ABSTRACTS OF THE 110TH OKLAHOMA ACADEMY OF SCIENCE TECHNICAL MEETING NOVEMBER 5, 2021 EAST CENTRAL UNIVERSITY – ADA

SECONDARY SCHOOLING TYPE AND DIFFERENCES IN ACADEMIC SELF-EFFICACY AND SELF-REGULATION

LaDonna Autrey. East Central University

College students who received secondary education of homeschooling or traditional schooling were compared using self-efficacy for learning and academic self-regulation ability. A quantitative nonexperimental study was used with a convenience sample of 184 traditional undergraduate college students (44 homeschooled and 140 traditionally schooled) from 18 to 24 years of age. Participants completed the SELF, MSLQ, Parental Involvement-Student Section, and demographic questions. An ANCOVA found homeschoolers had significantly higher academic self-efficacy but found no significant differences in academic self-regulation when holding parental involvement and SES constant. No significant difference was found between participants' SES or parental involvement levels, so an ANOVA analysis was used and found homeschooled students had significantly higher academic self-efficacy but no significant difference from traditional students on academic self-regulation. Differences in academic self-efficacy could stem from differing pedagogical approaches and role students play in directing homeschool education not found in traditional schooling. Lack of difference found in academic self-regulation could stem from erratic answer patterns displayed on the MSLQ not found on the other surveys.

CLONING, SEQUENCING AND IDENTIFICATION OF TWO CLINICAL ENTEROVIRUS ISOLATES FROM OKLAHOMA

Earl Blewett, McKayla Muse, Brett Szymanski, and BJ Reddig, Oklahoma State University Center for Health Sciences

We obtained clinical enterovirus isolates from the Oklahoma State Department of Health. Two isolates have proven very useful and have been studied in two publications (Brett, et al. 2019a, 2019b). We are continuing research on anti-viral drugs that act on a wide spectrum of viruses, using these isolates. To confirm the identity of the isolates, which were typed at the Department of Health, we are cloning, sequencing and analyzing the viral genomic nucleic acid sequence using bioinformatics. The isolate CoxA9-01 has been positively identified as a Coxsackie A Virus. Isolate Echo2-01 has been confirmed as an Echovirus 2.

NURSE PLANT EFFECT INCREASES PLANT SIZE AND INSECT ABUNDANCE ON *SOLANUM CAMPYLACANTHUM* ON AN AFRICAN SAVANNAH

Sudikshya Budhathoki and H. George Wang, East Central University

Nurse plant effect is a type of plant–plant interaction that can facilitate the focal plant by microclimate modification or protection from herbivory. It also has the potential to affect the community pattern at other trophic levels. We conducted a controlled field experiment to examine the nurse plant effect of *Acacia etbaica* on a perennial shrub *Solanum campylacanthum* in an area frequented by large mammalian herbivores in Laikipia County, Kenya. Ninety *S. campylacanthum* saplings were randomly assigned to three treatments: Thorn, Non-thorn, and Control. The initial height, stem length, and number of leaves were recorded for each plant. Plants of the Thorn treatment were covered with branches of *A. etbaica*, plants of the Non-thorn treatment were covered with branches of *Croton dichogamous*, and plants of the Control treatment were not covered. The *Solanum* plants were allowed to grow for nine months. At the end of the experiment the plant sizes were measured again and the insects on the plants were sampled. We also collected five leaves from each plant and used ImageJ to quantify leaf damage from insect herbivory. We used generalized linear modeling to compare the plant growth and insect density between the treatments. We also used linear mixed-effects modeling to compare leaf damage between treatments. The nurse plant significantly increased the growth of the *Solanum* plants and the density of insects on them relative to the Control plants. *Solanum* plants in the Thorn treatment had more leaf damage than the Control plants. The nurse plants, especially the type with thorns (*A. etbaica*), appear to have reduced large mammalian herbivory on *S. campylacanthum*, which in turn facilitated insect herbivory on the focal plant.

ANTIBIOTIC RESISTANT AND GROWTH PATTERNS OF INVASIVE SPECIES IMPORTED ON MELONS FROM CENTRAL AMERICA

Katlyn Hampton, D. Melton, A. Gauchan, and C. Biles, East Central University

Invasive species of fungi are commonly imported into the United States on fruits and vegetables. Our goal with this project was to establish what the differences were between the species imported locally. The 2 genera that we studied were *Fusarium* and *Diaporthe*. We investigated a range of physiological traits in order to better understand them including antibiotic resistance and growth characteristics. We performed a growth study where we used different kinds of media to observe species' specific growth rates across a range of 5 agar plates. We also performed an antibiotic study where we tested the isolate cultures to analyze resistance and susceptibility to 10 different antibiotics. Finally, we performed a temperature study to determine what the optimum temperature was for each species to grow. Results indicate that Czapek-Dox (CZD) and Corn Meal Agar (CMA) provided the best nutrients for growth for most species. The most effective antibiotic we tested on all isolates was econazole 10 mcg, and the least effective was fluconazole 25 mcg. The optimum temperatures were 23° C and 25° C. Invasive species threaten immunocompromised people as well as the environment. By better understanding what these species prefer, we can work towards minimizing their impact.

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BIOLOGICAL CHARACTERIZATION OF THE CYTOTOXIC EFFECTS OF NOVEL LACTATE DEHYDROGENASE INHIBITORS IN MIA PACA-2 CELLS

Hanna Hill, Horrick Sharma, and Pragya Sharma, Southwestern Oklahoma State University

Outstanding Undergraduate Paper in Biomedical Sciences

Pancreatic ductal adenocarcinoma cancer (PDAC) is one of the most lethal cancers, with a 5-year survival rate of ~8% and a median survival duration of fewer than six months. Therefore, identifying new biological drug targets is urgent. In the attempt to develop innovative anticancer treatments and selectively target cancer cells, growing interest has recently focused on the peculiar metabolic properties of cancer cells. One of the characteristic metabolic hallmarks of tumor metabolism is aerobic glycolysis. The Warburg effect in cancer cells is regulated by lactate dehydrogenase-A (LDH-A), which is shown to be overexpressed in many cancer types, including PDAC. Several studies have shown great potential in targeting this enzyme as a means of developing novel treatments. Our lab, in collaboration, has identified diverse novel lactate dehydrogenase inhibitors, which have shown promising anticancer activity against pancreatic cancer cells without having any cytotoxic effect in normal cells. We are currently investigating the mechanism of antiproliferative activity of lead LDHA inhibitors through Western blotting and Annexin V assays.

ANALYSIS OF THE SPATIAL DISTRIBUTION OF GEOREFERENCED HERBARIUM RECORDS IN OKLAHOMA AND TEXAS

Sierra Hubbard, Oklahoma State University

Outstanding Graduate Paper

Digitized and georeferenced herbarium collections are invaluable for research focused on spatial distributions of plants. However, herbarium data are often spatially biased; easily accessible locations are often overrepresented in herbaria, while remote locations are underrepresented. These spatial biases are compounded by the lack of digitization and georeferencing efforts in certain areas. The Texas Oklahoma Regional Consortium of Herbaria (TORCH) database currently houses 1.2 million vascular plant records, but only ~30% have been assigned geographic coordinates. Additional georeferencing improves data accessibility for researchers and can help address spatial bias, but it is necessary to develop methods for prioritizing locations for georeferencing. My objective is to analyze the spatial distributions of herbarium collections in Oklahoma and Texas to identify underrepresented locations that should be targeted for georeferencing efforts. My dataset is made up of ~300,000 georeferenced vascular plant records from Oklahoma and Texas. Examining the abundance of herbarium records from each county and the proportions of georeferenced records revealed that there are very few herbarium records from many counties in north and northwest Texas. The majority of these records do not have coordinates. Additionally, many counties of eastern and east-central Texas and one county in central Oklahoma have less than 15% of specimens georeferenced. Based on these findings, I recommend that TORCH georeferencing efforts should first focus on plant collections from the west-northwest and eastern-central regions of Texas. More specifically, locations in and near Haskell, Midland, Roberts, and Robertson counties appear to be in greatest need of attention.

IDENTIFYING CRITICAL HIGHER-ORDER INTERACTIONS IN COMPLEX NETWORKS

Sidra Jawaid, Mehmet Aktas, Thu Nguyen, Rakin Riza, and Esra Akbas ,University of Central Oklahoma

Outstanding Undergraduate Paper in Math, Computer Science & Statistics

Diffusion on networks is an important concept in network science observed in many situations such as information spreading and rumor controlling in social networks, disease contagion between individuals, and cascading failures in power grids. The critical interactions in networks play critical roles in diffusion and primarily affect network structure and functions. While interactions can occur between two nodes as pairwise interactions, i.e., edges, they can also occur between three or more nodes, which are described as higher-order interactions. In this talk, we present a novel method to identify critical higher-order interactions in complex networks. We propose two new Laplacians to generalize standard graph centrality measures for higher-order interactions. We then compare the performances of the generalized centrality measures using the size of giant component and the Susceptible-Infected-Recovered (SIR) simulation model to show the effectiveness of using higher-order interactions. We further compare them with the first-order interactions (i.e., edges). Experimental results suggest that higher-order interactions play more critical roles than edges based on both the size of giant component and SIR, and the proposed methods are promising in identifying critical higher-order interactions.

THE PALEOECOLOGY OF YAHUAI CAVE IN GUANGXI, CHINA AT 120 KYA: IMPLICATIONS FOR EARLY MODERN HUMAN DISPERSAL INTO EAST ASIA

Kathleen Kelley, University of Tulsa

One of the main questions in human evolution is the dispersal of modern humans across a range of ecological niches. Given that today South China is situated in a tropical environment, the question remains, if early modern humans dispersing into this region could penetrate the rainforest to forage for food and if the environment in that area was suitable for early hominins to seek out during their exodus out of Africa around 100kya. As a case study we present the small mammal remains from Yahuai Cave, Guangxi, China, dated to around 120,000 years ago as they dispersed into East Asia. The study aims to identify the paleoecology of the area by utilizing Middle Range and Niche Construction theories to make an analogous comparison between extant and the extinct micromammals around the region of the Yahuai cave. Reconstruction of the paleoecology will include a three-step process: taxonomic identification, quantification and a taphonomic study. The study will look at similar comparisons at other sites that were along the path of hominin's exit, to further solidify the paleoecological finding and the probability that early hominins would have utilized this novel ecosystem.

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INTERACTION OF DNA NUCLEOBASES WITH ARMCHAIR GRAPHENE NANORIBBONS: A VAN DER WAALS DENSITY FUNCTIONAL THEORY INVESTIGATION

Pujan Khatri, Sagar Ghimire, and Sanjiv K. Jha, East Central University

Benjamin O. Tayo, University of Central Oklahoma

Outstanding Undergraduate Paper in Physical Science

Graphene is a suitable candidate for a wide spectrum of applications, including the biosensing and sequencing of DNA nucleobases. In this work, we computationally examined the interaction of four DNA bases [Adenine (A), Cytosine (C), Guanine (G), and Thymine (T)] with graphene nanoribbons (GNRs) using periodic density functional theory (DFT). Our calculations were performed using the van der Waals corrected DFT (vdW-DF2 and semi-empirical Grimme's-D2) methods, as implemented in Quantum Espresso simulation package. N-Armchair graphene nanoribbons (AGNRs) with three different widths corresponding to the indices N = 13, 14, and 15, passivated with the hydrogen atoms were considered in our study. The binding energies of nucleobases on GNRs were examined for GNRs containing no surface defects, containing Stone-Wales (SW) defects, and containing di-vacancy (DV) defects. Our results show that DNA nucleobases form stable complexes with GNRs. The DNA bases showed different interaction strengths on graphene nanoribbons, and their binding energies followed the order: G > A > T > C. It was found that the presence of structural defects on the GNRs has no significant effect on the computed binding energies of DNA bases on GNRs. The computing for this project was performed at the OU Supercomputing Center for Education & Research (OSCER) at the University of Oklahoma (OU).

CONSERVATION OF KINASE DOMAINS WITHIN THE INSULIN/TOR SIGNALING PATHWAY OF *DROSOPHILA*

Aidan Long, Ryan Dufur, and Jimmy O'Brien, Oklahoma Christian University

Outstanding Undergraduate Paper in Biochemistry & Molecular Biology

The insulin/TOR signaling pathway is a key pathway within organisms that contributes to maintaining homeostasis and allows the uptake of glucose into cells. This pathway has been found to be well conserved in *Drosophila* species when compared to humans. Sik3 and S6k are two proteins that both fall within the insulin/TOR pathway. Sik3 was found to be less connected within the pathway than S6k, so we hypothesized that S6k would be more highly conserved than Sik3 due to the number of interactions within the pathway. After confirming the higher conservation of S6k in comparison to Sik3, we shifted our focus to the conservation of kinase proteins. Kinases are proteins that catalyze the movement of a phosphate from ATP to another protein, these proteins have kinase domains that are the structural active site of the phosphorylation process. Due to these domains having more interactions when compared to the whole protein, we hypothesized that the kinase domains would show a higher level of conservation than the overall whole protein. It was shown that the kinase domains of Sik3 and S6k had a lower degree of percent change when compared to the whole protein sequence. The proteins Sik3 and S6k are more conserved in the kinase domain than the overall protein sequence due to the interactive active site that is key for the protein function.

DNA POLYMERASE EPSILON MUTANTS EXHIBIT DELAYED RECOVERY AFTER DNA DAMAGE

Ostmo Lydia and Michael Smith, Northeastern State University

DNA replication requires many proteins to interact together to keep copies of our DNA intact and free of errors. Recent work in our lab with budding yeast has shown that Mcm10 plays an integral role in DNA polymerase epsilon (Polε) functionality. Polε contains three structural subunits and one essential catalytic subunit known as POLE1 in mammals and Pol2 in budding yeast. The N-terminal half of Pol2 contains functionally characterized DNA polymerase and exonuclease domains but the C-terminal half contains no experimentally characterized domains aside from two putative Zn-finger modules that are conserved from yeast to humans. Previously, we have shown that the C-terminus of Pol2 interacts with Mcm10 in budding yeast. Expanding on this research, we constructed mutations in yeast Pol2 that interrupted interaction with Mcm10. The current project studied cell cycle progression in the yeast POL2 mutants after exposure to DNA damage. Our results suggest that the specific mutants of Pol2 take longer to complete chromosome replication when treated with hydroxyurea. Our second project investigated the interaction of MCM10 and POLE1 in human cells. Co-immunoprecipitation experiments confirmed the interaction in HEK293T cells. Current experiments are focused on exploring POLE1 C-terminus mutants and their interactions in human cells. Our work in yeast and human cells will shed light on Polymerase Epsilon and MCM10 interaction and the function of this interaction in the maintenance of genome stability.

RECOVERY STUDY OF SILVER NANOPARTICLES THROUGH LIMESTONE AND DOLOMITE PACKED COLUMNS

Randall Maples, Rachel L Bley, and Jarett A Williams, East Central University

Nanomaterials have found use in diverse applications such as materials coatings and pharmaceutics, among many others because of the unique properties they possess. Due to this increased usage in society, the fate of these engineered nanoparticles being released into the ecosystem is important as potential environmental contaminants when devices and materials containing these nanoparticles are disposed of. Studies of the behavior of various nanoparticles in the environment is not new and has been underway for some time. Still, however, the environmental toxicity of these materials has not been fully determined due to the sheer variety of engineered nanoparticles available and in use. It is important to be able to assess the short and long-term fate of these engineered materials and the distribution of various nanoparticles in groundwater. This preliminary study examines the percent recovery of water dispersible functionalized silver nanoparticles using columns packed with limestone or dolomite as a potential model for their behavior in the local groundwater environment.

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LEAF WEIGHT AND SURFACE AREA OF THE THREE SISTERS IN MONOCULTURES AND POLYCULTURES

Jamian Maxwell and Leah S. Dudley, East Central University

It has been shown that plants grown in polycultures can have increased productivity when comparing them to monocultures. Leaf weight and surface area were taken when looking at the three sisters (bean, corn, and squash) in both monocultures and polycultures. Looking at these factors in relation to each other can give some insight on whether the three sisters grow more effectively in a polyculture or a monoculture. Four varieties of each sister were grown in a factorial design in two culture treatments: monoculture (3 varieties of the same sister) or polyculture (one variety each of corn, bean, and squash). Three seeds were sown into a mound randomly located within a garden space. They were then randomly assigned one of three watering treatments: control, medium (5mL/day on average of rainwater added) and high (10mL/day) Leaves were haphazardly collected from each living plant at the end of the flowering season, pressed and later weighed and scanned for leaf area The area was measured by using the program ImageJ. Surface area to leaf weight ratio has been linked to photosynthetic potential and yield in plants. We assess this ratio for the Three Sisters in monoculture compared to polyculture and hypothesize that plants in polyculture may benefit from the association compared to monoculture. If results support our hypothesis, then growing plants as a polyculture supports this long-held tradition.

MOLECULAR AND MORPHOLOGICAL CHARACTERISTICS OF PATHOGENIC FUNGAL SPECIES IMPORTED FROM CENTRAL AMERICA

Dylan Melton, Angeela Gauchan, Katlyn Hampton, Alisha Howard and Charles Biles, East Central University

Plant pathogenic fungi are the leading cause of plant diseases in the world. The increasing discovery of plant pathogenic fungal species in the United States is, in many cases, due to the introduction of infected host crops via international trade. The genus *Diaporthe* (Phomopsis) is distributed to several geographical locations and many host crops as an endophyte or a latent pathogen, causing disease at the host crop's maturity. The purpose of this study was to identify the presence of Diaporthe spp. on specifically melons (*Cucumis melo* L. var. *cantalupensis* Naudin) being imported from Central America to Oklahoma. We purchased a total of 61 melons from 3 different markets in Ada, Oklahoma. Melons were imported from Honduras, Mexico, and Costa Rica. The melons were washed in a 10% bleach solution and set out on a clean surface for 4 to 6 days, until lesions were visible. Infected tissue was isolated from the mesocarp tissue of the melon and put onto acidic potato dextrose agar (APDA) to facilitate fungal growth and prevent any bacterial contamination. Once in pure culture, the DNA was extracted using an OmniPrep Fungal Kit and amplified using polymerase chain reaction (PCR). Three different loci were targeted during this study: Beta-tubulin (TUB), Transcription Elongation Factor 1-alpha (TEF), and HIS. Prior to analysis, Koch's postulates was conducted with each *Diaporthe* isolate using healthy melons to determine virulence. We found variation in the population of *Diaporthe* spp. being imported as well as some isolates that were of a different genus. This includes *Stagonosporopsis* spp. The information gathered indicates that there is a multitude of fungi being imported from Central America, increasing the variety of pathogenic fungi in the United States.

A COMPARISON OF TICK ABUNDANCE ON DISC GOLF COURSES IN URBAN AND SUBURBAN CENTRAL OKLAHOMA PARKS

Jessie Merrifield and Heather R. Ketchum, University of Oklahoma

Outstanding Undergraduate Paper, Outstanding Undergraduate Paper in Biological Science

Tick surveillance is an important aspect of vector control because it provides necessary information about species abundance, the risk of a tick encounter, and the potential presence of pathogens. Risk assessment through flagging focuses on the possibility of a human coming into contact with a questing tick, one that is actively seeking a host, while carbon dioxide traps can be used to determine the presence and abundance of ticks in a defined area. For our project, we surveyed ticks on disc golf courses from two central Oklahoma parks, one urban and one suburban. Disc golf is an increasingly popular sport where players are exposed to a variety of environments where they could potentially encounter ticks. The fairways of disc golf courses are typically mowed and well maintained while the periphery of the fairway is relatively untouched. At each park, we flagged for ticks around the periphery and the fairway of disc golf courses to determine a player's risk of encountering a questing tick. Carbon dioxide traps were used around the park to determine tick abundance at each park. While ticks were present at both parks, the greatest abundance was at the suburban park. Generally, on the disc golf courses, there was a greater abundance of ticks around the periphery, which included unmanaged and wooded areas as well as tall grasses and shrubs. For less skilled players, chasing a disc into the periphery of the course could increase their risk of coming into contact with a tick.

G3MP2 COMPUTATIONAL STUDY OF GASEOUS BORON AND ALUMINUM HYDROXIDES

Dwight L. Myers, Brenna S. Hefley, and Uendi Pustina, East Central University

Refractory oxides and nitrides are important materials in high temperature applications. In environments containing water vapor, hydroxides and oxyhydroxides are important reaction products, particularly in combustion environments, which can contain 3 – 10 % water vapor. Formation of gaseous hydroxides and oxyhydroxides is an important mode of corrosion. This study is a computational study of the thermodynamic stability of two of the gaseous hydroxides of boron and aluminum, boron(III) hydroxide and aluminum(III) hydroxide. Calculations were performed using composite methods at the G3MP2 level of theory. The geometries, vibrational frequencies, thermodynamics, and steps toward computations at higher levels will be discussed.

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UNDERSTANDING EPIGENETIC MECHANISM: A NOVEL WAY TO APPROACH THERAPEUTIC TARGETS FOR THE TREATMENT OF COLITIS

Radhika Pande, Kenneth E. Miller, and Subhas Das, Oklahoma State University Center for Health Sciences

Inflammatory bowel disease (IBD) is a term used to characterize the conditions like Crohn's disease and ulcerative colitis, which involve inflammation of the digestive tract. The main symptoms include repeated abdominal pain, diarrhea, fatigue, reduced appetite, and weight loss. According to CDC, approximately 3 million Americans were reportedly diagnosed with IBD. Reasons underlying IBD are still unknown, but several factors such as environmental, genetics, diet, and microbiome composition might play an essential role in disease development and the pharmacological therapies are limited. Previous studies have linked the Nerve growth factor (NGF), which plays an important role in inflammation and immune response, expression with neurogenic inflammation in various inflammatory animal models. Numerous studies have shown that epigenetic regulation, especially DNA methylation, plays an important role in inflammatory modulation. Epigenetics is the study of changes in gene expression, which occurs without any changes in the DNA sequence. The epigenetic mechanism for NGF regulation during colitis is still unexplored. Aim: In this study, we evaluated the epigenetic mechanisms which regulate the gene expression of NGF during TNBS induced colitis in rats. Method: Colitis was induced in 8-10 weeks old female Sprague-Dawley rats by infusing TNBS into the colon. The colon was collected after 24 hours of inflammation. Azacitidine (Aza) was pre- and co-administered to/with TNBS in the colon. Bisulfite converted DNA was used for Methylation-specific PCR (MSP) to analyze the DNA methylation patterns in the NGF promoter's CpG islands. RNA and protein expression of NGF was determined by qualitative, quantitative PCR, and immunoblot techniques. Results & Conclusion: Our findings show altered NGF expression in the colon during TNBS induced colitis due to hypermethylation of CpG dinucleotides in the NGF promoter. Aza treatment mitigated this hypermethylation and reduced neurogenic inflammation in these animals suggesting NGF expression can be epigenetically regulated in colon inflammation.

ENVIRONMENTAL STEWARDSHIP IN CITIZEN SCIENCE PARTICIPANTS

Cheyanne Olson, Rogers State University

Outstanding Graduate Poster

In recent years, citizen science programs have gained momentum and involved members of the public in active and ongoing science projects. Citizen science is often defined as a form of research collaboration that engages members of the public in scientific research projects that involve data collection, analysis, and dissemination (Haklay, 2013; Dickinson et al., 2012; Conrad & Hilchey, 2011; Wiggins & Crowston, 2011). In Oklahoma, Blue Thumb is a state-sponsored citizen science program that focuses on water quality monitoring. Blue Thumb has over 300 active volunteers monitoring 80 streams across Oklahoma annually. Focus on citizen science has turned to evaluation of participant outcomes. Behavior and stewardship is defined as "measurable behaviors that result from engagement in citizen science projects but are external to protocol or skills of the specific citizen science project" (Phillips et al., 2018). Behavior change is considered to be the "most sought-after outcome" for environmental citizen science program, but initial pro-environmental behaviors are not always documented before participation (Phillips et al., 2017). There is a need in Blue Thumb to evaluate whether volunteers change environmental behaviors as a direct result of participation in citizen science activities or if environmental behaviors already exist in their participant demographics. This poster serves as a discussion of preliminary findings of pro-environmental behaviors of new BT volunteers. This study is part of an on-going multi-phase mixed methods evaluation of participant learning outcomes in water monitoring citizen science programs like Blue Thumb. New volunteer environmental stewardship scores will be compared to experienced volunteer scores to infer if their environmental behaviors have changed over time. Older, experienced volunteers will be asked to reflect on what specific actions they have undertaken as a result of something they learned or experienced within their Blue Thumb Participation. Results anticipated Spring 2022.

SEASONAL VARIATION OF ARTHROPODS COLONIZING DECOMPOSING MAMMALIAN CARCASSES

Sam Ray and George Wang, East Central University

Outstanding Undergraduate Paper in Applied Ecology & Conservation

Decaying mammalian carcasses attract a variety of insect detritivores and other colonizers. The succession of insect colonizers can be used to indicate the rate of decomposition in forensics. The type and abundance of insect colonizers can be affected by season. We examined insect colonization of medium-sized mammalian carcasses between spring and summer seasons at the Botanical Outdoor Learning & Outreach Space (BOLOS) of East Central University in Ada, Oklahoma. We collected meso-mammalian (*Didelphis virginiana*, *Procyon lotor*, *Castor canadensis*, and *Dasypus novemcinctus*) carcasses from highways and weighed them. We enclosed the specimens in metal-wire cages and placed them in a wooded area of BOLOS. We conducted the experiment twice, once in late April 2021, and then in early August 2021. During each experiment, we performed daily sampling of insects and other arthropods on all specimens for one week, and then sampled once every two days until the specimens fully decomposed. The species and densities of arthropods were recorded. The arthropod species richness is comparable for both seasons; however, the species composition differs. The densities of American carrion beetle (*Necrophila americana*) and margined carrion beetle (*Oiceoptoma noveboracense*) are higher in the spring whereas the densities of rove beetles (*Platydracus maxillosus* and *Creophilus maxillosus*) were higher in the summer. Fly larvae development period was shorter in the summer than in the spring. The mammalian carcasses decomposed faster in the summer. Our results suggest that the use of insect abundance to indicate the decomposition rate of bodies in forensics should consider the season and other environmental conditions.

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NOVEL MELANIN INSPIRED COMPOUND POSSESSES MEMBRANE-DIRECTED ANTIBACTERIAL MECHANISM FOR GRAM-POSITIVE BACTERIA

Daniel Reed, Toby L. Nelson, Gabriel A. Cook, and Erika I. Lutter, Oklahoma State University

Daniel Reed and Franklin R. Champlin, Oklahoma State University Center for Health Sciences

Outstanding Undergraduate Paper in Microbiology

Melanin-inspired compounds (EIPE) synthesized by our group possess a core that provides scaffolding for the attachment of various functional groups. The purpose of this study was to investigate the antibacterial potential of Melanin-inspired compounds EIPE-1 and EIPE-HCl which are hydrophobic and hydrophilic, respectively. Antibiotic resistance remains a threat as more pathogenic bacteria increasingly acquire resistance to clinically useful drugs. This creates a need for novel compounds to be developed to combat resilient pathogens like methicillin resistant *Staphylococcus aureus* (MRSA). A standardized disk agar diffusion bioassay was performed to qualitatively compare the susceptibility and resistance levels of 12 gram-positive and 13 gram-negative bacteria to EIPE-1 and EIPE-HCl. The hydrophobic derivative EIPE-1 exhibited a gram-positive spectrum that included two methicillin resistant *Staphylococcus aureus* (MRSA) strains, while the hydrophilic derivative EIPE-HCl possessed no antibacterial properties at the concentrations examined. Turbidimetric growth curves were constructed to investigate the EIPE-1 mechanism of action. Bacteriolysis occurred immediately upon treatment for Staphylococcus epidermidis SK01 and at the five-hour mark for B. subtilis ATCC 6633, likely resulting from dissolution of their cytoplasmic membranes. Minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) bioassays were employed to quantitatively determine EIPE-1 potency. All gram-positive bacteria tested were susceptible with MIC values ranging from 0.25 to 2.0 µg/mL, while gram-negative bacteria were resistant with MICs in excess of 128 µg/mL. MICs and MBCs for two MRSA strains and two strains of the obligate anaerobe Clostridioides difficile were less than 8.0 µg/mL. These data suggest that hydrophobic EIPE-1 is a novel compound that possesses a gram-positive antibacterial spectrum that involves disruption of the cytoplasmic membrane and does not involve the involvement of molecular oxygen. The intrinsic resistance of 13 disparate gram-negative bacteria is likely due to the typical impermeability properties of the gram-negative outer membrane for hydrophobic molecules.

BEE POLLINATION PATTERNS WITHIN A THREE SISTERS GARDEN

Hallie Reed, Bobby L. Cothren, and Leah S. Dudley, East Central University

Outstanding Undergraduate Poster

Bee pollination is an essential ecosystem service required for many plant species to set fruit. Mutualistic plant-pollinator interactions vary in efficiency, depending on the plant-pollinator species and frequency of flower visits. With the human demand for insect-pollinated crops increasing and the population of bee pollinators declining, understanding the plant-pollinator interactions of these insects are crucial. This study focused on three bee groups: the honey bee, the bumblebee, and the solitary bee and their behavior within a Three Sister (corn, bean, & squash) garden. With its open, zoophilous floral design, squash flowers may entice more visitors than the other two sisters. Here, we address the following three questions: 1) Will squash flowers receive more visitors than the other two sisters? 2) Will a squash plant receive more visitors as the number of open squash flowers increases? and 3) Do the different types of bees visit squash flowers equally? The study took place during June-July of 2021 in a Three Sister garden consisting of various Sister varieties grown in mounds in a random, full-factorial design. Plant species, number of open flowers, visitor morphospecies, visitor behavior, and number of visitors were recorded. Results show that squash flowers received the most insect visitation compared to the other two sisters. The number of open squash flowers on a single plant had no notable effect on the number of visits, and the most frequent visitor to the squash flowers were honey bees. Our results suggest that agricultural systems may benefit from planting squash to attract pollinators. By interspersing squash throughout an agricultural system, it may increase the overall pollination and yield of the entire system, not just that of squash. In addition, squash not only is used as a food source for the non-native honey bee but also is capable of supporting native bee populations.

VIRTUAL TWIN STUDY: EFFECTS ON PARENTING EFFICACY

Robin Roberson, East Central University

In this study, 235 developmental psychology students (n=169 female; n=66 male) were assigned the task of raising two virtual twins using Pearson's My Virtual Child© (n.d.). A parental locus of control pre/post survey was used to determine if students improved in their understanding of parental influence on child/adolescent development. Significant changes were seen overall, as well as when disaggregated by student classification, ethnicity, and course delivery mode. Results suggest using My Virtual Child© (n.d.) as a twin study improves student understanding of parental influence on human development.

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SINGLE-MOLECULE ANALYSIS OF DNA NUCLEOBASES USING VAN DER WAALS HETEROSTRUCTURES: A COMPUTATIONAL STUDY

Benjamin O. Tayo, University of Central Oklahoma

Sanjiv K. Jha, East Central University

Electronic DNA sequencing using two-dimensional (2D) materials such as graphene has recently emerged as the fourth-generation of DNA sequencing technology. Owing to its commercial availability and remarkable physical and conductive properties, graphene remains the most widely investigated material for DNA sequencing by both theoretical and experimental groups. One of the major issues with graphene is its lack of a band gap. Furthermore, the hydrophobic nature of its surface causes DNA bases to stick to its surface, slowing down translocation speed and increasing sequencing error rates. As part of the materials research project, our goal is to extend these studies to several 2D materials beyond graphene, including van der Waals heterostructures. In this talk, we discuss recent accomplishments and future perspectives.

THE NEAR SIGNIFICANCE OF THE RELATIONSHIP AMONG CHILDHOOD TRAUMA, ATTACHMENT STYLE, AND RELATIONSHIP SATISFACTION

Kaylee Thoma, East Central University

This study was conducted to find any relationships among Adverse Childhood Experiences (ACEs), attachment style, and relationship satisfaction. It was anticipated that attachment style would act as a mediator between ACE score and relationship satisfaction, and that people who are more securely attached would have higher relationship satisfaction and lower ACE scores than those who are not securely attached. Participants were 130 and individuals within the Amazon MTurk panel who indicated being in a relationship for 3 months or longer within the past month. Three valid and reliable scales were used to measure Relationship Satisfaction (CSI), Adult Attachment Style (RSQ), and Childhood Trauma (ACE questionnaire). The sample of 130 individuals reached near significance, leading to further research of people with 3 or more ACEs, those results will not be discussed in this presentation.

THE POTENTIAL FOR USING CERVIDS AS PROXIES FOR PALEOECOLOGICAL RECONSTRUCTION THROUGH STABLE ISOTOPE ANALYSIS: IMPLICATIONS FOR OUT OF AFRICA I

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Approximately 1.8 million years ago, Homo erectus moved through the Levantine corridor to spread throughout Europe and Asia. ‘Ubeidiya, a 1.5-million-year-old archaeological site in Israel, provides some of the earliest evidence of this dispersal. The details of the environment of the region at the time would provide a great deal of insight into the lives of our ancestors but is largely unknown. The analysis of the differential fractionation of stable isotopes is a powerful tool for paleoecological and paleoclimate reconstruction. The usefulness of cervids as proxies for this kind of reconstruction, however, is debated due to their foraging habits as variable browsers and grazers. In this study, I first develop a modern model to test if stable isotopes can distinguish between deer populations. I sample the tooth enamel from the M3 of different modern cervid populations to test for the δ13C and δ18O content of the tooth enamel. These data, when combined with data from GIS, will allow me to build an isotopic map of different cervid environments which can then be compared to samples taken from fossil cervids excavated from ‘Ubeidiya. This preliminary study will provide support for using cervids as a robust paleoecological proxy and could be a large step along the way to reconstructing the environment in which our ancestors lived and gaining a better understanding of *Homo erectus's* movement out of Africa.

CO-LOCALIZATION STUDIES REVEAL DISTINCT PATTERNS OF POLE: MCM10 ASSOCIATION DURING CELL CYCLE IN HUMAN CELLS

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In eukaryotic DNA replication, Polymerase epsilon (POLE) is responsible for synthesizing the leading strand of DNA. POLE is known to have roles in the activation of the DNA damage response pathway and is believed to have roles in cell cycle control. Unfortunately, the distinct roles of POLE are not well understood and heavily debated. However, mutations in POLE have been known for tumor predispositions in several types of cancer. Our laboratory has shown that Minichromosome maintenance protein 10 (MCM10) plays a vital role in the functionality of POLE through studies in budding yeast. MCM10 is essential for DNA replication and, its interactions are highly regulated by the cell cycle. Genetic amplification and or over expression of MCM10 has been observed in colon, breast and prostate cancer. Therefore it is imperative to determine if the POLE: MCM10 interaction is conserved in human cells and if the interaction is regulated by the cell cycle. To achieve our goal we cloned POLE and MCM10 into RFP and GFP vectors, respectively. The vectors were transfected into HEK293T cells and visualized by fluorescence microscopy as well as confocal microscopy. Interestingly we observed interactions between POLE and MCM10 in human cells using co-localization fluorescence studies. To understand the dynamics of POLE and MCM10 throughout the cell cycle, cells were synchronized in G0 phase by serum starvation and interaction was studied by fluorescence and confocal microscopy. We were able to identify localization patterns of MCM10 and POLE in the nucleus throughout the S phase. Interestingly, MCM10 and POLE interaction is only seen in the mid to late S phase even though both proteins are present throughout the S phase. Our data suggest that both POLE: MCM10 interact in human cells to carry out specific functions during DNA replication.