species. Most individual species identified during the study are known to be pathogenic species.

05.03.11 Chemical Composition of Femoral Gland Secretions in Male Collared Lizards

Abigail, McGee *University of Central Oklahoma*

F., Albadily *University of Central Oklahoma*

Thomas, Jourdan *University of Central Oklahoma*

John, Bowen *University of Central Oklahoma*

Troy, Baird *University of Central Oklahoma*

Wayne, Lord *University of Central Oklahoma*

Chemical signals function for intraspecific communication in numerous lizard species that have well developed chemosensation using their vomeronasal organs. Other species, such as eastern collared lizards (*Crotaphytus collaris*), have highly developed visual signaling, but also produce secretions from their femoral glands, suggesting that both chemical and visual signals may be involved in intraspecific communication. We used gas chromatography-mass spectrometry to analyze the femoral gland secretions of male collared lizards (N = 44) to determine the chemical composition and compare it with that in the secretions of lizards having highly developed chemical-based communication. Six of the compounds in *C. collaris* secretions were similar to those in a visually oriented congener, as well as those in other lizard taxa that rely heavily on chemical signaling. Future studies will examine the potential associations among these compounds and the ability of male collared lizards to signal competitive ability to rival males and attributes of males that promote high reproductive success.

05.03.12 An antioxidant 3,4',5-trimethoxybenzophenone inhibits growth of human hepatocellular carcinoma cells

Christopher,Patton *University of Central Oklahoma*

Hari,Kotturi *University of Central Oklahoma*

Pritika,Khadka *University of Central Oklahoma*

Liver diseases affect about 30 million Americans (American Liver Society). Hepatocellular carcinoma (HCC) is the third leading cause of cancer-related death worldwide. Risk factors for HCC include viral infection such as hepatitis B and hepatitis C, alcoholic hepatitis, non-alcoholic fatty liver disease, and liver cirrhosis. Current therapies available for treating HCC include Sorafenib, surgical resection, transcatheter arterial chemoembolization, radiofrequency ablation, ethanol ablation, combination drug therapy, and liver transplantation. However, these approaches are inadequate in controlling the progression of HCC and there is a growing need for inexpensive new therapeutic agents with minimal side effects to humans. Human hepatoma cell line (FCA4 cells) that harbors a subgenomic selectable HCV replicon was used to study the effect of 3,4',5-Trimethoxybenzophenone (TMBP). Western blot was conducted to analyze the viral NS5B polymerase level in FCA4 cells treated with varying concentrations of the drug. The effect of TMBP on cell proliferation/viability was assayed using MTT method. TMBP was found to be highly effective in reducing NS5B polymerase level at 2.5 μ M, which was found to be below its IC50 as determined by the MTT assay. Our results indicate that TMBP possesses anti-cancer and anti-viral properties.

05.03.13 Population Genetics and Structure of Local Invasion of Red Imported Fire Ants (*Solenopsis invicta*) at the University of Central Oklahoma

Allyson,Fenwick *University of Central Oklahoma*

Audrey,Matheny *University of Central Oklahoma*

Laura,Kimmel *University of Central Oklahoma*

This study looks at the genetic variation, population structure and geographic dispersal of the red imported fire ant (*Solenopsis invicta*) on the University of Central Oklahoma campus. Studying this local invasion can reveal patterns and trends that can be used to mitigate future invasions. In October of last year, biologists spotted red imported fire ants spreading across campus within a time span of two weeks. Students subsequently sampled colonies on campus mapping over 500 nests and took samples of workers from >20 colonies. The identification of red imported fire ants was confirmed by morphological techniques. We are evaluating the genetic diversity using published microsatellite loci and population genetic techniques. We have optimized the microsatellites and will soon genotype them. Genetic variation is expected to be low if there was a single introduction and higher if there were multiple introductions. Additionally, the social structure of the colonies was determined using the Gp-9 locus. Preliminary data show most colonies are polygyne (multiple queen) with 2 possible monogyne (single queen) colonies. Our results support previous work suggesting polygyne colonies are more successful invaders because they utilize colony budding dispersal. Future research will analyze microsatellite data and expand the study area.

05.03.14 The Effects of Staphylococcus Aureus Secreted Products on Fibroblast Tension Generation

Melville, Vaughan *University of Central Oklahoma*

Pratiksha, Kshetri *University of Central Oklahoma*

Robert, Brennan *University of Central Oklahoma*

Chronic wounds are often characterized by persistent inflammation. It provides a favorable environment for bacteria to establish an infection, which may lead to the formation of a biofilm that can delay the healing process. Although the occurrence of biofilm in chronic wounds is known, its pathogenesis is still unclear. Chronic wounds may be affected directly by the biofilm or through interaction with secreted products of the biofilm bacteria. Secretions by planktonic bacteria may also play a role in chronic wound pathology. Concurrent studies in our lab have shown that myofibroblast proliferation and differentiation are affected by products secreted by *S. aureus* biofilm and planktonic forms. Therefore, we hypothesized that biofilm and planktonic conditioned medium of *S. aureus* would affect fibroblast ability to generate tension in a stress-relaxed collagen lattice. Tension generation is one of the important factors in wound closing by myofibroblast. Control and TGF- β treated lattices were cultured in the presence or absence of *S. aureus* biofilm and planktonic conditioned medium. TGF- β treated lattices were too contractile and self-released prior to maturation. The mature control lattices showed the greatest contraction followed by biofilm with less contraction. The planktonic treated lattices showed no contraction. Whether the reduced contraction was correlated with reduced cell number and/or myofibroblast presence is currently being investigated.

05.03.15 Phylogeography of Sonoran mud turtles (*Kinosternon sonoriense*) in the Madrean Sky Islands

Laura, Kimmel *University of Central Oklahoma*

Michelle, Haynie *University of Central Oklahoma*

Paul, Stone *University of Central Oklahoma*

Phylogeography is the study of the geographic distribution of genetic lineages. When well-planned and executed, phylogeographic analyses can show historical patterns of gene flow and genetic isolation. Naturally fragmented freshwater habitats often create replicated natural experiments well-suited to phylogeographic study. The often subdivided topography of individual mountain ranges in the Madrean Sky Islands in New Mexico and Arizona make the habitat ideal for studying genetic variation of the Sonoran mud turtle at three levels: within drainages, among drainages, and among mountain ranges. We have obtained sufficient samples (between 17 and 40 per population for three populations per range) from the Peloncillo, Galiuro, Huachuca, and Pajarito Mountains. Sequencing of the mitochondrial DNA D-loop is ongoing. After DNA extraction from blood samples, we amplify and sequence 400 bp of the left domain of the mitochondrial DNA D-loop and 400 bp of the right domain of the D-loop. Future research will focus on completing sequencing and using sequences to examine the genetic structure of Sonoran mud turtles.

05.03.16 METHODS FOR TESTING FOR INSECTICIDE EFFECTIVENESS

Luvey,Deatherage *East Central University*

METHODS FOR TESTING FOR INSECTICIDE EFFECTIVENESS Authors: Luvey Deatherage University of Scholar: East Central University Location of Research: East Central University, Ada, OK, USA Funding: OK-LSAMP, NASA Mentors: T. Cluck, and C. Biles. East Central University Our laboratory is interested in testing the effectiveness of insecticides using *Drosophila melanogaster* as a test organism. One suggested method of applying insecticides was to inject small quantities into a fly. This method was rejected because exposure in nature using injection was unlikely, and we did not have the equipment to perform injections. Five other procedures were developed and tested for the most efficient analysis of insecticide effectiveness. Exposure of flies to insecticide-impregnated strips of filter paper was the best. However, larval exposure to insecticides in food also provided a good measure of efficacy for survival to adulthood when insecticides are present in the food supply.

05.03.17 Reporter Systems and the use of Transgenic Plant Technology

Kevin,Wang *Northeastern State University*

Yves Saint,Hall *Northeastern State University*

Yves Saint Damien Hall Mentor Dr. Kevin Wang Natural Science Department, Northeastern State University at Broken Arrow 3100 East New Orleans Street, Broken Arrow, OK 74014 Famine, pestilence, world hunger, and disease eradication. Problems that have been plaguing our world since biblical times can be eradicated through the use of transgenic plants. To address these, we used indicator proteins such GFP (Green Fluorescent Protein) and GUS (β -Glucuronidase), to show successful expression. GFP gene was transiently expressed in the leaves of tobacco plants. It is a convenient method and we could check for indication at 4 to 5 days after infiltration. GUS could be stably introduced to the plants. GUS positive blue indicated that we successfully received transgenic state in plants. Transient expression technique has been used in molecular pharming and are currently used in the fight against Ebola. Using the plant as a biofactory can help so many places in so many ways, not to mention eradicating current and future disease. Today, Ebola and the flu, tomorrow HBV and HIV.

05.03.18 Purification and Quantification of tadA enzyme in Escherichia coli

Baylee,Tatum *University of Central Oklahoma*

The tadA enzyme is responsible for the chemical substitution of the standard adenosine base pair with the nonstandard hypoxanthine base pair at specific wobble positions in the *Escherichia coli* transcriptome. This substitution allows for flexibility in the translation of proteins by increasing the number base pairs the edited nucleotide can interact with. Due to the limited amounts of the tadA enzyme in *E. coli*, recombinant DNA techniques had to be utilized to acquire a quantifiable amount of the enzyme. The genetic sequence translating for tadA was replicated using a sequence specific primer and polymerase chain reaction (PCR). By inserting the replicated tadA gene into the 1655 *E. coli* culture, the gene could be ligated into an *E. coli* expression vector and cloned into the culture. Once the recombinant vector was cloned into the *E. coli*, the protein was allowed to accumulate in vitro and was purified using a histidine tag and subsequent histidine purification technology. A nucleotide specific assay was performed on the purified enzyme to quantify the activity of the tadA enzyme. This data would demonstrate how efficient the protein is at high concentrations and as well as its enzymatic threshold at optimal conditions.

05.03.19 Tree Characteristics, Woody Biomass, and Carbon Sequestration Estimates on the University of Central Oklahoma Campus

Chad,King *University of Central Oklahoma*

Daniel,Bond *University of Central Oklahoma*

Shelbi,Richett *University of Central Oklahoma*

University campuses across the world have led efforts to quantify sources and sinks of carbon to attain carbon-neutrality in light of climate change. One of the leading approaches to identifying carbon sinks is quantifying tree characteristics that are present on the campus. Woody vegetation function in sequestering carbon via photosynthesis and also storing carbon in their biomass. The objectives of our research included: 1) quantifying structural characteristics of trees on the University of Central Oklahoma (UCO) campus; 2) estimating total and genus-level above-ground biomass; and, 3) estimating total and genus-level annual carbon sequestration. We collected five forestry measurements on 543 trees located on the UCO campus between July and November 2014. We estimated biomass and carbon sequestration using the Center for Urban Forest Research (CUFR) Tree Carbon Calculator program. Of the 543 trees measured at UCO, oak (*Quercus* spp.) was most common (n =122), however *Juglans* spp. and *Carya* spp. had the largest mean diameter (\bar{x} = 68.6 cm, S.E. \pm 5.88) and mean height (\bar{x} = 15.2 m, S.E. \pm 1.01). Preliminary analysis indicates the oak group sequesters 15.9 metric tonnes C yr and currently stores 70.7 metric tonnes C in above-ground woody biomass. This result highlights the relatively low carbon sequestration rate compared to similar results for oak at other sites, globally. Additional carbon sequestration results will be presented for other species found on

05.03.20 Potential of an Old-Growth Cross Timbers Forest at Lake Arcadia, Oklahoma

Chad,King *University of Central Oklahoma*

Shey,Ramsey *University of Central Oklahoma*

The Cross Timbers is an oak-dominated ecotone located between the Eastern Deciduous Forest and the Great Plains in the south-central United States. Previous research has modelled potential sites in Oklahoma that may contain old-growth Cross Timbers forest; one of the sites highlighted by the model was the Arcadia Lake region in central Oklahoma. The objective of our research was to investigate the structure and historic dynamics of the Cross Timbers forest at Lake Arcadia. Increment cores were collected from dominant and co-dominant tree species to determine age structure. Remnant wood was opportunistically collected to determine if fires were historically present at the site. Results demonstrate several *Quercus stellata* (Wangenh.) that are the oldest trees, dating to the mid-19th century. Remnant wood provided evidence of 10 fires that occurred between 1900 and 1950 based on fire-scar analysis. Ignition of these fires was likely related to early Euro-American settlement in the area. The contemporary structure of the forest at Arcadia Lake suggests an increase in mesophytic species density that is a product of fire suppression, similar to other studies of forests in the Cross Timbers. Continued analysis of forest structure and dynamics will provide a deeper understanding of forest succession and old-growth status at Lake Arcadia.

05.03.21 The Roles of Body Condition and Onset Date on Annual Clutch Production in Female Collared Lizards

Connor, McGill *University of Central Oklahoma*

Rory, Telemeco *University of Washington*

Troy, Baird *University of Central Oklahoma*

In some lizard and snake species, females produce multiple successive clutches throughout a protracted reproductive season. Previous studies on collared lizards at the Arcadia Lake Dam spillway suggested that the amount of energy stored at the beginning of each reproductive season limits the number of clutches that they produce (Telemeco and Baird, 2011). This hypothesis predicts that female body condition before the onset of first egg production should be a strong predictor of the number of clutches produced annually. Alternatively, the length of the activity season may also play a role in determining the number of clutches, because development of each clutch requires adequate time and last clutches must be laid early enough that hatchlings can grow to a size allowing them to survive the impending winter. We are testing these predictions by examining the number of clutches produced by individual collared lizard females at the Arcadia Lake site throughout the 2007-2014 reproductive seasons, a period over which the onset of reproduction and clutch production varied markedly.

05.03.22 Identifying the enzyme involved in hypotaurine to taurine biosynthesis

Roxanna, Grove *University of Central Oklahoma*

Steven, Karpowicz *University of Central Oklahoma*

Taurine is the most abundant amino acid-derived molecule in the cell and is a product of cysteine metabolism. It is ubiquitous in animal tissues, but more concentrated in the brain, liver, retina, and adipose cells. It is essential for many biological processes, such as neonatal development, though its exact role is unclear. The nature of the biological reaction of the reactant hypotaurine to the product taurine is still unknown. The goal of this project is to identify the gene product that performs this biochemical reaction. Gene co-expression analysis of liver cell mRNAs has revealed several potential candidate genes. The candidate proteins will be expressed and tested for catalysis of hypotaurine to taurine using HPLC and o-phthalaldehyde (OPA) as a colorimetric derivatizing reagent.

05.03.23 Modeling the affect of platelets on blood clot degradation.

Brittany, Bannish *University of Central Oklahoma*

Hyunjong, Kim *University of Central Oklahoma*

The objective of this research is to understand how the rate of blood clot degradation is affected by tPA and platelets. We hypothesize that degradation is affected by tPA and platelets which act as obstacles and that more obstacles reduce the degradation rate. We use a mathematical model to run computational experiments (using the Fortran and MATLAB programs) to obtain results. We create snapshots which depend on the configuration of the obstacles with the same tPA concentration. The result is that for a fixed tPA concentration, the degradation rate is faster as the obstacles are placed further from the starting point of tPA. On the other hand, if we put the obstacles closer to the initial point of tPA, the degradation rate is slower.

05.03.24 Characterization of Three Major Histocompatibility Complex Class II Loci in *Neotoma albigula*

Lindsay,Stone *University of Central Oklahoma*

Michelle,Haynie *University of Central Oklahoma*

The major histocompatibility complex (Mhc) is an important component of vertebrate immune systems. Genetic analysis at Mhc loci can provide information on susceptibility to certain viral strains. *Neotoma albigula* (white-throated woodrat) has been associated with at least three distinct strains of arenaviruses, suggesting an interesting coevolutionary history between the host and virus. In this study, we have been screening three Mhc class II loci to detect genetic variation within *N. albigula* subpopulations in Arizona. We hypothesize that specific alleles for each locus will be positively correlated with disease susceptibility. Initially, we screened two loci using capillary electrophoresis-based single strand conformational polymorphism (SSCP) analysis. Using this method, we found moderate levels of genetic variation at the loci and little correlation between disease susceptibility and alleles. Due to SSCP optimization issues, we have added a third locus and are sequencing the alleles to confirm their identity.

05.03.25 Comparison of Acid Production and Growth Rate of Selected Gram Negative Bacteria and Yeasts in Different Carbohydrates

Erin,Little *Northwestern State University*

Several species of gram negative bacteria are known to ferment different types of sugars, including maltose, sucrose, dextrose, and many other. However, the amount of acid produced by different bacteria varies greatly depending on the type of carbohydrate that is present. In this experiment, five gram negative species of bacteria: *Escherichia coli*, *Enterococcus faecalis*, *Proteus vulgaris*, *Proteus mirabilis*, *Enterobacter aerogenes*, and two species of yeast, *Candida albicans* and *Saccharomyces cerevisiae*, were compared to see the growth pattern and acid production in various carbohydrate media. Results show that *Enterococcus faecalis*, *Escherichia coli*, and *Proteus vulgaris* fermented sugars into acid more efficiently compared to the rest of the microbes used in this experiment. The pH of the acid produced by the bacteria is directly related to the growth rate of individual species.

05.03.26 Molecular Farming: Biodegradable Plastics

Miko,Atkins *Northeastern State University*

My research project is over biodegradable plastics. Recycling or "going green" is a big issue right now because pollution is a big problem and it affects the earth's land, oceans, animals, and humans. Each year in the US alone we throw away billions of plastic items whether it's a water bottle or a plastic bag and it can take these plastics thousands of years to degrade. A standard plastic water bottle, plastic bag or plastic anything contains harmful toxins such as BPA. BPA is a potentially harmful chemical that is widely used to make many different plastics including those that hold foods and beverages. Biodegradable plastics are a smarter choice and they are non-toxic. There are several benefits to using biodegradable plastics including but not limited to: they take way less time to break down, they are renewable, and they are better for the environment. In our efforts to reduce pollution and keep our mother earth healthy, it is now that through molecular farming scientists are able to produce biodegradable plastics that are eco-friendly.

05.03.27 Oriental Medicine: The Five Elements

Ashley, Hopkins *Northeastern State University*

The Five Elements of Oriental Medicine are known as wood, fire, earth, metal and water. The elements are a major focus in oriental medicine. It is a theory, when all the elements are in balance, the being is in harmony. The elements work to balance one another out. If one element is out of balance, the corresponding element is also out of balance. The elements each represent different sources. The Wood Element represents the liver and gallbladder and its corresponding element, wood, represents the Spleen and Stomach. Fire represents the heart, small intestines and pericardium and its corresponding element, metal, represents the large intestines and lungs. The last element, water, represents the bladder and kidneys. When one of the elements are out of sync, there are some "illnesses" that one may experience, depending on the element that is not in balance.

05.03.28 A Comparison of the Nestling Provisioning Rates of Male and Female Swainson's Warblers (*Limnothlypis swainsonii*)

Darby, Hanna *Northeastern State University*

Mia, Revels *Northeastern State University*

The young of altricial species require parental care to develop and survive. In birds, the nestlings remain in the nest for some time and the parents must bring them food. Provisioning rates, the rate at which a parent brings food to its nestlings, are a critical part of the natural history of birds with altricial young. Little is known of the natural history of the Swainson's Warbler, *Limnothlypis swainsonii*, including information about provisioning rates. Nests were located and filmed on the Little River National Wildlife Refuge in southeastern Oklahoma. Videotapes were viewed and the following behaviors were noted: frequency and duration of visits by each parent to the nest, frequency of parental provisioning of the nestlings, and the number of nestlings fed during each trip. Provisioning rates were compared within early, middle, and late developmental stages. We found that the overall provisioning rates increase as the nestlings age, with the average female rate increasing disproportionately to the average male rate. This overall feeding increase is consistent with the idea that as the nestlings grow, they require more food to meet higher metabolic demands.

05.03.29 Chlamydia trachomatis Recruits Protein Kinase A and Protein Kinase A Substrates During Infection

Amanda, Behar *Oklahoma State University*

The obligate intracellular pathogen, *Chlamydia trachomatis*, usurps many host cell-signaling pathways from within a membrane bound vacuole, deemed an inclusion. *C. trachomatis* has been previously shown to recruit and activate Src family kinases at discrete microdomains on the inclusion membrane. These microdomains are theorized to be regions for additional kinase activity. This study investigated the recruitment of Protein Kinase A (PKA) and PKA phosphorylated substrates to the inclusion membrane microdomains during *C. trachomatis* infection. PKA was found to be sequestered to the inclusion membrane microdomains and colocalizing with active Src family kinases at mid to late infection. Phosphospecific antibodies to PKA phosphorylated substrates demonstrated that PKA substrates also colocalized with Src family kinases. Pharmacological inhibition of PKA activity resulted in a loss of PKA phosphorylated substrate recruitment and localization, while PKA recruitment remained unaffected. These studies provide novel insights into the diverse role of PKA during *C. trachomatis* infection and suggest that the active Src family kinase rich microdomains function as highly active kinase regions on the inclusion membrane surface that may be involved in many essential chlamydial processes.

05.03.30 Chlamydia trachomatis Manipulates Protein Kinase C During Infection

Brooke, Romine *Oklahoma State University*

Chlamydia trachomatis is the most commonly reported bacterial infection in the United States and the leading cause of sexually transmitted infections worldwide. Infection by *C. trachomatis* can lead to severe medical complications in women, including pelvic inflammatory disease; yet, despite these concerns, there are fundamental gaps in our understanding of *Chlamydia* pathogenesis, particularly with regards to the mechanisms used to manipulate host proteins for intracellular survival and growth. Our central hypothesis is that *C. trachomatis* manipulates and recruits host signaling proteins, such as Protein Kinase C (PKC). We have shown that *C. trachomatis* manipulates PKC during infection, recruiting multiple isoforms of PKC to the chlamydial parasitophorous vacuole, the inclusion, during infection. Phosphorylated PKC co-localizes with activated Src family kinases at discrete microdomains on the inclusion membrane. PKC substrates were also found to localize to the entire periphery of the *C. trachomatis* inclusion. The recruitment of PKC and PKC phosphorylated substrates suggests that PKC may play a very important role during *C. trachomatis* infection. These studies provide novel insights into the diverse mechanism by which *C. trachomatis* manipulates host cell processes for survival and infection.

05.03.34 Unconsciously Saying No

Bailey, Craig *Northwestern State University*

Westermarck theorized that nature would select out breeders for a successful evolutionary outcome. As such he hypothesized that there is a natural dislike to mating between persons living closely together from childhood. Taking this hypothesis into consideration, we looked at the incest taboo in a little different way; this experiment looked at the dating patterns in small rural schools compared to large schools. It has been observed that in small schools (student body size less than a hundred) where adolescents grew up in close association with each other, that they do not date each other within their school, they tend to date other adolescents from small schools in the surrounding areas. Adolescents in smaller schools see the kids they grew up with, essentially as brothers and sisters. They do not see their fellow peers as dateable. In other words small school adolescents see this as a form of inbreeding. Surveying adolescents from rural schools in Northwest Oklahoma served as the source for collecting data. As a result of the survey a majority of students currently dating or have previously dated, had dated someone from another surrounding school. However, a majority of the students said they would think about dating someone from their school.

05.03.35 Golden Rice: Genetically Modified Crop That Could Benefit Vitamin A Deficient Populations in Developing Countries

Brian,Clark *Northeastern State University*

Paper review: Genetically modified (GM) crops have the potential to alleviate nutritional deficits in developing nations that subsist on a staple cereal and have few dietary sources of micronutrients. The modification of crops and their associated traits has been conducted by humans for many generations through selective breeding, but with the employment of GM technology it has become possible to convey traits that could not otherwise be introduced into a species as native plants do not contain the variability for these genes. Vitamin A deficiency (VAD) is a problem that affects millions of people and can lead to blindness as well as death. The development of Golden Rice offers a solution to reduce the pervasiveness of VAD by creating a strain that incorporates biosynthetic pathways for beta-carotene, the precursor of vitamin A. Since the first publication on Golden Rice in 2000, the micronutrient content has increased to meet dietary requirements and has been shown as a sound source of vitamin A especially for those in the most rural settings that cannot receive supplementation or fortification of vitamin A.

05.03.36 Cryptic Species and Contact Zones: Using Molecular Markers to Assess Geomys Distributions in Oklahoma

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Michelle,Haynie *University of Central Oklahoma*

Rebecca,Dimanche *University of Central Oklahoma*

The aim of this project is to utilize genetic markers to address two questions concerning members of the genus *Geomys* (pocket gophers) found in Oklahoma: 1) What are the distribution boundaries of *G. bursarius* (plains pocket gopher) and *G. breviceps* (Baird's pocket gopher) in central Oklahoma and 2) Is *G. jugossicularis* present in the Oklahoma panhandle? The mitochondrial DNA cytochrome b (cytb) gene, the Y chromosome SmcY gene, and a suite of 14 microsatellite markers will be used to identify specimens collected in central Oklahoma and the panhandle. The geographic boundary between *G. bursarius* and *G. breviceps* in central Oklahoma is undefined, though Heaney and Timm proposed a boundary based on morphological data and a known contact zone has been identified in Norman. Testing will be done to determine if the boundary suggested by morphological data is supported by genetic data, and if additional contact zones exist along the boundary of the two species. Genetic data obtained from samples collected in central Oklahoma will be compared to samples collected from within the well-defined ranges of the two species (western Oklahoma – *G. bursarius*; southeastern Oklahoma – *G. breviceps*) to ensure correct genetic identification and to account for the possibility of hybridization between the two species in central Oklahoma. Additionally, samples collected in the panhandle will be compared to known *G. bursarius* samples to determine if they represent a different spec

05.03.37 Effects of Prescribed Fire and Forest Dynamics at an Urban Cross Timbers Forest in Central Oklahoma, USA

Carmen,Esqueda *University of Central Oklahoma*

Chad,King *University of Central Oklahoma*

Understanding effects of prescribed fire is essential to the development of forest management practices. In 2011, the Oklahoma Forestry Service began a prescribed fire regime for forest fragments at Lake Stanley Draper located in southeastern Oklahoma City, Oklahoma, U.S.A. Lake Stanley Draper lies within the Cross Timbers ecoregion and is surrounded by urban landscape. One goal of this project is to obtain pre- and post-burn plant species composition for one designated burn unit using permanent fixed-plots (0.01 ha). Pre-burn data has revealed post oak (*Quercus stellata* Wangehn.) and blackjack oak (*Quercus marilandica* Munchh.) as the dominant overstory tree species. Including post and blackjack oak, nine other tree species in the understory and fifteen species at ground level have been identified. Post-burn data will be collected three times following prescribed burning to determine fire effects on residing plant species. This study is important for foresters managing the regime at Lake Stanley Draper by evaluating burn effectiveness. Effects of prescribed fire at this site will also benefit the scientific community because these results have yet to be determined for urban forest fragments of the Cross Timbers.

05.03.38 Comparison of Work Performance in Men with Traumatic Transtibial Amputation and One Male at Risk for Residuum Injury

Eugene,DeLoach *Langston University*

Transtibial amputations (TTAT) are frequently performed in individuals who have sustained a traumatic event. The majority of adults with a traumatic transtibial amputation are healthy, male, and of working age. Nevertheless, residuum pain and injury suffered during work-related activity (WRA) are chief reasons adults with amputation are overly represented among the unemployed. The purpose of this study was to compare self-paced gait, brisk gait, carrying, and lifting in healthy working adults to a working adult at risk for residuum injury. A cross-sectional study design was used to assess consenting men (25-55 yrs) with unilateral TTAT. The subjects completed a Prosthetic Evaluation Questionnaire (PEQ) and Locomotor Capacity Index survey. During 2-minute self-paced walk, 2-minute brisk walk, floor-to-knuckle lifting, and 25-ft carrying tests, single limb support, cadence, step length, and stride length were recorded concurrently with perceived pain and exertion. Data were tabled and graphed for analysis. Data collected in each WRA indicated that the "at-risk" subject demonstrated greater single limb support on his residual limb than the group at a brisk walking pace and less difference in speed and stride length while carrying a weighted test box. Overall, the "at-risk" subject operated at a comparatively lower performance level. WRA capacity, specific gait parameters, anthropometrics, PEQ subscales are proposed measures to test in men for residuum inj

05.03.39 Use of Jasmonic Acid and Salicylic Acid to Control Harmful Nematodes in Soybeans

Felicia,Osburn *University of Central Oklahoma*

Ibrahim,Taher *University of Duhok*

James,Bidlack *University of Central Oklahoma*

Jane,Jarshaw *University of Central Oklahoma*

Joshua,Faw *University of Central Oklahoma*

Michaela,Metts *University of Central Oklahoma*

Michelle,Littlefield *University of Central Oklahoma*

Winifred,Zajac-McConaghy *University of Central Oklahoma*

Matheus,Almeida *University of Central Oklahoma*

This experiment was conducted to determine if jasmonic acid, salicylic acid, or a combination of both treatments would alter the biomass of soybeans in the absence and presence of harmful nematodes. Plants were established in pots on the roof of UCO's Science Building and nematodes were introduced a few weeks after establishment. Chemicals were sprayed shortly after nematodes were introduced. Half of the plants were harvested at mid-season and the rest of the plants were harvested at maturity. Measurements were taken to determine plant height, fresh and dry weight of all plant components, and number of nematodes present for each treatment. In general, salicylic acid increased the weight of some soybean yield components in both the nematode infected and non-infected treatments. These results suggest that salicylic acid could be used to increase soybean yield, particularly when nematodes are present.

05.03.40 Recent Approaches in Producing Marker-Free Transgenic Plants

Taylor,Skorupski *Northeastern State University*

Recent Approaches in Producing Marker-Free Transgenic Plants Taylor Skorupski Mentor: Dr. Kevin Yueju Wang Molecular & Cellular Biology Laboratory, Department of Natural Sciences Northeastern State University at Broken Arrow 3100 East New Orleans Street Broken Arrow, OK 74014 Abstract: Today, many consumers are worried about the process of genetic modifications in concerns to our food. One of the many techniques that are used in genetically modifying our plants is by the insertion of a selectable marker such as an antibiotic resistance or herbicide resistance gene. These selectable marker genes are used to easily and more readily screen transgenic plants. Since many consumers are unaware of the benefits and fear genetically modified organisms, several techniques have been at play in order to remove the selectable marker gene. These techniques include: co-transformation, transposition, homologous recombination, and site-specific recombination. These techniques use strategies such as excising the selectable marker, in other words cutting it out of the DNA or simply separating the selectable marker from the wanted gene in the early transformation stage. By removing the selectable marker gene, industries have now produced a marker-free transgenic plant. We reviewed recent approaches to produce marker-free transgenic plants.

05.03.41 Evaluation of The Antimicrobial Activity of Cinnamon Oil Nanoemulsions Against Methicillin-Resistant Staphylococcus aureus (MRSA)

Cole,Craig *University of Central Oklahoma*

Hari,Kotturi *University of Central Oklahoma*

Kanika,Bhargava *University of Central Oklahoma*

Maine,Barros *University of Central Oklahoma*

Matheus,Almeida *University of Central Oklahoma*

Wanderley,Vital *University of Central Oklahoma*

MRSA has emerged as epidemic crisis in clinical, veterinary medicine and food safety worldwide. The presence of trans-cinnamaldehyde in cinnamon oil has proven to be a powerful antioxidant as well as a powerful antimicrobial agent against an array of microorganisms and their biofilms. These properties provide us with a natural alternative compared to today's standard antimicrobial agents. However, its application is limited due to high minimum inhibitory concentration (MIC) and insolubility in water. One of the strategies in dealing with such hydrophobic compounds is by dispersing them in emulsion droplets. Nanoemulsions of cinnamon oil were prepared via ultrasonication using 10% v/v of oil and surfactant Tween 80 in DI water. Essential oil emulsions prepared by this optimized method exhibited average particle size of 212.92 nm. In this study we investigated the antimicrobial properties of cinnamon oil nanoemulsions against Staphylococcus aureus and MRSA strain ATCC 43300. Antimicrobial activity was investigated using the Broth Microdilution Assay and the Kirby-Bauer Disk Diffusion test. Cinnamon oil nanoemulsion exhibited MBC of 0.078% v/v and zone of inhibition (mm) of 14.5. Antimicrobial nanoemulsion of cinnamon oil offer alternatives to control MRSA in hospital, community and food processing settings. Future studies should explore the antibiofilm effect of cinnamon oil nanoemulsions against MRSA.

05.03.42 How Marker-Free Transgenic Plants Can Help Reduce the Concerns of Consumers

Hayley,Fischer *Northeastern State University*

How Marker-Free Transgenic Plants Can Help Reduce the Concerns of Consumers Hayley Fischer Mentor Dr. Kevin Wang Natural Science Department, Northeastern State University at Broken Arrow 3100 East New Orleans Street, Broken Arrow, Ok 74014 Selectable marker genes are commonly used for the transformation of plants. A selectable marker is a gene with an expression that allows it to correctly identify the cells that have been transformed with the marker gene in order to produce higher quality plants. Transgenetics are used most frequently in plants to add in foreign DNA for resistance to herbicides and to genetically modify them. Normally, selectable marker genes are either antibiotic or herbicide resistant. Unfortunately, many consumers are concerned about human health if we were to ingest the plants that have the genes still intact in them. Biologists have developed numerous different strategies such as: co-transformation, screenable markers, site-specific recombination, transposition and homologous recombination in which a marker gene is eliminated from a chloroplast or nuclear genome after the selection process has occurred. This strategy is called marker-free transgenic plants. A marker-free transgenic plant means the production of transgenic plants without selectable antibiotic or herbicide resistance markers, but instead promotes regeneration after transformation.

05.03.43 Prevalence of Tick-borne Diseases in Oklahoma County

Matthew, Bryson *University of Central Oklahoma*

Robert, Brennan *University of Central Oklahoma*

Over the past decade, there has been an increase in the cases of tick-borne diseases in the area of Oklahoma County. This study will ascertain whether this increase is due to a higher rate of pathogens in ticks themselves. Tick specimens will be collected from multiple sites around Oklahoma County utilizing dragging techniques. Specimens will be identified to species and the contents of their gut analyzed via Multiplex Polymerase Chain Reaction to determine the presence of seven tick borne pathogens.

05.03.44 Utilization of Recombinase Mediated Cassette Exchange for Proper GMO Design And Its Ability To Overcome Environmental, And Health Concerns

James, Brown *Northeastern State University*

Kevin, Wang *Northeastern State University*

The mission statement of biotechnology is often said to be to feed, fuel, clothe, and heal the world. While these are a noble set of goals, detractors have voiced much concern regarding the safety of biotech products, especially the use of antibiotic or pesticide resistance genes to select for successfully transformed organisms. While markers of some sort are necessary to produce a GMO product, the possibility that those markers could then transfer to other organisms in the wild, be it a weed or bacterium raises genuine health and environmental concerns. On top of this, markers also produce a barrier to further modification of an organism by the fact that each marker can't be used repeatedly in successive transformations. Here, we reviewed recombinase mediated marker removal which is an efficient method of removing these markers to produce an amitotic marker gene free GMO product.

05.03.45 Variability of Pseudomonas aeruginosa Recovered From Cystic Fibrosis Patients in Different Age Groups

Elizabeth, Pascual *Oklahoma State University*

Cystic fibrosis (CF) is the most common autosomal recessive genetic disorder, resulting in faulty chloride ion channels in the lungs. As a result, the lungs are severely compromised with viscous secretions leading to chronic and repeated infections, and the colonization of a diverse microbial community. Pseudomonas aeruginosa is one of the primary pathogens in the CF lung and prior research has demonstrated a high degree of phenotypic heterogeneity among adult isolates in comparison to control strains. This study uses subsets of P. aeruginosa CF isolates recovered from two patients in each age category: children (under 13), adolescents (13-18), and adults (over 18). Isolates were assayed for a number of virulence factors including surface motility (swim, swarm, and twitch) and production of hydrogen cyanide, biosurfactant, casein protease, and various fluorescent pigments. Isolates from most patients showed a high degree of consistency in producing hydrogen cyanide, fluorescent pigments, protease and biosurfactant. There was, however, variability seen in the different surface motilities of isolates between the different age groups. These results provide insights to the variability of P. aeruginosa between age groups and confirm differences between P. aeruginosa isolated from newly infected CF patients and those chronically infected for many years.

05.03.46 Marker Free Transgenic Plants for a Healthier and Safer America

Andrew, Fisher *Northeastern State University*

Marker Free transgenic plants are in high demand and should be made readily available, unfortunately we are lagging behind. Why should we be forced to consume hazardous foods against our wills and do so unknowingly? Marker genes are used in order to change the genes of plants so they will be resistant to antibiotics and herbicides; these are called genetically modified organisms, GMO. These GMO's can be passed on to the consumer, known as a horizontal transfer, and can interfere with medications and other necessities. This also allows extremely harmful toxins, such as Roundup, to be used on food products that we all eat. For this reason and many more the need for marker free transgenic plants has grown exponentially. In a poll, 91% of those in which were polled wanted GMOs labeled (2012 Mellman Group poll) and 53% of consumers would not buy GMOs (CBS/New York Times poll). Transgenic marker free plants are plants in which are not genetically altered so they do not contain the resistance genes and will not interfere with medications or contain harmful herbicides. In this review, multiple ways of producing plants without GMOs will be discussed.

05.03.47 Barcoding the COI Mitochondrial Gene of Culicoides, Biting Midges

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Jennifer, Nichols *Tulsa Community College*

Jordan, Cox *Tulsa Community College*

Valerie, O'Brien *Tulsa Community College*

Gabriel, Johnson *Tulsa Community College*

Tulsa Community College Departments of Biotechnology and Biology DNA barcoding has emerged as a powerful tool to supplement traditional methods of taxonomy. Cytochrome c Oxidase Subunit I (COI), a highly conserved 650 base pair segment of the mitochondrial genome, has become a 'global standard' to sort out broad taxonomic diversity in animals and this gene is the target of the study. Biting midges (Diptera: Ceratopogonidae: Culicoides spp.) were collected in two wildlife management areas in Oklahoma. Biting midges are vectors for parasites and pathogens but can be difficult to identify morphologically. Our aim was to investigate a protocol to name the specimen to the species level using molecular biology techniques of the barcoding standard. Our techniques included DNA extraction, PCR amplification, sequencing, and analysis through a multiple sequence alignment and phylogenetic tree formation. We conclude that the identification of as few as five midges could be completed using the COI amplification protocols outlined here.

05.03.48 COI Microgenomic Identification and Phylogenetic Evaluation of Arachnida and Insecta Specimens

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Ashton, Williams *Tulsa Community College*

Diana, Spencer *Tulsa Community College*

Grant, Chrapla *Tulsa Community College*

Lina, Guerrero *Tulsa Community College*

Nicol, Whinery *Tulsa Community College*

The purpose of this study was to compare phylogenetic relationships of Oklahoma Arthropoda organisms through discriminate analysis of the cytochrome c oxidase subunit I (COI) gene. COI codes for an enzyme in cellular respiration, and the 650-base nucleotide fragment on the 5' end of the mitochondrial gene is designated as the universal barcode of life in animals. DNA was extracted, and amplified through polymerase chain reaction with the LCO1490 and HCO2198 primers. Products were quantified, purified, and sequenced. Electropherograms were analyzed and trimmed, with contigs assembled. The data were analyzed using a Maximum Likelihood clustering method; genetic distances were visualized in Jalview. The katydid grasshopper samples were highly conserved. Although our samples were not professionally identified morphologically, they were analyzed through NCBI BLAST with divergences and similarities often verified. Seven of the twenty original samples were phylogenetically placed. Consistent with our expectations, the spiders and insects showed marked genetic similarities with some unexpected aberration.

05.03.49 Analysis of Glyceraldehyde-3-Phosphate Dehydrogenase Genes In Oklahoma Plants

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Samantha,Rice *Tulsa Community College*

Tyler,Noble *Tulsa Community College*

The protein Glyceraldehyde-3-Phosphate Dehydrogenase (GAPDH) is a well-understood enzyme in cellular respiration. The target of this study is the GAPC family of genes that code for GAPDH. Human GAPDH is over expressed in certain types of cancer and appears to have roles in DNA replication and repair, regulation of transcription, programmed cell death, and human neuronal diseases. Our aim was to have a major portion of the GAPC gene sequenced from native plants in northeastern Oklahoma and investigate whether potential phylogenetic placement based upon the sequences of the GAPDH gene would be similar to present taxonomic schemes. We hypothesized that the plants from Asteraceae would be most similar to each other, and the monocot data would exhibit the greatest genetic distance from the dicot data. In this study, DNA from Oklahoma plants was extracted and evaluated. The DNA was amplified and analyzed on an agarose gel. The purified product was ligated into a plasmid vector and then transformed into a bacterium for selection. Plasmids were purified, restriction enzyme digested, and DNA sequenced from positive clones. Following bioinformatics analysis, we conclude that the relationship between the GAPC gene sequences may support traditional phylogenetic placement.

05.03.50 Digestive Tract Microbiota Analysis of *Sceloporus consobrinus*

Alejandra,Mera *Northeastern State University*

Cindy,Cisar *Northeastern State University*

Mark,Paulissen *Northeastern State University*

Recent microbiological studies have revealed the abundance and diversity of microorganisms inhabiting the digestive tracts of animals. The gut microbiota of mammals has been well studied, while there has been little study of lizard gut microbiota. In this study, we investigated the gut microbiota of the prairie lizard, *Sceloporus consobrinus*, an insectivorous species. Rectal swab samples were collected from eight prairie lizards captured in Cherokee county in northeastern Oklahoma in the spring and fall of 2014. High throughput 16S rRNA gene sequencing of fecal DNA samples was performed by Research and Testing Laboratory (Lubbock, TX). Bacteria from eight different phyla were identified in the samples: Acidobacteria, Actinobacteria, Bacteroidetes, Cyanobacteria, Firmicutes, Planctomycetes, Proteobacteria, and Verrucomicrobia. A high level of variability in bacterial community composition was observed among individuals. Only Proteobacteria and Actinobacteria were present in all eight lizard samples, ranging from 8-98% and 0.2-8.6% of total bacteria, respectively. The most abundant phylum was Proteobacteria constituting $47.91 \pm 40.98\%$ of total bacteria, followed by Firmicutes ($28.56 \pm 24.65\%$), and Bacteroidetes ($21.20 \pm 22.81\%$). The remaining phyla were present in low abundance, on average < 3% of total bacteria. These results provide the first data on *S. consobrinus* gut bacterial populations and their diversity.

05.03.51 Assessing Black Rail occupancy and habitat along the Texas Gulf Coast

Chris,Butler *University of Central Oklahoma*

Jeffrey,Tibbits *University of Central Oklahoma*

The Black Rail (*Laterallus jamaicensis*) is one of the most secretive birds in North America, and little is known about the habitat requirements of Black Rails along the Gulf Coast. Anecdotal observations suggest that this species' population has declined during the last century, and wetland surveys document a substantial loss of breeding habitat. We conducted breeding bird surveys to estimate occupancy and detection probability for the Black Rail in estuarine wetlands. Surveys occurred at Brazoria and San Bernard National Wildlife Refuges from March to May of 2014. We incorporated breeding bird survey data with habitat covariates to identify the variables that influence Black Rail occupancy. This information will be used to improve Black Rail survey protocols and management strategies for Black Rails along the Texas Gulf Coast.

05.03.52 Continued Investigations on Use of Plant Pigments in Photovoltaic Cells

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Ben,Sutter *University of Central Oklahoma*

David,Graves *University of Central Oklahoma*

Erinn,Murphy *University of Central Oklahoma*

James,Bidlack *University of Central Oklahoma*

Winifred,Zajac-McConaghy *University of Central Oklahoma*

This investigation is a continuation of on-going research to find a plant substance which is suitable for the manufacture of practical dye-sensitized photovoltaic cells. During the past year, we focused on evaluation of chloroplast isolations from moss, fern, pine, and deciduous specimens for incorporation into photovoltaic cells. These cells were constructed with glass planes, an anode and cathode; one doped with tin-oxide, with a deposited layer of titanium dioxide, later stained with the plant extract; the other being a similar tin doped glass plane, except coated with graphite. The titanium dioxide coated plane (anode) was stained with a plant extract of chloroplasts and chlorophyll, given a protective seal to protect it from the atmosphere, and then injected with a solution of electrolyte to permit the flow of electricity to the cathode plate. The plates were joined with rubber bands, and offset slightly, to allow the connection of digital voltmeters connected to a computer for data logging. Among treatments applied to the cells, pine demonstrated the highest and most consistent voltage over a 30 day period. An unusual phenomenon, in which cells stopped producing voltage and then demonstrated a spike of voltage many days later, was consistently observed in pine treatments and these data are currently being evaluated.

05.03.53 Identification and Characterization of the Bile Salt Sensitivity Mechanism in Escherichia coli

James, Bidlack *University of Central Oklahoma*

Maximilian, Lyon *University of Central Oklahoma*

Our previous research has linked the genes *yciS* and *yciM* in *Escherichia coli* to bile salt sensitivity. In this research project we have attempted to isolate and sequence these loci in order to characterize the genes responsible for this phenotype from five strains of bacterium with different genotypes in these regions. One strain is the original strain that demonstrated sensitivity, the second is a resistant sister strain, two are sensitive knock-out mutants, and the last is the parent strain to the others. Our objective was to be accomplished by amplifying the select regions using polymerase chain reaction (PCR) on the selected region to produce high quantities of the DNA in question. The product of these reactions would then be sent to an offsite center for sequencing. The sequences attained from the strains on *E. coli* used in this project would then be compared to the wild type to determine the exact mechanism for the sensitivity observed. Further research will focus on determining if this sensitivity is transferable to other bacterium and if so, which phenotype is dominant. This will be accomplished by transforming a plasmid to contain either the resistant or sensitive gene and inserting it into bacteria with the opposite phenotype. A change in phenotype will indicate which of the two phenotypes is dominant.

05.03.54 Recreating Spray Pyrolysis: Thin Film Solar Cell Methodology

Hunter, Porter *University of Oklahoma*

James, Bidlack *University of Central Oklahoma*

Spray pyrolysis is an advanced technique used to create thin films on solid media by applying atomized liquids to the surfaces while simultaneously heating them to annealing temperature. Thin film solar cells were created using glass doped with a thin layer of tin oxide. One glass slide was coated with titanium dioxide nanoparticles in an acidic solution and then heated to anneal the titanium, creating an anode. Titanium was applied using three techniques: a cold atomized spray that was then heated to annealing temperature, an atomized spray onto glass preheated to annealing temperature, and a hand-based doping method using a template acting as a control. Cathodes were created by deposition of graphite onto other tin-doped slide. Cells were then assembled by loading an iodine electrolyte (KI/I₂) solution between the anode and cathode and held together using cyanoacrylate glue. Cells were evaluated qualitatively (based on appearance, thickness, and imperfections) and quantitatively (based on voltage output and percent viability). Cold spray cells contained unavoidable imperfections and moderate voltages. Hot spray cells contained few imperfections, a perfect viability rate, high ease and speed of construction, but higher variability and lower voltages. Control cells contained technical issues and a low viability rate, but had overall higher voltages.

05.03.55 Effects of Sugar Mixtures on Feeding Preferences of Field-Collected Fruit Flies (*Drosophila melanogaster*)

Jessica,Huffman *Southwestern Oklahoma State University*

Jimena,Aracena *Southwestern Oklahoma State University*

Maryanne,Dantzler-Kyer *Southwestern Oklahoma State University*

Fruit flies, *Drosophila melanogaster*, show preferences between various types of mono- and disaccharides. Our purpose was to test their ability to discriminate between pairs of sugars while freely foraging on a patch of food. Three different sugars (sucrose, glucose, fructose) were tested in combination pairs. A fructose-glucose mixture was used to determine if the flies preferred sucrose to its monosaccharide components. We also tested the effect of an unacceptable sugar (lactose) on the preference for sucrose. The flies were deprived of food for 20 hours and tested undisturbed for one hour in groups of 50 flies in a small arena containing one patch of 24 wells of sugar solution. The solutions were dyed red (12 wells) or blue (12 wells), which later were visible through the abdominal walls and allowed for easy scoring of preferences. The flies preferred sucrose to the fructose-glucose mixture. Lactose increased the preference for sucrose. Flies with purple abdomens (having fed on both sugars tested) were more common when both sugar solutions were acceptable, showing that the flies foraged on more than one resource on a patch and that foraging increased in patches consisting of higher quality resources.

05.03.56 Explication of the Bile Salt Resistance Gene Locus in *Escherichia coli*

Angeline,Satchell *University of Central Oklahoma*

James,Bidlack *University of Central Oklahoma*

Jennifer,Walling *University of Central Oklahoma*

Molecular investigations are being pursued to isolate, clone, and sequence *yciM* and *yciS* genes that appear to be responsible for bile salt resistance / sensitivity in *Escherichia coli*. We are using *E. coli* strains BW25113, JW1271, JW1272, JC3272F, and JC3272I to amplify target DNA using polymerase chain reaction (PCR) and then gel electrophoresis to obtain DNA fragments. Our plan is to use the amplified DNA for sequencing and then compare these sequences among strains to identify the exact mutation that leads to bile salt sensitivity. Our team has been successful at amplifying target DNA in some strains of the *E. coli*. The next steps will be to successfully amplify all strains of *E. coli*, sequence the DNA, and make a comparative analysis of wild type and mutant strains of *E. coli*.

05.03.57 The Effects of Scaling Abundance on the Pattern of Commonness and Rarity

Chris,Butler *University of Central Oklahoma*

Nathan,Hillis *University of Central Oklahoma*

The relationship between common and rare species is one of the most prevalent relationships found in nature. In the majority of communities, there are few species with high abundances and many species have low abundances. This relationship is known as the species abundance distribution (SAD). The effects of different levels of abundance on the SAD have not been well studied. This study uses Christmas Bird Count data from 1963 to 2012 for the grasslands of North America to examine how the SAD responds to various scales of abundance. For this project, random fractioning models were developed to predict the SAD based on the total abundance and number of species present in a sample. The observed SADs will be compared to the predicted SADs to determine how the SAD responds to different levels of abundance. Based on earlier studies, we predict that the SAD will move from log-series to lognormal to log-series as the total abundance of the sample increases.

05.03.58 Transgenic Crops Shaping the World through Pharmaceuticals

Dimitri,Mahee *Northeastern State University*

Dimitri Mahee Mentor: Dr. Kevin Yueju Wang Molecular and Cellular Biology Laboratory, Department of Natural Sciences Northeastern State University at Broken Arrow, Broken Arrow, Oklahoma, United States, 74014 Abstract: Biotechnology could be a key source to the overall health of the world we live in today. The subject in biotechnology that could advance the human race, specifically, is molecular farming. Molecular farming is a technique that many scientists/researchers utilize to genetically alter organisms, such as plants and the recombinant proteins that lie within, to become widely transformed and produced to give rise to pharmaceutical usage (drug, vaccines, etc). Transgenic crops like tomatoes, in the last decade, have grown to be a huge interest of study. Tomatoes are being under research currently because once they are a transgenic crop vaccines can be created and help one's body to fight against and possibly be cured of: Alzheimer's disease, Hepatitis B, cholera, rotavirus, prostate cancer (the nutrient lycopenes in tomatoes helps with the defense due to the properties it holds) and help produce more insulin for diabetic persons. In addition, it will not be a hindrance to bio-safety concerns on non-targeted biologics like other plants, insects, and pollination. One concern about tomatoes is if mass production can be made in high yields per hectare. Nonetheless, matters are being taken to produce more of this crop and will continue to grow in high number

05.03.60 Alteration of Flower Morphology Ballota Acetabulosa Influences Pollinator Guild Composition and Behaviour

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The Greek horehound, *Ballota acetabulosa* (Lamiaceae), is an evergreen shrub native to Southeast Greece, Crete, and West Turkey. Flowers of this plant are bilateral, with filaments and styles located on the adaxial side or top of the flower. Thus, many bee species, have morphological adaptations to passively collect pollen from this type of flowers. Flowers also feature a nectar guide, which may serve to signal reward and guide the searching behavior of pollinators. To investigate how removal of the flower's nectar guide affects bee visitors, we conducted an experiment in two adjacent plots, one control plot and one experimental plot, on the island of Lesbos, Greece. Bee visitation, handling time per bee, and nectar flow per plant were measured during 30-minute trials that were timed at two-hour intervals on each day. Nine bee species visited our plots; however, honey (*Apis mellifera*) and leaf cutter bees (*Megachile lefebvrei*) were the most frequent visitors. Handling time per bee were similar but also displayed high variance, suggesting that individual bees might have learned or that innate differences may exist between species. Our results support the hypothesis that nectar guides reduce searching behavior of bee foragers, but also suggest that different bees may not use nectar guides or that they rely on other clues to locate flowers.

05.03.63 ZMapp: The Cure for Ebola?

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In 1976, the first outbreak of Ebola occurred in Zaire and Sudan and has continued to spread panic to this day. There are five different strains of Ebola, which are all named according to the area where they were first discovered, for example, Ebola-Zaire and Ebola-Sudan. Ebola-Zaire is the most dangerous strain, and is the strain that is plaguing West Africa today. Ebola is usually fatal and the symptoms can range from diarrhea, chest pain, internal and external bleeding. Currently there is no cure or treatment for Ebola, but there is research being done in order to help those who have already contracted the virus. Zmapp is a new therapy that is made up of three different antibodies, which help to prevent the spread of the disease throughout the body. It is produced through molecular farming, which is the use of plants to create cost-effective, and renewable pharmaceuticals. Molecular farming is done by inserting a gene that codes for a specific pharmaceutical into a plant, and this pharmaceutical is eventually harvested, and used for its intended purpose. The antibodies that make up Zmapp are harvested from tobacco plants, and are administered directly into a patient's vein. When the antibodies are injected into a patient, they attach to the Ebola virus, thus preventing it from being able to enter a cell and replicate. The antibodies also help recognize the antigens as foreign, which allows the body to launch an immediate immune response. Testing has been done on anim

05.03.64 Uewv (Water- The First Medicine)

Norma, Rice *College of the Mvskoke Nation*

The focus of the research was over local tribal areas of water and the consideration of the importance of clean water. Six local areas were used for sampling in rivers and lake of, the North Canadian River, Okmulgee Creek, Lake Eufaula, Lake Henryetta, and the Arkansas River. Results have indicated a significant amount of bacterial and viral concentrations. Bacterial coli phage presence shows that the concentration of E. coli appears to be elevated. The bacterial isolation techniques used microscopy. For verification of the level hindrance or contamination, plating of growth, coliform screenings, and PFU data were obtained. Analysis for water looked at concentration of oxygen, nitric oxide, ph., and phosphate. This study is still currently ongoing and will continue into the spring water quality screenings as a comparison. Bacterial isolated in water in significant concentrations will be further identified using polymerase chain reaction and DNA sequencing. For now, results still indicate impairment of water quality. Knowing about the importance of clean water sources for local tribal communities only increases the need for educating others about these findings and certain steps that individuals and groups can choose to improve aquatic life.

05.03.65 Ultraviolet Fluorescence of the Rattlesnake Rattle

Aaron, Place *Northwestern State University*

Gabriel, Dunbar *Northwestern State University*

The western diamondback rattlesnake rattle fluoresces a yellow-green color when exposed to ultraviolet light of 395 nanometers. Previous studies have demonstrated that fluorescence in scorpions is utilized in communication with other scorpions; however, few studies have been conducted on fluorescence in rattles. An experiment was designed to collect fluorescence data in ten species of rattlesnake. Corrected total fluorescence data was gathered on ten species of rattlesnake by exposing preserved specimens to ultraviolet light of 395 nanometers and analyzing the photographs in ImageJ, followed by various statistical analyses. Four hypotheses were tested: Snakes prone to rattling demonstrate more intense fluorescence, snakes from open habitats possess greater fluorescence, snakes with tail banding have greater fluorescence, and snakes with unicolor tails exhibit greater total fluorescence. Results of the analyses provided no support for any of the four hypotheses. Future revisions of the experiment will include more specimens from each species and a more complete representation of the pit viper clade. Additionally, future research will attempt to determine whether the rattle serves as a photoreceptor when hiding under rocks in the same manner that olive sea snakes do, or if the fluorescence in the rattle serves as a lure for prey.

05.03.66 Deletion of Antibiotic Resistance Genes from Transgenic Tobacco Using Site-Specific Recombinases CinH and ParA

Alexia, Dickey *Northeastern State University*

Commercially available transgenic plants often contain an antibiotic resistance gene in addition to their novel traits. The antibiotic resistance gene, also known as the selectable marker, is used to screen for transformation events. After this marker is no longer needed, it unnecessarily remains in the plant's genome. Escape of the resistance genes to the environment has raised consumer concern about GMO safety. This research utilizes two novel recombinases, CinH and ParA under control of a seed-specific promoter to remove the unwanted transgenes from genetically modified tobacco while leaving the novel traits intact. This seed-based system can be a powerful tool in plant biotechnology. Both Codon-Optimized and wild type ParA and CinH were cloned into pCambia2300-Phas1470-Nos respectively. Agrobacterium mediated transformation was used to introduce the four binary vectors, pCinH-GUS, pCinH-OP-GUS, pParA-GUS, and pParA-OP-GUS to *Nicotiana tabacum* SR1 leaf discs. The Kanamycin resistant transformants were screened on Kanamycin medium (100mg/L) and later transferred to soil. Reporter gene GUS was used to select for plants expressing novel traits. GUS positive plants have been allowed to set seed. Phas, the seed specific promoter will drive recombinase expression. The recombinase will mediate antibiotic-resistance gene excision, leaving the seeds and subsequent generations marker-free.

05.03.67 In vitro tests to evaluate PCL fiber effect on titanium-bone scaffold interfaces Joshua Cody Knight, Fariha Sultana, Mika Barnes, Melville B. Vaughan, Morshed Khandaker

Joshua, Knight *University of Central Oklahoma*

The objective of the study was to determine the influence of the osseointegration on the bonding strength, σ , between titanium (Ti) and bone scaffold due to collagen (CG) and collagen-polycaprolactone (PCL) (CG/PCL) fiber coatings on Ti. A beta-tricalcium phosphate (β -TCP) disc (9.5 mm diameter \times 1.6 mm thickness) was used as bone scaffold. Cells were cultured on the top of Ti, Ti/CG, Ti/CG/PCL and β -TCP surfaces for 14 days. β -TCP were placed on top of Ti/CG and Ti/CG/PCL specimen in a custom made acrylic well to make the coupled β -TCP- Ti/CG and β -TCP-Ti/CG/PCL specimen, respectively. Cell culturing was conducted on the coupled samples for 2 months, followed by tensile measurements on each of the constructs. The coupled samples were glued on the holders in the Evex tensile test stage. Tension tests were conducted at strain rate 0.001 mm/sec to determine the σ values of the samples. No bonding occurred between Ti and β -TCP whereas Ti/ β -TCP samples with CG and CG-PCL showed noticeable bonding strength, σ , though the differences of σ between those samples were not significant. This result suggested that both CG and CG-PCL can improve the bonding of Ti/bone.

05.03.68 The Advancement of Plant Made Pharmaceuticals

Hannah, Meraou *Northeastern State University*

For centuries, plants have been enhanced through selective breeding. With the emersion of transgenic technology in 1983, more recent biotechnology developments have enabled the establishment of genetically modified (GM) crops. Such advances in technology have allowed for the production of pharmaceuticals in transgenic plants. As plant molecular farming has evolved, biosafety concern regarding possible transgene spread in the environment, and the potential for recombinant molecules to contaminate the food chain has grown. However, strategies such as transformation of the plastid genome, sterility of male plant lines, and use of transgenic plants that can be cultivated in bioreactors minimize these risks.

05.03.69 A Novel Method for Non-Invasive Measurement of Stress Hormone Levels in Zebrafish (*Danio rerio*)

Alexis, Jones *Northeastern State University*

Whitney, DeNeen *Northeastern State University*

The popularity of zebrafish as a model organism in behavioral neuroscience, neuropharmacology, and specifically in stress research, raises the need for measuring circulating levels of stress hormones. However, due to the small size of zebrafish, blood collection is difficult and involves sacrificing the fish, and the amount of plasma collected is small (1-5 μ L). Homogenates can also be used to measure hormone levels but this prevents repeated sampling of the same individual. Previously validated non-invasive methods require technical expertise and equipment that may not be available at every institution. Our study investigated use of EIA for non-invasive measurement of cortisol from the holding water of zebrafish. 10 adult wild-type zebrafish were used; individuals were removed from the home tank and placed individually into a well containing 10mL of RO filtered, deionized water for 30 min, 1 hr, or 2 hrs. After this, the water was collected from each well and stored at -20oC until analysis. Water samples were analyzed for cortisol concentration using the ACE™ Competitive EIA and results were interpreted using a microplate reader. We found that measurement of holding water cortisol using this method effectively determines free cortisol released into the water through the gills of zebrafish. Given that cortisol released to holding water correlates positively with plasma concentrations, this method represents a novel alternative to blood collection or whole body homog

05.03.70 Some Fleshy Fungi From the Pre-montane Forests of Western Panama

Adriana, Corrales Osorio *University of Illinois at Urbana-Champaign*

Clark, Ovrebo *University of Central Oklahoma*

Neotropical montane forests are often dominated by ectomycorrhizal (EM) tree species, yet the diversity of their EM fungal communities remains poorly explored. In lower montane forests in western Panama, the EM tree species *Oreomunnea mexicana* (Juglandaceae) forms locally dense populations in forests otherwise characterized by trees that form arbuscular mycorrhizal (AM) associations. Other common ectomycorrhizal trees in the area are *Quercus* and *Coccoloba* spp. It is important to document and identify the fleshy fungi associated with these trees in order to provide a reference collection for the DNA sequences that are isolated from the root tips. Here we report on some of the fungi collected during the 2014 field season. EM genera commonly found were *Russula*, *Lactarius*, *Cortinarius*, *Boletus*, *Tylopilus*, *Amanita*, *Hydnum* and *Cantharellus*. Many species of these genera resemble temperate species but may be different due to subtle differences in morphology or their DNA sequences. A few examples include *Lactarius indigo*, *Cortinarius violaceus*, *C. bolaris*, *Hydnum repandum* and *Leccinum abellum*. Species with known tropical distributions include *Austroboletus subvirens*, *Velophyrellus pantoleucus* and *Amanita flavoconia* var. *inquinata*. Saprotrophic fungi were also common and examples include *Marasmius cladophyllus*, *Xerula hispida*, *Polyporus tenuiculus*, *Fistulina hepatica*, *Mycena margarita*, *Aseroe rubra* and *Laternea pusilla*.

05.03.71 Response of Chlamydomonas reinhardtii to Medium Viscosity

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Steven,Karpowicz *University of Central Oklahoma*

Thi,Nguyen *University of Central Oklahoma*

The unicellular alga *Chlamydomonas reinhardtii* contains two cilia, which provide cellular locomotion and environmental sensing. The objective of this study is to determine whether physical forces experienced by the cell affect gene expression, and, conversely, whether gene expression influences cilia behavior. Specifically, we are determining whether different medium viscosities will affect cilia behavior and expressed forces and influence gene expression. Differences in growth medium viscosity do not affect cellular growth rate. However, cells do exhibit a 7-fold decreased velocity in more viscous growth medium. Cells do not appear to retain physical inhibition of motility if transferred from high to low viscosity medium. RNA-seq is being performed on RNA isolated from cells grown in five viscosity conditions. Gene expression results are forthcoming.

05.03.72 Molecular Farming of Carrots for Vaccines

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Joshua Curtiss Molecular and Cellular Biology Dr. Kevin Wang 1/26/15 Northeastern State University at Broken Arrow 3100 East New Orleans Street, Broken Arrow, OK 74014 Molecular Farming Carrots for Vaccines Paper review: Molecular farming is not a new topic to the human population. Certain plants and animals have been genetically modified specifically for medicinal use. Using recombinant technology, we can fundamentally change the DNA of an organism and cause them to produce compounds that have medicinal purposes. Molecular farming has evolved the technique of using these plants or animals to produce specific proteins that are usable by humans as vaccines or treatments of various diseases. One example is the use of carrot tap root in producing a multitude of vaccines, such as: Hepatitis B, Measles, Human Immunodeficiency virus, Chlamydia trachomatis, Mycobacterium tuberculosis, and Yersinia pestis (also known as the Black Death). Research into all of these diseases is ongoing, but the carrot is important because it is the first plant approved to produce biopharmaceuticals for human use.

05.03.74 OHP protein may preserve red algal photosynthesis from high light damage

Steven, Karpowicz *University of Central Oklahoma*

Sukyong, Kwak *University of Central Oklahoma*

One helix protein (OHP) is associated with the photosynthetic apparatus in green plants and is necessary for recovery of photosynthetic activity after exposure of the plant to increased light intensities. Red algae are distant relatives to green plants and algae. We have identified several genes in the red alga *Porphyra umbilicalis* (nori) that encode proteins that are homologous to photoprotective proteins in green plants. We are specifically investigating whether the function and regulation of the *Porphyra* OHP homolog is similar to that of green plants' OHP. An artificial microRNA to knock down expression of the *Chlamydomonas reinhardtii* OHP gene has been created. Knockdown mutants that demonstrate a high-light sensitive phenotype are being tested for genetic complementation with the *P. umbilicalis* OHP gene. Green plants' OHP mRNA and protein expression are known to respond to high light intensity. The response of *P. umbilicalis*' OHP mRNA to high light levels is being tested with a time course experiment in which *P. umbilicalis* blades are exposed to elevated light intensities. Gene expression data are being collected.

05.03.75 "LONG-TERM OUTCOMES OF SERVICE-LEARNING ON CIVIC ENGAGEMENT AND PROFESSIONAL NURSING PRACTICE"

Barbara, Arnold *University of Central Oklahoma*

Although there is a growing body of knowledge concerning service-learning in professional nursing education, nursing research reports minimal studies that sufficiently address the effects of service-learning strategies on baccalaureate nursing alumni in promoting self-efficacy toward long-term civic engagement or development of professional practice. The purpose of this predictive, correlational study was to determine if a relationship existed between participation in the service-learning experience and self-efficacy toward civic engagement as a long-term outcome of professional nursing education and the development of professional practice in nursing alumni. Spearman's Rho was used to correlate the independent variable of service-learning with the dependent variables of civic engagement and professional practice. Multiple regression analysis indicated that service-learning had less than a 4% effect on civic engagement attitudes and a 6% effect on community service hours (behavior). The Social Cognitive Theory, specifically self-efficacy coupled with the construct of practical reasoning provided framework for the study. Results concluded that service-learning had a low to moderate relationship with both long-term civic engagement and the development of professional nursing practice. Key Terms: civic engagement, service-learning, self-efficacy

05.03.76 Influence of climate on radial growth of blackjack oak (*Quercus marilandica*, Munchh.) in the central Cross Timbers, Oklahoma.

Chad,King *University of Central Oklahoma*

Plant species at the edge of their contemporary habitat distributions are more affected by changes in climate. As such, climate change has the potential of altering plant species distributions. Blackjack oak (*Quercus marilandica*, Munchh.) is at its western distribution limit in central Oklahoma and is historically a dominant tree species of Cross Timbers forests. However, very little is known about what factors (temperature, precipitation, PDSI) have the greatest effect on its growth. This study's objective was to assess the correlation of climate variables on radial growth in *Q. marilandica*. Increment cores (n=49) were collected from *Q. marilandica* in three forest stands in central Oklahoma and were used to run climate analysis to determine effects on radial growth. Data analysis suggest significant positive correlation between annual radial growth and monthly precipitation (October, January, May) and significant negative correlation between annual radial growth and temperature (June, July). Analysis also suggest available moisture (average monthly PDSI) has a significant effect on radial growth ($r > 0.40$, $p < 0.05$). These results suggest that declines in precipitation due to climate change in central Oklahoma could affect *Q. marilandica* populations at their current distribution limits. With a shift to an even greater arid climate in the region, *Q. marilandica* could face potential declines in forest stands causing a shift of species composition in south-central forests.

05.03.77 Epigallocatechin Gallate Inhibits Dupuytren's Myofibroblast Phenotype in a Two-Dimensional Culture

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Melville,Vaughan *University of Central Oklahoma*

Sonnie,Gainer *University of Central Oklahoma*

Dupuytren's contracture is a hand condition that pulls one's fingers to a bent position due to the excessive tissue that forms under the skin. This is treated through surgery but recurrence is very likely, so most of the time patients have to go through surgery several times. Myofibroblasts have an effect on wound healing and excessive scarring in patients with Dupuytren's contracture and other diseases. Antioxidants are thought to interfere with myofibroblast differentiation. EGCG (green tea extract) is an anti-inflammatory and anti-oxidant we predicted may inhibit myofibroblast growth. In this experiment, a coverslip staining technique was used to test this prediction. The results showed that adding EGCG to cells does inhibit the percentage of myofibroblasts in a population of fibroblasts derived from Dupuytren's contracture. Our concurrent studies are testing whether the contractile function of cells is also inhibited by this treatment. These results may help us understand the cell biology of Dupuytren's contracture and lead to new treatments.

05.03.78 Combined Effects of Fluoxetine and β -Funaltrexamine on Chemokine Expression in Normal Human Astrocytes

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Introduction: Neuroinflammation is a key component of brain disorders including neurodegenerative disorders, infection and depression. The therapeutic effectiveness of some antidepressants such as fluoxetine (FLX) is reportedly due in part, to anti-inflammatory action. We are particularly interested in the effects of FLX and other novel anti-inflammatory agents. Astrocytes have a fundamental role in neuropathogenesis in part, through the release of neuroinflammatory chemokines (e.g. CXCL10). Our goal was to explore the combined effects of FLX and β -funaltrexamine (β -FNA), a novel anti-inflammatory agent, on CXCL10 expression in normal human astrocytes (NHA). Methods: NHA were maintained in cell culture with media replenished every 48 to 72h. Chemokine expression was induced with IL-1 β (3ng/ml) or IFN γ (10ng/ml) + HIV-Tat 1-72 (100 nM). β -FNA and FLX (5 μ M or 10 μ M) were added at time of stimulation. CXCL10 levels in media were determined by enzyme-linked immunosorbent assay (ELISA). Western blotting was used to assess NF- κ B activation. MTT viability assay was performed to assess cytotoxicity of treatments. Results: Unstimulated cells expressed negligible CXCL10; however, IL-1 β and IFN γ + HIV-Tat 1-72 significantly induced CXCL10. As we previously reported 10 μ M β -FNA inhibited CXCL10 expression whereas neither 5 μ M β -FNA nor FLX (5 μ M or 10 μ M) were inhibitory. Interestingly, the combination of 5 μ M

05.03.81 Autophagy plays an essential role in neuronal development and maintenance.

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Ashley, Powers *Southwestern Oklahoma State University*

Matt, Abbott *Southwestern Oklahoma State University*

For the past decades, scientists noted that many neurodegenerative disorders, such as Alzheimer's, Huntington and Parkinson's Disease are characterized by pathological accumulations of protein aggregates. However, more recently, analyses from brain autopsies and animal models show that the accumulation of toxic protein aggregates come together with a reduced protein recycling machinery. Autophagy, the primary focus of the research summarized herein, involves the removal of cell debris and the recycling of protein aggregates in health and disease. BEC-1, a *Caenorhabditis elegans* protein conserved from human to yeast, was shown to play an essential role in autophagy and recycling of nutrients under starving conditions. Furthermore, recent research suggested that BEC-1 may link recycling of nutrients in nerve cells with growth, differentiation and maintenance of neurons. To test this probable link, we characterized the neuronal structure and function of *C. elegans* mutants expressing all proteins except BEC-1. Collectively, we found that BEC-1 mutants have developmental and functional defects at the level of motor neurons. Imaging analysis revealed a reduction in the number of motor neuron extensions called commissures. Quantification of motor function demonstrated severely dysfunctional locomotion. Last, results of chemical dose-response assays indicate neuronal synapses have a normal neurotransmission.

05.03.82 Lanthionine ketimine is a neurotrophic agent that promotes axonal elongation and autophagy.

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Collapsin response mediator proteins (CRMPs), are cytoskeletal adaptor molecules involved in a variety of normal cellular functions including alteration of cell shape and cell communication. CRMP2s have also been associated with pathological disorders and neurological diseases. For instance, CRMP2 protein collects in cytoskeletal tangles in Alzheimer's disease, which may contribute to neural degeneration in this disorder. In other examples, differences in CRMP2 expression have been documented in some subsets of patients suffering paranoid schizophrenia. Lastly, the anticonvulsive drug lacosamide (Vimpat) was found to act by binding to CRMP2, which unmasked the pharmacological importance of CRMP2-binding in epilepsy. Thus, based on these observations, we hypothesize that CRMP2 plays a central role in neuronal connectivity and may represent a critical junction linking neural brain function with neural pathologies. Moreover, we reasoned that if we target CRMP2 therapeutically, we may reverse or slow-down onsets of many neurodegenerative disorders. To this end, we began a study focused on the in vivo effects of lanthionine ketimine (LK), a natural brain metabolite and neurotrophic agent, in *C. elegans*. Work from our group shows that LK partially rescues CRMP2 hypomorph mutants while activating a recycling mechanism called autophagy. These data provide evidence for in vivo function of LK and reveal new opportunities for therapy development when CRMP2 functionality is compro

05.03.83 Determining the toxic effects of silver nanoparticles using *C. elegans*.

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Kalkan,Kaan *Oklahoma State University*

Tony,Sanchez *Southwestern Oklahoma State University*

Silver nanoparticles are frequently used as an antimicrobial agent in paints, toys, household chemicals and appliances. Even though these particles are the most widely used nanomaterial, controversy surrounds the analysis of their toxicity. To shed some light in this field, we used the model organism *C. elegans* and study the effects of silver nanoparticles by determining mortality rates. In contrast to some published work, our finding showed that nematodes exposed for 24 h and 48 h to increasing concentrations of silver nanoparticles washed extensively to remove unbound silver did not show increasing mortality when compared to those exposed to citrate (vehicle solution). Moreover, examinations of mortality rates of animals exposed to silver nitrate or to unwashed silver nanoparticles (contaminated with dissolved silver nitrate) suggested that silver ions were the ultimate toxicant. One hundred percent of nematodes died after 48 h exposure to plates impregnated with 4 ml of silver nitrate solution or 4 ml of non-washed silver nanoparticles, while little lethality was noted with similar exposures to either citrate or washed nanoparticles. Together, our observations show that *C. elegans* can be used as an inexpensive in vivo model to test the toxicity of emerging materials. More specifically, these studies of silver nanoparticle point out the importance of avoiding free silver contamination when used in products such as paint, toys, and antimicrobials.

05.03.84 Establishing a Minimum Bactericidal Concentration for Aqueous Extractions From Raw Fresh Garlic

Heather,Jackson *Rogers State University*

Water borne illnesses continue to be a major problem for more than one third of the human population. In areas of the world where access to safe water is questionable, access to modern medicine is also problematic. Garlic has been used medicinally for millennia with increasing study into the active compounds. Previous studies have suggested sulfur-based allicin, a protease which forms when raw garlic is crushed or cut, is the chemical of interest. Two bulbs (125.23g) of organic garlic were chopped and washed with sterile water, yielding 9 mL of liquid. This garlic stock was serially diluted with Mueller-Hinton Broth and inoculated with *Escherichia coli*. Minimum bactericidal concentration (MBC) of garlic was 83.9 mg/mL. Although the consumption of raw garlic in solid form may deliver this dosage within the 4g maximum daily tolerance for humans, it took more than 4g of garlic to reach the MBC with water extraction. The possibility of hypersensitivity reactions in the skin due to garlic exposure during handling makes this model inadvisable as an acceptable substitute for modern medications.

05.03.85 Comparative analysis of Dictyostelium discoideum and Myxococcus xanthus

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Muatasem, Ubeidat *Southwestern Oklahoma State University*

Dictyostelium discoideum is a powerful biomedical model organism to study developmental regulation and cellular signaling because of the ease of genetic, biochemical and cell biology approaches. Upon starvation, single-celled amoebae emit cAMP and migrate toward aggregation centers. This gives rise to a discrete multicellular structure called the "slug". In the migrating slug, the precursors for stalk and spore cells become recognizable and are localized in specific regions. Prestalk cells are located in the anterior 20% of the slug and prespore cells occupy the remainder. Myxococcus xanthus is a gram-negative bacterium with a developmental life cycle, social behavior and multicellular morphogenesis that resemble the eukaryotic Dictyostelium discoideum. This resemblance between a prokaryotic and a eukaryotic organism can hold key information about the common evolutionary ancestor of these social organisms and probably their relation to other organisms with similar characteristics. In this study both organisms are being compared in growth and simple physiology to initiate a larger project.

05.03.86 In Vivo Interactions of Mcm10 and S Phase Checkpoint Proteins Analyzed Using FRET

Joseph, Cameron *Northeastern State University*

Shaina, Riggs *Northeastern State University*

Cell cycle checkpoint proteins delay DNA replication to allow for repair of damaged DNA or allow for apoptotic processes. Cancerous cells bypass these checkpoint mechanisms. A greater understanding of these checkpoint mechanisms could provide possible targets in anti-cancer therapies. Minichromosome maintenance protein 10 (Mcm10) has been previously found to be involved in DNA damage signaling with the 9-1-1 clamp during the G1 phase of the cell cycle. Using yeast two hybrid techniques, our lab has found that Mcm10 interacts with Mrc1 and the C-terminus of Pol2 which is the catalytic subunit of Polymerase epsilon (Pol ϵ). Mrc1, Pol ϵ , and DNA polymerase B 11 (Dpb11) are essential for cell viability and work in a complex to signal for S phase checkpoint. The goal of our project is to observe if Mcm10 is part of this signaling complex. To pursue this goal, we will be using FRET to study these interactions. We will create double-tagged strains of Mcm10-YFP with Mrc1-CFP/ Pol2-CFP/ Dpb11-CFP/ Dpb2- CFP by homologous recombination. These strains will be sequenced to confirm the correct integration of the fluorescent tags on the genome. We wish to extend these studies to cells exposed to DNA damaging conditions. We hypothesize that Mcm10 will closely interact with Pol2, Mrc1, and Dpb11 during S phase and DNA damage, and serve as a component of the checkpoint control pathway

05.03.87 Do pre-cancerous keratinocytes up-regulate alpha smooth muscle actin in response to TGF-beta?

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There is evidence that myofibroblast presence in tumor stroma leads to poor prognosis. Mechanical tension enhances differentiation of myofibroblasts. Myofibroblasts are distinguished from fibroblasts by the assembly of α -sm actin filaments. Transforming growth factor-beta (TGF- β) is the best-known inducer of α -sm actin and is correlated with increased contractility. Precancerous keratinocytes lead to two types of carcinomas. In vitro carcinomas can form through a pathway which involves the up-regulation of the H-ras protein. Ker-CT-Ras demonstrate an epithelial to mesenchymal transition (EMT), meaning the cells begin to demonstrate fibroblast form and function. Fibroblasts generate tension in the dermis during wound healing. So far, Ker-CT-Ras has shown an ability to generate tension in a dermal equivalent with an increased effect in the presence of TGF- β as well as a reduction of this ability when dosed with N-acetyl cysteine (NAC). Grinnell's stress-relaxation collagen matrix model provided the necessary microenvironment for myofibroblast formation. The model was originally used to investigate properties of fibroblasts, but we have appropriately extended its use to Ker-CT-Ras. Previously, we gathered comparative data on the Ker-CT-Ras matrices to the tension-generating ability of fibroblast matrices (DP-147-H-Tert). Now, we will present preliminary Western blot data examining the production of α -sm actin in Ker-CT-Ras collagen matrices.

05.03.88 Understanding Mcm10: Polymerase epsilon interaction in budding yeast

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Errors that occur during DNA replication can cause mutations leading to genomic instability. These elevated rates of mutation are often distinguishing characteristics commonly associated with the formation of cancer. During replication, a series of critical checkpoints evaluate the integrity of the DNA as well as the replication machinery. It is known that the checkpoints stabilize the fork and help to assemble the repair machinery. However, how the checkpoint pathway is activated is not completely understood. Preliminary studies suggest that Minichromosome maintenance protein 10 (Mcm10) interacts with the catalytic domain of Polymerase epsilon (Pol2) to activate the stress response pathway in *Saccharomyces cerevisiae*. Interestingly, Mcm10 interacts with the C-terminus checkpoint domain of pol2. Our goal here is to map the exact region on the C-terminus of Pol2 that binds to Mcm10. We will also perform experiments to determine if this binding site is distinct from Dpb2, Dpb3, and Dpb4 binding to Pol2. Lastly, we would like to determine if Mcm10 binds to Dpb11, a protein important for both replication initiation and checkpoint activation.

05.03.89 Floral and Faunal Survey in a Post-Oak – Blackjack Oak Forest and Tallgrass Prairie-Savanna Ecosystem

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Tulsa Community College – Southeast Campus, preserves 5-6 hectares of land, consisting of post-oak – blackjack oak forest, fragmented tallgrass prairie-savanna, and bottomland vegetation types. In order to assist conservation efforts, this study provides the first documentation of floral and faunal species present in the area. Additionally, we studied associations between faunal species and vegetation types, predicting that specific fauna would be found more often in either forest or prairie-savanna due to resources and habitat structure. Baited camera traps and fortuitous encounters were utilized to detect fauna. Faunal species richness was comparable in the forest and prairie-savanna habitats, and 36 species, including 10 mammal, 17 bird, 2 amphibian, and 7 reptile species, were identified in the area as a whole. Also, 93 vascular plant species were identified via non-random sampling, with 79 genera, and 33 families represented; 48 forbs, 15 graminoids, and 30 woody species were represented. Animal activity, based on the number of captures, and moon phases were compared, and showed that overall animal activity fluctuated with different phases. Activity decreased most during full moon and waning crescent phases. The combined results may be used to support and encourage conservation efforts for the preserve.

05.03.90 Mcm10 and Polymerase Epsilon: Communication in Maintaining Genome Stability

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Minichromosome maintenance 10 (Mcm10) and DNA polymerase epsilon (Pol ϵ) are essential replication proteins. Mutations in each one has been shown to cause genome instability, a hallmark of cancer cells. Mcm10 is required to facilitate both replication initiation and elongation. Pol ϵ is present during initiation in the preloading complex and is critical for replicating the leading strand DNA during elongation. It is a unique polymerase due to its role also in the DNA damage checkpoint pathway. Pol ϵ is made up of four subunits: Dbp2, Dpb3, Dpb4, and Pol2. Pol2 is the catalytic subunit of Pol ϵ . Results from our lab show a strong interaction between Mcm10 and Pol2, the catalytic subunit of Pol ϵ . Our project attempts to determine the significance of this interaction which may be involved in checkpoint activation. We plan to synchronize yeast cells in different phases of the cell cycle and study the Mcm10:Pol ϵ interaction by co-immunoprecipitation during normal replication. The ultimate goal is to study this interaction under replicative stress and DNA damage conditions, which will give us insight into how mutations in these proteins cause genomic instability. Subsequently, a better understanding of their interactions will provide a possible target for cancer screening and treatment.

05.03.91 Oriental Medicine: The Five Elements

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The Five Elements of Oriental Medicine are known as wood, fire, earth, metal and water. The elements are a major focus in oriental medicine. It is a theory, when all the elements are in balance, the being is in harmony. The elements work to balance one another out. If one element is out of balance, the corresponding element is also out of balance. The elements each represent different sources. The Wood Element represents the liver and gallbladder and its corresponding element, wood, represents the Spleen and Stomach. Fire represents the heart, small intestines and pericardium and its corresponding element, metal, represents the large intestines and lungs. The last element, water, represents the bladder and kidneys. When one of the elements are out of sync, there are some "illnesses" that one may experience, depending on the element that is not in balance.

05.03.92 The Expression and Purification of The Recombinant Magnetosome Associated Protein Mad2 From Desulfovibrio magneticus Strain RS-1 in Escherichia coli

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A diverse group of prokaryotic organisms known as magnetotactic bacteria produce magnetosomes, crystals of magnetite or greigite surrounded by a lipid membrane. Magnetosomes are organized in chains which allow cells to be oriented by the Earth's magnetic field. Usually, magnetite crystals have either cuboctahedral or elongated (bullet-shaped) morphology. The molecular mechanism responsible for the crystal morphology remains unknown. This work is aimed at investigating of the role of the Mad2, a protein found to be involved in magnetosome formation in *Desulfovibrio magneticus* strain RS-1. Two expression vectors with 6xHis tags on either C-terminal or N-terminal ends of mad2 gene were synthesized with codon optimization for expression in *Escherichia coli* BL21. We are working on the transformation of synthesized vectors in host bacterium. Following that, the overexpression, based on the use of a T7 promoter will be performed; results will then be visualized on a gel electrophoresis. Once the optimization of expression is carried out, the Mad2 tagged with histidine residues will be purified using immobilized metal affinity chromatography. This work will be advanced by experiments on iron binding assay using radioactive isotope Fe55 and investigating of the effects on crystal morphology during biomineralization in vitro.

05.03.93 Effects of Altered Protein Phosphatase 5 (PP5) in Cancerous and Non-Cancerous Cells

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Teresa,Golden *Southeastern Oklahoma State University*

Serine/threonine Phosphatase 5 (PP5) is an enzyme that has a role in the processing of signals received by cells. It has been shown that overexpression of PP5 increases the growth of breast cancer cells (MCF-7), increasing cancer cell survival. Overexpression of PP5 in neuronal cells has been observed to reduce the severity of Alzheimer's disease yet result in cell death in healthy human cells. To further understand these differences, we compared various catalytic PP5 mutants to fully functional PP5 expression in HF-12 human fibroblast cells and MCF-7 breast cancer cells using lipofectamine-based transfection inclusive of the PLUS reagent (Life Technologies) to initiate expression from normal or mutated PP5-EGFP constructs. We also used SYTOX Orange and Calcein Blue dyes on transfected breast cancer cells to observe correlations between mutated and non-mutated PP5-EGFP constructs. At various intervals, cells were observed using fluorescent microscopy under transmittance 4x/10x and 20x/40x, and fluorescent protein channels GFP, RFP and DAPI to detect fluorescence from transfected and dyed cells. HF cells transfected with PP5-EGFP and mutations varied in response. Control HF cells without extra PP5 exhibited health while fluorescing HF cells with PP5 and mutants were observed most commonly as dying cells, correlating with previous lab data. Overexpression of PP5 in healthy normal cells results in cell death. Studies with MCF-7 and comparisons to HF-12 are in progress.

05.03.94 Molecular Farming – Potato Ashley Strain Mentor: Dr. Kevin Yueju Wang Molecular & Cellular Biology Laboratory, Department of Natural Sciences Northeastern State University at Broken Arrow

Ashley,Strain *Northeastern State University*

Molecular farming is used to mass produce plants with the ability through the use of transgenic plants to replace certain pharmaceuticals such as antibodies, hormones, vaccines, and even growth factors. Transgenic potato plants were the first plants in 1990 used to create plant-derived pharmaceutical proteins. Human serum albumin was the first recombinant plant-derived pharmaceutical protein. After years of research the potato has led to many products approaching commercialization. Arntzen group is working with transgenic potato plants to produce many plant-derived pharmaceuticals such as a vaccine against Diarrhoea, Hepatitis B, and the Norwalk virus infection. Transgenic potato plants can also be used in the production of veterinary vaccines. Transgenic potato plants are an inexpensive option for replacement of many pharmaceuticals. According to current research being done on new drugs and vaccines, 250 acres of transgenic potato plants can produce enough plants to produce enough Hepatitis B vaccine to meet South East Asia's annual demand. The world has a growing need for pharmaceuticals. With a growing need the cost of these pharmaceuticals can be overwhelming for patients which may lead to very few of the pharmaceutical needs actually met. Transgenic potato plants through research have shown to be a viable, cost-effective option for the growing need of pharmaceuticals nationwide.

05.03.96 Thermal Parameters of Microhabitats of Lizards in the Wichita Mountains

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Saranah, Isenberg *Cameron University*

Previous work has shown that *Sceloporus consobrinus* (the prairie lizard) and *Crotaphytus collaris* (the Eastern collared lizard) prefer different microhabitats within the Wichita Mountains. Prairie lizards might be choosing microhabitats to avoid competition with or predation by collared lizards. Alternatively, prairie lizards may be accommodating different thermal preferences as they have lower preferred body temperatures than collared lizards. The body temperature of lizards is influenced by factors that include wind speed, conduction, solar radiation, air temperature, and organismal anatomy. Operative temperature is a thermal parameter that accounts for all of these factors. We tested the hypothesis that lizards are choosing microhabitats based on available environmental temperatures rather than to avoid competition or predation. We used fourteen anatomically correct copper lizard models ranging in snout-vent length from 2.7-7.5cm as operative temperature thermometers. We placed models in various locations suitable for prairie lizards within five sites in the Wichita Mountains Wildlife Refuge during summers of 2013 and 2014. Additionally, we recorded air temperature, wind speed, and relative humidity throughout the day. We then overlaid this data with the preferred body temperatures of each lizard species to determine if lizards were choosing areas that best matched their thermal preferences.

05.03.97 Antagonistic interactions between *Pseudomonas aeruginosa* isolated from different age groups of cystic fibrosis patients

Anna, Wright *Oklahoma State University*

Pseudomonas aeruginosa is an opportunistic human pathogen affecting cystic fibrosis (CF) patients and immunocompromised individuals contributing significantly to morbidity and mortality. Once infected with *P. aeruginosa*, patients are chronically colonized and unable to clear the infection even with antimicrobial treatment. *P. aeruginosa* is inherently resistant to many antimicrobials which has encouraged the hunt for novel potential therapeutics. Recently, *P. aeruginosa* isolates obtained from the same CF patient were shown to interact antagonistically where secreted signals from one isolate decreased protease production by another isolate. This antagonistic interaction also decreased the virulence of the virulent *P. aeruginosa* isolate. The purpose of this study was to determine if *P. aeruginosa* isolates from a variety of patients in three different age groups (under 13, between 13 and 18, and above 18) would respond to the antagonistic signals. Two antagonistic signal producing *P. aeruginosa* isolates (14672 and 14651) were co-cultured with *P. aeruginosa* isolates obtained from various patients. After *P. aeruginosa* cultures are grown and mixed they are spotted onto skim milk plates to test for the levels of protease production. Protease production is measured by a zone of clearing around the bacterial culture. The mixed cultures are then compared to individual strains also spotted on the skim milk plates. This method was used to test *P. aeruginosa* isolates from all age

05.03.98 Microbial Pathogenesis of Pseudomonas aeruginosa in Microgravity

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Jesse,Jahn *Southwestern Oklahoma State University*

Stressors during space take their toll on the human body, particularly the immune system, increasing the susceptibility of astronauts to opportunistic pathogens like Pseudomonas aeruginosa. Pseudomonas aeruginosa, a bacterium found in soil, water and on the skin, it can cause urinary tract, lung, and kidney infections. This microbe was grown in conditions mimicking micro-gravity and normal gravity conditions. Twitching assays were conducted to examine if micro-gravity conditions enhance pathogenesis and disease establishment. After growth periods, P. aeruginosa grown under zero gravity conditions showed a significant difference in the spreading/ twitching growth on 0.3% agar motility plates, as well as a difference in colony morphology, compared to cultures grown under normal gravity conditions. We also observed that two strains of Pseudomonas aeruginosa (PA01 and PA14) caused greater necrotic zones in bio-assays using lettuce leaves when grown under micro-gravity conditions. These results led us to believe that Pseudomonas aeruginosa (both PA01 and PA14) shows increased virulence under micro-gravity conditions. We have identified three potential proteins involved in increased twitching/motility and two of three proteins were over expressed in the micro-gravity grown microbe compared to the microbe grown under normal conditions. The third protein was under expressed in the micro-gravity grown microbe. We plan to further examine the function of the three proteins.

05.03.99 The study of Azoreductase enzymes in Bacillus cereus

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TaJae',Lloyd *Langston University*

The study of Azoreductase enzymes in Bacillus cereus TaJae' Lloyd and K.J. Abraham, Department of Biology Langston University, Langston, Oklahoma 73050 Azoreductase enzymes in human intestinal bacteria biotransform azo dyes into carcinogenic compounds. Azo dyes are synthetic dyes that contain an azo group. Azo dyes are widely used in the pharmaceutical, textile, food, and cosmetic industries. Azoreductase enzymes catalyze the reductive cleavage of azo linkages to produce aromatic amines, many of which are carcinogens. The hypothesis is that the bacterium, Bacillus cereus will metabolize the azo dye because of the presence of the azoreductase enzyme. The objective of this study is to investigate the presence and activity of azoreductase enzymes. Bioassay experiments with B. cereus and an azo dye, Acid Red 27 show presence of azoreductase activity. Future studies will include cloning and sequencing of the azoreductase gene.

05.03.100 Dietary Sugar and Protein Increases Cancer in a Drosophila Model

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Dietary restriction may be a viable strategy to reduce cancer incidence. The study of caloric restriction in a Drosophila model of cancer, called eye-ful, has shown to be a cancer reducing factor in tumorigenic fruit flies. However, it is not clear whether this effect is due to lack of a specific macronutrient rather than wholesale caloric restriction. In this experiment, we studied the effects of dietary restriction of specific macronutrients on tumor formation in a Drosophila model of cancer. Our experiments revealed that protein and sugar supplemented flies exhibited about a fourfold increase in eye tumors, whereas flies supplemented with fats and starch showed very little change relative to the low calorie control. Overall, these results suggest that general dietary restriction of proteins and carbohydrates may be an effective anti-cancer strategy with a specific emphasis placed on reducing dietary sugars rather than complex carbohydrates.

05.03.101 Pollinator Traits Correlate with Nectar Standing Crop Levels in an Invasive Plant Species found in Island Ecosystems in Greece and the USA

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JeAnna,Redd *University of Central Oklahoma*

John,Barthell *University of Central Oklahoma*

John,Hranitz *Bloomsburg University*

Theodora,Petanidou *University of the Aegean*

Victor,Gonzalez *University of Kansas*

Animal species interact in a variety of ways (negative, positive and neutral) in order to acquire resources they need to survive in their respective environments. Competition is a negative interaction that can be mediated in ways that reduce stress among competitors. To understand this phenomenon, we recorded numbers, sizes and types of bees found at plots of the highly invasive weed species yellow star-thistle, *Centaurea solstitialis*, in both the USA (on Santa Cruz Island) and Greece (on the island of Lesbos). Larger bodied bees were, on average, most common at high nectar volume plots of this plant species while smaller bodied species were common at low nectar volume plots. This pattern was consistent between locales and over time. These results are also consistent with the hypothesis that pollinator species minimize direct competition by partitioning their foraging efforts in a manner that avoids physical contact with other species at flowers. The underlying mechanism for this process is under investigation.

05.03.102 The Effects of FlexHets on the Activity of STAT3

Dana,Rundle University of Central Oklahoma

Felix,Ramirez University of Central Oklahoma

The Effects of FlexHets on the Activity of STAT3

05.03.104 Litterfall Accumulation and Composition: from the Ecotone into Primary Forest at Las Cruces, Costa Rica

Morgan,James Langston University

Edge effects can alter forested ecosystems due to changes in light, wind, and soil moisture that occur when forests become fragmented. Litterfall dynamics are affected by edge effects due to phenological responses of plants and animals to the altered abiotic factors. We predict that there will be a difference in litterfall biomass from the edge to the interior of a primary forest. In this study we placed 10 50x50 cm baskets on a 100 meter transect at the ecotone of a secondary and primary forest. We placed litterfall baskets at 0 meters, 30 meters, and 100 meters into primary forest. Litterfall was collected once a week over a 3 week sampling period, sorted into 5 categories to get individual biomass of leaves, reproductive parts, woody, mosses, and miscellaneous. There was no difference in litterfall biomass from the ecotone into the primary forest. However, litterfall complexity was greater 100m into primary forest compared to either 0 or 30m into primary forest. Greater litterfall complexity could provide more niches to support greater arthropod diversity and this may affect decomposition and nutrient cycling.

05.03.105 Sexual conflict in an ecological context

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Sexual conflict is a form of male-female interaction that is beneficial for one sex and detrimental to the other. Such conflicts have been increasingly studied as important engines of evolutionary change. Theory suggests that the sexes may engage in arms races over the control of mating interactions resulting in rapid changes in sexually antagonistic traits (i.e. traits that determine the outcome of these interactions). This field of behavioral ecology has been scrutinized because empirical studies testing the assumptions of sexual conflict theory often lack ecological realism. We are currently exploring how the ecological context affects the costs and benefits of mating interactions in small crustaceans (freshwater amphipods in the genus *Hyaella*) that are found in a variety of freshwater habitats. We will share discoveries about how changes in the ecological context affect the costs of mating and the ability of males and females to “build” traits used to resolve conflicts over mating. Our work demonstrates that understanding sexual conflict over mating as an engine of diversification requires knowledge of the ecological context in which mating takes place.

05.03.106 Denning and Nesting Sites of Neotoma cinerea by Radio Telemetry
Mary, Jordan Langston University

The bushy-tailed woodrat (*Neotoma cinerea*) is a medium-sized rodent found throughout the Pacific Northwest, North Dakota, northern New Mexico and the Sierra Nevada (Carey 1991). Bushy-tailed woodrats are very important animals in the forest food-chain. They are one of the most important species in the diet of the Northern Spotted Owl (*Strix occidentalis caurina*) (Wilson 2013). The Northern Spotted Owl is one of the most studied bird species (Zabel 2003) and in 1990, mainly due to habitat loss, was listed as a federally threatened species (Olson 2004). Although bushy-tailed woodrats serve important ecological roles, there is relatively little information about their life history traits or habitat needs. Recently, studies have begun to increase. Several bushy-tailed woodrats were caught in traps and radio-collared for tracking. Being an aboreal species, it can be assumed that most of the bushy-tailed woodrats' den locations will be in trees, particularly conifers. Much is to be learned about their dispersal and living patterns. The more known about bushy-tailed woodrats and other small forest prey, the more is known about the Northern Spotted Owl upon which many major forest plan decisions are based on.

05.03.107 A Proteomic Approach to Analyze Novel Interactions of Mcm10 in DNA Damage Repair Pathway

Cody, Miller Northeastern State University

Ofelia, Patrick Northeastern State University

Genomic stability must be maintained to avoid the development of cancer. Problems in DNA replication and repair may lead to genome instability. One protein implicated in maintaining genome stability is minichromosome maintenance protein 10 (Mcm10). Mcm10 is a conserved eukaryotic DNA replication factor known to interact with other DNA replication proteins such as Mcm2-7 and PCNA. Preliminary work from our lab has implicated a novel role for Mcm10 in DNA damage repair pathway. The focus of our research is to investigate the interactions of Mcm10 under normal replication and under conditions of DNA damage. Our approach will be to purify Mcm10 from budding yeast and then analyze its novel interactions by mass spectrometry. To accomplish this, we will be over-expressing 6xHis-tagged Mcm10 from a Gal promoter in a protease deficient yeast strain. We will purify the His-tagged Mcm10 by Ni-NTA affinity columns and then check the purity using Coomassie Blue staining and Western blot. The purified Mcm10 will be analyzed for its interactions by mass spectrometry. Ultimately, we would like to analyze interactions in yeast subjected to DNA damage conditions.

05.03.108 Title: To study the natural evolution in Watermelon mosaic virus (WMV) in Oklahoma. Rajbanshi, Naveen & Ali, Akhtar University of Tulsa

Naveen,Rajbanshi *University of Tulsa*

Cucurbits are economically important vegetables grown extensively in United States and worldwide. Cucurbit varieties like pumpkin, squash, watermelon are highly susceptible to infection by Watermelon Mosaic virus (WMV) and it can have a devastating effect on the yield. The symptoms manifested by the plants infected by WMV are mostly mosaic patterns in leaves, chlorosis, leaf curling and deformation. Due to the presence of RNA as genetic material, the mutation rate is very high in WMV and thereby generating a pool of new strains. Therefore, it is very important to monitor the genetic structure of the virus population before developing any control strategy. The leaf samples used in this study were collected in 2014 growing season from the fields of Tulsa. Coat protein primers were made from the published sequence and used to amplify the coat protein of collected isolates. Based on the coat protein sequence, we constructed the neighbor joining tree and performed phylogenetic analysis

05.03.110 Using Candida albicans to Provide Visual Aids for the Pleomorphic Characteristics of Fungi

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Robert,Brennan *University of Central Oklahoma*

Candida albicans is a pleomorphic fungus that produces three growth forms; yeast cells, pseudohyphae, and hyphae. These forms are dependent on pH, temperature, length of exposure, and nutrient source, to name a few. Pleomorphic fungi have the ability to transition into these forms as a mode of self-preservation, which can make opportunistic infections caused by this fungus more difficult to treat; therefore, it is important for students to understand this concept. Some students are visual learners and can comprehend lessons better with the use of visual aids. The objective of this project was to determine a rapid, efficient method to produce a visual aid of the pleomorphic characteristics of *Candida albicans* during a semester to provide better understanding of this characteristic for students in our Pathogenic Microbiology and Immunology course. We addressed this by comparing different media types, at room temperature, 30°C, and 37°C, as well as various environmental conditions for different lengths of time. We hypothesized that the best demonstration of pleomorphic characteristics of fungus would be those grown on TSA in 37°C for 48 hours, then left at room temperature for approximately three weeks; however preliminary results favor nutrient agar, tryptic soy agar, and Sabouraud dextrose agar, at all temperature ranges, in the anaerobic conditions of a candle jar.

05.03.111 Next Generation Sequencing of a Mega Plasmid in a Campylobacter jejuni Isolated from Retail Chicken Meat Reveals the Presence of Mu-Like Prophage and Multidrug Resistance Genes

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Mohamed, Fakhr *University of Tulsa*

Campylobacter spp are one of the most frequently isolated foodborne bacteria from retail poultry meats. The whole-genome sequencing of Campylobacter jejuni previously isolated from Oklahoma retail chicken showed one chromosome of 1,733,718 bp in size. It also showed the presence of a mega plasmid of ~ 85 kb in size that was also detected by PFGE. Libraries were prepared using Illumina Nextera XT and the next generation sequencing was performed in house on a MiSeq sequencer. Genome assembly was done using CLC Genomic Workbench. Annotation was done using RAST. The draft sequence of the mega plasmid was found to be 84,727 bp in size. It appeared as a large pTet like plasmid interestingly carrying some Mu-like prophage genes like the Campylobacter jejuni Integrated Element (CJIE) prophage I protein gene, prophage MuSo1, a transcriptional regulator gene, Mu-like prophage FluMu protein gp29 gene, and Mu-like prophage virion morphogenesis protein gene. Interestingly, the plasmid also carried aminoglycoside resistant genes (putative aminoglycoside 6-adenylyltransferase and aminoglycoside phosphotransferase) in addition to the tetracycline resistance tet(O) gene, a streptothricin acetyltransferase gene, and a hygromycin-B-phosphotransferase gene. While Mu-like prophage genes were previously reported in few Campylobacter chromosomes, to our knowledge, this is the first report of its presence on a Campylobacter large plasmid.

05.03.112 Implications of Climate Change and Emerging Parasitic Disease in Loggerhead Sea Turtles (Caretta caretta)

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Parasites may regulate free-living host populations; these interactions often affect the management and limit the recovery efforts of endangered species across many taxa. Mitigating the effects of anthropogenic climate change and preserving biodiversity has become the highest priority of many monitoring and management agencies. Changes in host distribution and abundance could affect parasite assemblages and life history strategies; moreover, environmental stressors such as pollutants and rising temperatures may negatively impact host immunity. The vital relationship between parasites and disease prevalence is complex and often poorly understood; few studies have tracked infectious diseases in marine systems. The Loggerhead sea turtle (*Caretta caretta*) is a species of concern in coastal and marine ecosystems; this species is often used as an indicator of environmental quality and health. Seasonal migration patterns among *C. caretta* present an opportunity to track parasite assemblages across a wide geographic distribution. Our research will specifically target the diversity and prevalence of Helminth parasites found within *C. caretta* at varying latitudes to quantify any significant seasonal or spatial differences. Fecal samples will be obtained and analyzed using light microscopy and compared with published Helminth parasite analyses to determine whether individuals at higher latitudes are less susceptible to parasitism than those subsisting seasonally at lower latitudes.

05.03.113 Prevalence, Virulence, and mecA Gene Possession of Staphylococci in Oklahoma Retail Fresh Mushrooms

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Muna,Alharpi *University of Tulsa*

The objective of this study was to determine the prevalence of staphylococci in both conventional and organic retail mushroom sold in the Tulsa, Oklahoma area. Characterizing the isolated strains for their possession of toxin and mecA genes was also aimed at. A total of 420 samples of retail mushrooms were purchased from retail stores including Asian markets across the Tulsa area. A total of 297/420 of mushroom samples (70.71%) was positive for the presence of Staphylococcus spp. The prevalence of *S. aureus* in the tested mushroom samples was only 2.36%. The mecA gene was detected in 64/297 (21.55%) of the positive samples. A total of 551 isolated Staphylococcal strains were also tested for the presence of 18 toxin genes. The prevalence of enterotoxins ranged from 0.34% to 2.69%. A subset of 120 staphylococcal isolates was subjected to 16S rDNA gene sequencing and was molecularly identified. A total of 10 different Staphylococcus species was detected including *S. aureus*, *S. fleurettii*, *S. saprophyticus*, *S. vitulinus*, *S. sciuri*, *S. xylosus*, *S. succinus*, *S. pasteurii*, *S. warneri*, and *S. haemolyticus*. More than half of the screened *S. fleurettii* strains carried the mecA gene. In conclusion, the prevalence of Staphylococcus spp. in fresh mushrooms is high and a subset of the strains was shown to harbor enterotoxin genes which might lead to foodborne poisoning. Staphylococci other than *S. aureus* may serve as reservoirs for the methicillin resistance mecA gene.

05.03.114 Detection and Prevalence of Large Plasmids in Staphylococcus aureus Strains Isolated From Various Oklahoma Retail Meats

Leena,Neyaz *University of Tulsa*

Mohamed,Fakhr *University of Tulsa*

Staphylococcus aureus is considered as one of the important foodborne bacterial pathogens causing food poisoning. Studies that discuss the characterization of large plasmids of *S. aureus* isolated from retail meat are limited. The objective of this study was to determine the prevalence of plasmids including mega plasmids in *S. aureus* strains isolated from various Oklahoma retail meats. The alkaline lysis method was used to isolate small to medium size plasmids and Pulsed Field Gel Electrophoresis (PFGE) was applied for the detection of large plasmids. Two hundred and twenty three *S. aureus* isolates including MRSA (67 beef, 58 chicken, 42 pork, 27 chicken liver, 22 turkey, and 7 chicken gizzard) were subjected to plasmid isolation with alkaline lysis and PFGE. Using alkaline lysis, 218/223 (97%) of the screened *S. aureus* isolates showed the presence of plasmids ranging in size from 3-60 kb. Using PFGE, 55/223 (38%) of the strains screened showed plasmids \geq 60 kb the majority of which was not detectable using the alkaline lysis method. The highest prevalence of these large plasmids was in the turkey isolates (59%). PFGE was able to detect plasmids > 200 kb in size in 7 *S. aureus* strains. In conclusion, *S. aureus* isolated from retail meats showed a high prevalence rate of plasmids with variable sizes. Also, PFGE can be considered an excellent tool in detecting mega plasmids in *S. aureus* that are not detectable by alkaline lysis.

05.03.115 Traditional Chinese Herb Potential Treatment for Cancer

Patrice, Samuels *Northeastern State University*

Abstract: Traditional Chinese culture has been using herbs for thousands of years to cure a wide range of diseases and health issues. *Artemisia annua* (woodworm) plant is one of these herbs that has been studied and found to potentially offer great benefits in the fight against cancer. The extract artemisinin from the plant has been utilized by tagging to be selected for cell apoptosis. Artemisinin has also been shown to inhibit receptors that are associated with angiogenesis, therefore causing cell death of the cancer. It is a hopeful inexpensive fore runner in the race to cure cancer.

05.03.116 Effects of pyocin production by *Pseudomonas aeruginosa*

Dillon, Jones *Oklahoma State University*

Cystic fibrosis (CF) is an inherited genetic disorder that results in an imbalance of chloride and sodium ions across apical cell membranes in the digestive system and the lungs. The result is thick mucus secretions that clog the lungs and leads to life threatening chronic infections by pathogens such as *Pseudomonas aeruginosa*. *P. aeruginosa* is quite prevalent as it is recovered from nearly 60% of all CF infections and contributes significantly towards morbidity and mortality. Antibiotic treatment rarely clears the bacterial populations from the lungs of CF patients due to increased antibiotic resistance and *P. aeruginosa*'s ability to produce biofilms. The difficulties encountered in treating patients with *P. aeruginosa* infections has increased interest in alternatives to traditional antibiotics and has inspired investigators to search for novel therapeutics. One such alternative includes antibacterial proteins called pyocins, which are produced by *P. aeruginosa* and could be adapted to target other *P. aeruginosa*. Pyocins are potent toxins with a narrow killing range in comparison to antibiotics. The aim of the proposed project is to evaluate the effects of pyocin production by *P. aeruginosa* in a *Drosophila melanogaster* infection model. *D. melanogaster* was infected individually and with mixed *P. aeruginosa* cultures consisting of pyocin producing *P. aeruginosa* and other CF isolates. The survival of *D. melanogaster* was monitored for 14 days. Mixed infections exhibi

05.03.117 Sublethal Effects of Three Pesticides on *Apis mellifera* in Turkey

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Maria Jose,Pastor *San Francisco State University*

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Montserrat,Plascencia *University of California Santa Cruz*

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Honey bees are exposed to a variety of insecticides used in apiculture or on crops. Recently, researchers showed that sublethal exposure to neonicotinoid insecticides duplicates Colony Collapse Disorder (CCD) affecting honey bee (*Apis mellifera* L.) populations in the United States and Europe. Sublethal stress models predict CCD due to transport of tainted pollen and nectar concentrated in the hive. Our goal was to test acute sublethal effects of three pesticides, a pyrethroid insecticide (deltamethrin) and two neonicotinoid insecticides (thiacloprid, acetamiprid) on bees in Turkey. We assessed sublethal doses of the three pesticides, at dilutions of the LD50 dose (1/5 LD50 to 1/1000 LD50), on gross motor control and the sucrose sensitivity of the proboscis extension reflex (PER) of honey bees. Both deltamethrin and thiacloprid affected gross motor control at 1/5 LD50 and 1/10 LD50. Deltamethrin and thiacloprid also affected sucrose sensitivity of the PER, with extinction of the PER occurring more frequently at the low sucrose concentrations than the moderate and high sucrose concentrations. In contrast, acetamiprid showed no effect on either gross motor control or sucrose sensitivity of the PER in honey bees. These results support the role of insecticides in the SLS Model of CCD, with the caveat that honey bees are affected by thiacloprid and deltamethrin but acetamiprid appears to be "bee friendly."

05.03.118 Remote Sensing: Determining Plant and Soil Health Through the use of Infrared Technology

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With today's reality of water scarcity, it is important to grow healthy crops using minimal amounts of water. Utilizing advanced technology such as infrared cameras and Unmanned Aerial Vehicles can assist in optimizing this process. By collecting information with an infrared camera, such as intensity, wavelength, and temperature emitted by the plants and soil, we can more efficiently determine the growth, health, and decay of the plants long before they are visible to the naked eye. We experimented growing Wisconsin Fast Plants in both Martian soil regolith and Earth top soil. When the plants were water stressed, the infrared camera clearly detected the dryness or saturation of the soil. We also examined plants with long, grass-like leaves, in which the infrared camera better revealed the health or decay by detecting damage and dryness of the leaves that would otherwise be difficult to spot. Using a mathematical equation based on the intensity and wavelength emitted, and matching this data with parameters determined by the characteristics of each plant type, we can determine health or decay at its earliest stages. This helps determine optimal watering levels for the soil, in order to prevent waste and promote crop health. This process will ultimately be incorporated in the experiment using remote sensing in UAV's, in order to monitor the health of plants, crops, and soil on a larger scale.