Welcome to the 105th Kentucky Academy of Science Annual Meeting at Berea College

Esteemed Kentucky science educators of the Kentucky Academy of Science.

Welcome back to Berea College for the first time since 1957. We are delighted to host the KAS 105th annual meeting. Thank you for your sustained and faithful support of scientific discovery and understanding throughout our great state.

Let me share a bit about our school. Berea College offers a high-quality education to academically promising students with limited economic resources. Founded in 1855, Berea was the first interracial and co-educational college in the South. Today, Berea is consistently ranked as one of the leading private liberal arts colleges in the USA, garnering much national attention and appreciation for its service to talented students who might not otherwise be able afford to attend college. To all 1,650 of our students we offer a 4-year no-tuition promise and a rigorous and high-quality education. Also, we don’t just admit students, we hire them. Every Berea student participates in our well-regarded Labor Program, which not only provides the College with a talented part-time work force, but also enables them to cover their other costs: room, books, and fees.

Another hallmark of Berea College is our very inclusive community, which warmly welcomes diversity in all of its forms. We are proud to be remaining faithful to our founder, abolitionist Rev. John Gregg Fee’s inspiring vision, expressed through the motto he chose (from the book of Acts) for our school, “God has made of one blood all peoples of the earth.”

We are also very proud of our programs and new facilities in the sciences. Our new Margaret A. Cargill Natural Sciences and Health Building, a 125,000 square foot, $72 million dollar facility, with a tissue-culture lab, vivarium, 500 MHz NMR, scanning electron microscope, high-fidelity Nursing simulation labs, optics lab, planetarium, and off-site greenhouse and observatory, houses our Biology, Chemistry, Geology, Mathematics, and Physics programs. Berea also has regular KAS participation from faculty and students in our Agriculture and Natural Resources, Psychology, Education, and Health and Human
Performance Programs.

Again, welcome to Berea College. We trust you will enjoy the meeting and your visit.
Sincerely,
Dr. Lyle Roelofs
President, Berea College

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Thank you to our Gold Level Sponsor

Thank you to our In-Kind partners

Thank you our Local Arrangements Team at Berea: Dawn Anderson and Tracy Hodge

Thank you to our Program Coordinator Melony Stambaugh

Thank you to Our 2019 Section Leaders
Agricultural Sciences
Shreya Patel, Kentucky State University, Chair
George Antonious, Kentucky State University, Secretary

Anthropology and Sociology
Benjamin Freed, Eastern Kentucky University, Chair

Cellular and Molecular Biology
Dena Weinberger, Murray State University, Chair

Chemistry: Analytical & Physical,
Jay Baltisberger, Berea College, Chair

Chemistry: Organic / Inorganic,
Yongming Deng, Western Kentucky University, Chair
Elizabeth Thomas, University of Pikeville, Secretary

Computer and Information Sciences
Jerzy Jaromczyk, University of Kentucky, Chair

Ecology,
Richard Boyce, Northern Kentucky University, Chair
Roberta Challener, Bellarmine University, Secretary

Environmental Science
Ben Brammell, Asbury University, Chair

Geography
Christopher Day, University of Louisville, Chair
Charlie Zhang, University of Louisville, Secretary

Geology
Patricia Kambesis, Western Kentucky University, Chair
Ann Harris, KCTCS, Secretary

Health Sciences
Avinash Tope, Kentucky State University, Chair
Lingyu Huang, Kentucky State University, Secretary

Mathematics
Justin Trulen, Kentucky Wesleyan College, Chair
Kyle Besing, Kentucky Wesleyan College, Secretary

Microbiology
Rachel Pritchard, Kentucky Wesleyan College, Chair

Physics and Astronomy
Thomas Jarvis, Eastern Kentucky University, Chair
Marilyn Akins, KCTCS, Secretary

Physiology and Biochemistry
Michael Guy, Northern Kentucky University, Chair
Tracy Livingston, Georgetown College, Chair

Psychology
Richard Osbaldiston, Eastern Kentucky University, Chair
Matthew Shake, Western Kentucky University, Secretary

Science Education
Melody Danley, University of Kentucky, Chair
KAS Annual Meeting Online Program, 2019

KAS Code of Conduct
The Kentucky Academy of Science Annual Meeting is an interdisciplinary professional environment that cultivates scientific discovery and understanding. Thank you for contributing to our advancement of science by behaving professionally, respectfully and collegially at all times.

We want to make this meeting welcoming and accessible for you! Please let us know what you need.

Gender Neutral restrooms are available on MAC Science Building 5th floor

Mothers' Room is available on MAC Science Building 3rd floor

A Quiet room is available on the lower level of the MAC Science Building

Vans or other Transportation Assistance are available between buildings and to and from the parking areas.

Berea Campus map

Friday, November 1, 2019  9:00am - 11:00am

KAS Governing Board meeting
Room 457, MAC Science Building
Open to all KAS members

Friday, November 1, 2019  9:30am - 11:30am

Kentucky Organization of Field Stations (KOFS) Business Meeting
All are welcome to find out more about the [Kentucky Organization of Field Stations](#), a network of researchers, land managers, and educators.

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<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event Description</th>
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<tr>
<td>Friday, November 1</td>
<td>11:30am - 6:30pm</td>
<td>Registration 2nd floor atrium, MAC Science Building</td>
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<tr>
<td></td>
<td>12:00pm - 3:00pm</td>
<td>Poster Check-in - Poster Session I Alumni Building, main lobby If you are presenting a poster, please check in at the table in the Alumni building lobby. All posters should be up by 2:00pm</td>
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<tr>
<td></td>
<td>12:00pm - 5:00pm</td>
<td>Practice Room Room 304, MAC Science Building</td>
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<td></td>
<td>12:30pm - 5:00pm</td>
<td>Oral Presentations and Section Meetings MAC Science Building</td>
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<td></td>
<td>12:30pm - 5:15pm</td>
<td>Physics &amp; Astronomy- Oral Presentations 15 min. break at 2:30 Room 406, MAC Science Building Section meeting follows talks at 5:00 12:30 - A Study of the Quasar PKS2135-147</td>
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I present a long-term variability study of the Quasar PKS2135-147. PKS2135 was first optically identified in 1966 as a quasar, and is variable on the scale of months to years. It has been observed by SWIFT since 2013, and the optical data analyzed in this study are from a 2016 SALT observation. I will discuss the X-Ray variability of this source, as well as the UV results and projected results of the optical spectra. I will also discuss recent observations of the source with Swift.

12:45 - Active Galactic Nuclei with rapid high amplitude variability.

First Author
Dirk Grupe
Morehead State
University

I will report on the most recent discoveries by the NASA Neil Gehrels Swift mission of Active Galactic Nuclei (AGN) with high amplitude variabilities. While AGN typically vary with factors of 3 on times scales of days to years, some AGN exhibit outbursts or dramatic drops in the X-ray fluxes by factors of even more than 100. Recent examples are IRAS 23226-3843, RX J2317-4422 and repeatedly Mkn 335 on which we triggered XMM/NuSTAR and HST observations several times in 2018 and 2019. In particular IRAS 23226-3843 is a so called changing look AGN that has changed its optical spectroscopic type several times. In most recent Swift observations IRAS 23226-3843 was found to be flaring again.

1:00 - Development of Simulations for Moon-Forming Giant Impacts

First Author
Tyler LaBree
Northern Kentucky
University

There are various models of lunar formation that may be applicable, but simulations are needed to verify this. These simulate collisions between a proto-Earth and an impactor, which creates a disc that coalesces into the moon. The goal of this project was to prepare simulation software, FDPS-SPH, for use by a wider collaboration of people. It utilizes Smoothed Particle Hydrodynamics to compute the impact of the two bodies, which forms the disk. After that, we study attributes about the disk such as temperature and vapor mass percentage to compare them with observations.

1:15 - Why are the Orbits of Uranian Trojans so Unstable?

First Author
Jeremy Wood
Kentucky Community
and Technical College
System

Trojans asteroids of a planet are those asteroids which librate about the planet's L4 or L5 Lagrange point. Though the planet Jupiter has over 6,700 known Trojans, Saturn has zero, Uranus has 1 and Neptune 17. It is known from numerical simulations that the orbits of hypothetical Trojan asteroids of Saturn and Uranus are more unstable than those of Jupiter and Neptune (Nesvorny ? & Dones 2002, Dvorak et al. 2010). In this work, I prove that Neptune is responsible for the instability by causing the Uranian Trojans to leak out of tadpole orbits into more unstable horseshoe orbits.

1:30 - Magnetic High-Entropy Alloys

First Author
Magnetic high-entropy alloys are a promise for many fields. From cryogenic to aircraft and spacecraft applications, the possibilities are varied but one thing is necessary: to have a better understanding of the properties of these materials in order to put them to good uses. Korman et al., made predictions for the Curie Temperatures ($T_c$) of HEAs of the form $\text{Cr}_x\text{CoFeNiQ}_x$ with $Q$ being Pd, Cu, Ag, or Au. In our study, we focused on the Pd alloys varying both Cr and Pd in order to check the accuracy of the $T_c$ predictions. Using the 'Treasure Maps' provided by Korman et al. we chose combinations of Cr and Pd that were predicted to have a $T_c$ near room temperature. Based on our work, we found the maps to be very reproducible with the procedure used, which is further explained in this presentation.

1:45 - Design of single cell superconducting radio frequency cavities

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<tbody>
<tr>
<td>Madison Howard</td>
<td>Kenji Saito</td>
<td>Walter Hartung</td>
<td>Safwan Shanab</td>
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<tr>
<td>Morehead State University</td>
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<td>University</td>
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Radio Frequency (RF) cavities are essentially metal tubes made of conducting materials which are used for the acceleration of beams of electrons, protons, and heavy ions. This cavity, however, has several limitations in performance, including a high surface resistance/impedance ($R_s$) and penetration depth ($\delta$). Together, these high values result in heating on the cavity walls and a decrease in the acceleration efficiency. Because of this we turn to Superconducting Radio Frequency (SRF) cavities. Made from superconducting materials, mainly niobium, these cavities have a much smaller surface resistance and penetration depth which results in minimal heating on the surface of the cavity. The goal of this project was to design single cell SRF cavities both analytically and using CST Studio Suite ®. We also observed the testing of SRF cavities their cryomodules at Michigan State University's Facility for Rare Isotope Beams (FRIB).

2:00 - Calibration of Gamma Scout Detectors for Environmental Radiation Measurements

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<tr>
<th>First Author</th>
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<tbody>
<tr>
<td>Kevin Adkins</td>
<td>Ignacio Birriel</td>
<td>Eddie Henderson</td>
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<tr>
<td>Morehead State University</td>
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Our world today is dominated by radiation from both manmade and naturally occurring sources. One such naturally occurring source of radioactivity prevalent throughout Eastern Kentucky is the black organic shale family. Presently, we have measured the amount of radioactivity at an Ohio Shale outcrop a few miles from Morehead State University in Rowan County, Kentucky. We employed Gamma Scout radiation detectors but found large fluctuations in the readings although the detectors are factory calibrated. This talk will focus on a relative calibration of the detectors in a laboratory setting using a 5.0 $\mu$Ci CS-137 source. A report on the method and the data corrections will be given along with opportunities for future improvements.

2:15 - Testing Silicon Photomultipliers for use in the nEDM experiment

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<th>First Author</th>
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<tr>
<td>Ricardo Santos</td>
<td>Vince Cianciolo</td>
<td>Syed Kavish Imam</td>
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<tr>
<td>Berea College</td>
<td>Oak Ridge National Lab</td>
<td>University of Tennessee</td>
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The existence of the neutron electric dipole moment (nEDM) would create a new type of parity violation in the standard model, however, to find it a high level of precision is required. Silicon Photomultipliers (SiPM) will be used within the nEDM measuring apparatus, being constructed at Oak Ridge National Lab, to measure scintillation light that will be used to find an upper limit of the nEDM. The SiPM that will be used in the experiment must be tested in order to ensure that they are working at max efficiency. We designed a testing apparatus for the SiPM and then created a python script to analyze the output generated from our experiment. Using some sample data from one of the SiPM we were able to create a working rough draft of the analyzes, though a dark rate correction component still
needs to be added to find the peak efficiency.

2:45 - Fitting Neural Networks to Thermal Equations of State for use in FLASH models

In High-Performance Computing (HPC) code used for simulations of complex physical processes, such as FLASH for SuperNovae explosions, Equations of State (EOS) must be modeled to calculate values such as energy and entropy. A complex EOS, such as the Helmholtz EOS used in FLASH simulations, can be difficult to model and execute efficiently. In the example of the Helmholtz EOS values are stored in a table and used to interpolate intermediate values during run time, while this method is faster than others it can lead to events where a value cannot be interpolated, leading to a stoppage of the entire simulations. To combat this issue Dense Fully Connected Neural Networks were trained on data from the Helmholtz EOS in order to reproduce the data efficiently and robustly. All networks were modeled to take temperature, density, and electron composition as input and individually output energy, entropy, and pressure. These values were then used in a simulation of a Type 1a SuperNovae explosion and compared to a simulation using the unedited FLASH Helmholtz EOS. It was found that the Neural Network was able to reproduce values of energy for the Helmholtz EOS within 2% error. The results show that a Neural Network can reproduce the results of an equation of state and are more robust than interpolation methods currently used.

3:00 - Late-time Light Curves of Type Iax Supernovae

SN 2002cx was a very peculiar Type Ia Supernova that did not fit into any of the known subclasses of SNe Ia. There have since been other objects that share similar observational properties to the prototype of this new subclass of Type Ia Supernovae. We present late-time optical photometry of several objects in this sub-class. We discuss the late-time decline rate of the optical bands and how they compare to the other classes of Type Ia Supernovae.

3:15 - Long Term Monitoring of Narrow-Line Seyfert 1 Galaxy PG1211+143 Using Swift

I am presenting x-ray and UV observational data of the Narrow-Line Seyfert 1 galaxy PG1211+143 from the NASA Swift satellite observatory. I will show the long term x-ray and UV lightcurves of this source and discuss them in the context of various AGN variability models. I will especially focus on new observations since a year ago.

3:30 - PASCO's Coulomb Law Experiment: Effects of Humidity on Results

Coulomb's law is an empirically determined relationship that quantifies the force between two charged particles. PASCO corporation sells a Coulomb (torsion) balance that allows students to investigate the effect of both charge and separation distance. Students can also use the device to measure the value of the Coulomb constant. The device manual has a disclaimer which states 'If you live in an area where humidity is always high, and if you have no facilities for controlling humidity, the experiment will be difficult, if not impossible, to perform.' We examined the effect of varying levels of humidity on the experimental data in order to quantify what levels of humidity provide acceptable experimental results. Our results indicate that this device performs well only when the ambient humidity is lower than 30%.
3:45 - Typical Misconceptions about Lunar Phases in Introductory Astronomy

First Author  Co-author
Jing Wang  Jessica Lair
Eastern Kentucky  Eastern Kentucky
University  University

What causes the phases of the Moon? A study done at Harvard University showed that even the brightest college students don't truly grasp basic scientific concepts. [1] Although thirty years have passed, there are signs suggesting that the improvement is limited. In fall 2017 and fall 2018, we conducted a survey using the Lunar Phases Concept Inventory (LPCI). [2] The results show that although students have received both lecture and laboratory instructions on lunar phases in an introductory astronomy course, the responses are still concentrated to certain distractors, suggesting that there are misconception models hidden behind these wrong answers. We analyzed the distractors for each item, and tried to reproduce the misconception models students might held. We proposed possibilities to solve these problems in introductory astronomy classrooms.


4:00 - Quantum Coin Flipping

First Author  Co-author
Johnathan Baird  Joshua Quals
Craft Academy  Morehead State
University  University

Quantum computing (QC) is a radically new approach to computation. Classical computing is based on the idea of bits: strings of 1’s and 0’s on which we do arithmetic operations. QC, however, is based on quantum bits, qubits, and new physical operations. Despite the complexity of QC, we contend that it is an appropriate and useful topic for undergraduate physics students. In this talk, we present our results from three small QC projects relating to flipping coins. In the first, we investigate the results of a secret coin flip and use QC to guess whether the coin landed on heads or tails. In the second, we determine whether a given coin is fair or unfair using only a single qubit (instead of multiple bits). In the third, we explore how quantum communication can alleviate dishonest player biases in coin flipping cryptographic primitives.

4:15 - Spectroscopic and Hydrodynamic Analyses of the Northwestern Rim of the Galactic Supernova Remnant G156.2+5.7

First Author  Co-author
Thomas Pannuti  Glenn Allen
Morehead State  Lexington High School
University  University

We present a broadband X-ray study of the northwestern rim of the Galactic supernova remnant (SNR) G156.2+5.7. Our primary goals are to search for evidence of synchrotron emission from this rim and to characterize the shape of the electron spectrum. Our analysis is based on observations made of this rim using the ROSAT, XMM-Newton and RXTE observatories. We derive statistically acceptable fits to the extracted spectra using models with two VPShock components or with one VPShock component and one SRCUT component. We argue that the results favor the model with two thermal components (i.e. that there is no evidence of X-ray synchrotron emission from the northwestern rim of G156.2+5.7) and we suggest that these components represent a single kappa-like distribution of electrons associated with shock-heated circumstellar material. Furthermore, the results for two small regions, one at the forward shock and another just downstream of the forward shock indicate that the electron spectral shape changes as the forward-shocked gas propagates downstream. There are more high-energy electrons, and they have a flatter spectral slope, downstream of the forward shock, perhaps due to the electrons and ions being more thermally equilibrated. We also performed hydrodynamic modeling, which is constrained, in part, by the results of the spectral fits, to determine the most probable ranges of values for physical properties associated with this SNR. This analysis yields an ambient hydrogen number density of 0.023 -- 0.049 per cubic centimeter, a distance of at least 1.8
kiloparsecs, a radius of at least 27 parsecs, an age of at least 23 kiloyears and a forward shock velocity between 360 and 1200 kilometers per second. The hydrodynamic analysis also suggests that this SNR was most likely produced by a core-collapse supernova.

4:30 - The Not so Obvious Relationship Between Magnetic Energy Storage and the Solar Flares of NOAA AR11283

First Author
Alanna Cavins
Morehead State
University

At the extreme end of the variability spectrum, powerful events we call solar flares produce orders-of-magnitude increases in the shorter-wavelength luminosity output on millisecond time-scales. Although it is generally accepted that solar flares occur through the release of energy stored in the coronal magnetic field above an active region it is not well understood how much of the stored energy will be released in a single event. The NOAA AR11283 (at central meridian on 2011.09.06), proves to be an interesting point of research for this investigation. The objective of the ongoing research is to compare estimates of the magnetic energy stored by individual current systems with the region’s flaring history. The study heavily focuses on the apparent magnetic energy of sub volumes in the region, identified from spherical nonlinear force-free modelling, to better understand the possible relationship between flares and the visible current system evolution.

4:45 - Safety Engineering for Lunar IceCube

First Author
Akira King
Morehead State
University

In late 2020, the Morehead State University Space Systems Engineering Program will launch Lunar IceCube (L-IC) – a 6U CubeSat (or small satellite) about the size of a large shoebox. L-IC will be launched alongside 12 other secondary payloads aboard NASA's Artemis I rocket as part of NASA's Next Space Technologies for Exploration Partnerships (Next STEP) initiative. L-IC is a science mission designed to prospect water ice deposits on the surface of the Moon for future exploration. When developing a small satellite, it is important to adhere to both NASA-defined and internal standards when designing the spacecraft to ensure that LIC can carry out its mission without harming itself, the other payloads, or – most importantly – the rocket. Informed decisions in safety, systems, and quality engineering insure that the satellite meets all requirements for launch. This includes choosing and implementing the best materials for the spacecraft and enacting strenuous test procedures for those materials. The Morehead State Safety Engineering Team – three undergraduate space systems engineering students – is responsible for assuring that all parts of Lunar IceCube meet the safety requirements laid out by NASA for small satellites. This work utilizes government databases, NASA documents, data processing tools, testing equipment and procedures, and working with materials and systems engineers from NASA's Jet Propulsion Laboratory (JPL), Goddard Space Flight Center (GSFC), Marshall Space Flight Center (MSFC), and private companies such as Busek and Blue Canyon Technologies.

Friday, November 1, 2019 1:00pm - 3:00pm

Computer & Information Sciences - Oral Presentations

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| 1:00 - The Swiftly Changing Landscape of CS and CS Ed Research
First Author
Janice Pearce
Berea College |
This is an invited talk in the Computer Science section

1:30 - Machine Learning-Training in Style

First Author Co-author
Andrew Tapia Jerzy Jaromczyk
University of Kentucky University of Kentucky

Vital to much work in machine learning is the concept of training. Broadly, training is the process in a machine learning algorithm of using data to improve the algorithm's performance on a task. This presentation aims to provide a brief overview of the mechanisms of training in supervised machine learning with the goal of illuminating the workings of Neural Style Transfer algorithms, which use convolutional neural networks to stylize images.

1:45 - BLAST redundancy cleaner: a bioinformatics tool that allows for easy viewing of complex genomic repeat BLAST results

First Author Co-author Co-author Co-author Co-author
Alex Stewart Noah Clements Jerzy W. Jaromczyk Mostafa Rahnama Mark Farman
University of Kentucky University of Kentucky University of Kentucky University of Kentucky University of Kentucky

Most presently characterized genomic repeat elements contain internal repeat sequences, causing bioinformatics program like BLAST to return redundant hits. To combat this problem, we have developed BLASTrec: a command-line tool implemented in Python v3+ that can flexibly clean BLAST reports to remove redundancy. Results are returned in in file formats that allow for easy and compact viewing in visualizers such as IGV. BLASTrec tool supports an assortment of options that control the cleanliness of the final output, final output filetypes, and provide the ability to run BLASTn-short in addition to BLASTn. Furthermore, BLASTrec can be used in a wide variety of genomic studies, including characterizing the movement of known genomic repeat elements and identifying potential novel repeat elements through genome self-comparison. This works is a part of the NSF project to investigate telomere roles in fungal genome evolution: Dr. Mark Farman (PI).

2:00 - Evaluations of Mechanical Properties of ABS Parts from Open-Source 3D Printers and Conventional Manufacturing

First Author Co-author Co-author Co-author Co-author
Robert Harper Coilin Bradley Jordan Garcia John Scmidt Charles Lu
University of Kentucky University of Kentucky University of Kentucky University of Kentucky University of Kentucky

Manufacturing has always been synonymous with large factories, expansive machine tools, and sophisticated production lines. However, a new technology could revolutionize the sector: the three-dimensional printing (3D printing). 3D printing is a revolutionary manufacturing method that allows the productions of engineering parts almost directly from modeling software on a computer. With 3D printing technology, future manufacturing could become vastly more efficient. However, the procedures used in 3D printing differ substantially among the printers and from those used in conventional manufacturing. The objective of the present work was to evaluate the mechanical properties of engineering products fabricated by 3D printing and conventional manufacturing. Three open-source 3D printers, i.e., the Flash Forge Dreamer, the Tevo Tornado, and the Prusa, were used to fabricate the identical parts out of the same material (acrylonitrile butadiene styrene - ABS). The parts were printed at various positions on the platforms of the printers and then tested in bending. Results indicate that there exist substantial differences in mechanical responses among the parts by different 3D printers. Specimens from the Prusa printer exhibit the best elastic properties while specimens from the Flash Forge printer exhibit the greatest post-yield responses. Specimens from the Tevo printer seem to display the weakest stress-strain behaviors. There further exist noticeable variations in
mechanical properties among the parts that were fabricated by the same printer. Depending on the positions that the parts were placed on a printer platform, the properties of resultant parts can vary greatly. Identical parts were further fabricated by using the conventional manufacturing method, i.e., compression molding. Results show that the 3D printing methods do not produce parts with the same strength and durability as those produced by the conventional manufacturing.

2:15 - Development of Software to Control a Snake Robot

First Author
Elizabeth Isbell
Murray State University

Co-author
Destyn Pearson
Murray State University

Co-author
Ashtynn Herrington
Murray State University

Co-author
Codi Slawson
Murray State University

This project focuses on the design and development of software to control the movements of a snake robot using an Arduino microcontroller. The robot itself was a project that had been started by a previous group of students, whose progress has been instrumental to our success as they had made great strides on building the hardware. Since the hardware has been completed, we have been focusing on the software side of this project, which involves programming the movement for the robot. Arduino is an open-source electronics platform based on easy-to-use hardware and software. The Arduino Uno microcontroller, a microcontroller board based on the ATmega328P, is being used to control multiple servos to attempt to create realistic snake movement. The Arduino IDE was utilized in the programming of the snake's movements. The servo motors create forward motion by moving in sequence. We are currently in the process of finishing the software to create proper snake-like movement.

2:30 - MoTeR Distribution Across Magnaporthe oryzae Genomes

First Author
Katie Richard
Eastern Kentucky University

Co-author
Presley Bryant
Northern Kentucky University

Co-author
Mostafa Rahnama
Department of Plant Pathology, University of Kentucky

Co-author
Jerzy Jaromczyk
Computer Science, University of Kentucky

Co-author
Mark Farman
Department of Plant Pathology, University of Kentucky

The purpose of this project was to determine the chromosomal locations of mobile genetic elements, known as Magnaporthe oryzae Telomeric Retrotransposons (MoTeRs) within genomes of M. oryzae, a fungal pathogen of rice and other grasses. MoTeRs normally insert into telomeres - the sequences that constitute chromosome ends. However, all M. oryzae genomes also contain short fragments of MoTeR sequences (relics) at internal chromosomal locations, which suggests that sequences at chromosome ends periodically immigrate to the genome interior. To explore the precise chromosomal distribution of these relics, MoTeR sequences were as queries to search several M. oryzae genome assemblies using BLAST. The alignment data were then visualized using custom-built R programs. One program was designed to summarize the distribution of MoTeR sequences relative to chromosome ends, and presents summary data for individual, or multiple genomes. Another program was implemented in a SHINY app - which generates a user interactive environment that allows the user to zoom in and out and/or visualize MoTeR relic loci in any contigs/chromosomes within a genome. Utilization of these visualization tools led to the discovery of a novel retrotransposon within the M. oryzae genome. Moving forward, the tools we developed will facilitate analysis of MoTeR distribution in the > 200 M. oryzae genome sequences that are currently available. Furthermore, they can be easily utilized for studying the chromosomal distributions of many kinds of repeated sequence in any organisms for which a high quality, contiguous genome sequence is available. This project was funded by the NSF Telomere Grant.

Friday, November 1, 2019 1:00pm - 5:15pm

Ecology - Oral Presentations
15 min. break at 2:45
Room 170, MAC Science
Building Section meeting follows talks at 5:00

1:00 - Possible Predators (Non-Hosts) of the Digenetic Trematode Cercaria, Proterometra macrostoma, at North Elkhorn Creek, KY

First Author
Joseph Mecham
Berea College

Co-author
Bernedette Kwisera
Berea College

The life cycle of the digenetic trematode, Proterometra macrostoma, is indirect, incorporating a snail intermediate host (Pleurocera semicarinata) and a centrarchid fish definitive host. The large cercaria of P. macrostoma engages in sustained cyclical, vertical swimming bursts which is a highly adaptive behavior that promotes ingestion by not only its fish definitive host, but possibly non-host predators as well. The objective of this study was to evaluate possible invertebrate (Red Swamp crayfish, Kentucky River crayfish, dragonfly larvae and damselfly larvae) and vertebrate (adult leopard frogs, bullfrog tadpoles, Cope's Grey Tree Frog tadpoles and mosquito fish) predators of the P. macrostoma cercaria. Naturally infected snails shedding P. macrostoma cercariae were collected from North Elkhorn Creek, Scott County, Kentucky. Animals were then exposed to two levels of cercariae less than three hours post-release from their snail hosts for seven hours. All animals, with the exception of adult leopard frogs, ingested cercaria. Crayfish appeared to be the most successful predators, followed by mosquito fish, dragonfly larvae, damselfly larvae and tadpoles, but there was no distinct pattern of predation with regard to level of exposure to cercaria. These results indicate that the cercaria of P. macrostoma is likely a significant component of the aquatic food web in North Elkhorn Creek.

1:15 - Assessing the Influence of Telecommunication Towers on Osprey (Pandion haliaetus) Nesting Productivity and Behaviors

First Author
Gage Barnes
Murray State University

Co-author
John Hewlett
Murray State University

Co-author
Kate Slankard
Kentucky Department of Fish and Wildlife Resources

Co-author
Loren Taylor
Kentucky Department of Fish and Wildlife Resources

Co-author
Andrea Darracq
Murray State University

Osprey (Pandion haliaetus) nests located on telecommunication towers (TCTs) are approximately 3â€“8 times higher than natural or constructed nests. Consequently, nestlings reared on TCTs may be exposed to harsher weather conditions and ultimately have lower survival rates. Additionally, adults may use more energy during food provisioning because of TCT heights, which could influence foraging or nest guarding behaviors. The objective of our study is to evaluate the influence of TCTs on Osprey nest productivity, adult foraging, and nest guarding behaviors. We observed 30 Osprey nests (TCTs; [n=11], navigation daymarkers [DMs; n=10], natural substrates [NATs; n=9]) from aircraft, vehicle, or on foot. To assess differences in adult behaviors and nest success and productivity, we monitored each nest for adult foraging and nest guarding behaviors and the number of successful fledglings produced throughout the 2019 breeding season. Nests on DMs received 2 to 2.6 times more fish than nests on NATs and TCTs, respectively. Though not significant, DM nest success was 22.2% and 14.2% greater than NATs and TCTs, respectively. We hypothesize that the potential costs associated with TCT height may be counteracted by reduced human disturbances. Though DMs had high rates of human disturbance, increased provisioning of fish to offspring may offset these costs and partially explain the greater nest success we observed at nests on DMs. Consequently, there may be a trade-off between intensity of human disturbance and fish provisioning.

1:30 - Stage Based Matrix Modeling of Trifolium stoloniferum Restoration Populations in Madison County, Kentucky

First Author
Running buffalo clover, *Trifolium stoloniferum* Muhl. Ex A. Eaton (Fabaceae), is a federally endangered herbaceous perennial that is currently pending to be de-listed, after extensive recovery efforts across its range. This species, and many other endangered or threatened plant species, can benefit from more detailed population viability analyses. To highlight the value of these more detailed population viability analyses, stage-based population viability analyses were conducted for six restoration populations located at the Taylor Fork Ecological Area in Madison County, Kentucky and were related to how this type of analysis can and ought to be used in the conservation of this species, and other endangered species. In order to conduct the analyses, proposed life history stages were first analyzed and found to be valid. Furthermore, the stage-based analyses conducted in this project were compared to previous research done with the restoration populations at Taylor Fork Ecological Area with count-based population viability analyses to compare the value of stage-based modeling over the simpler count-based methods. Ultimately, even though stage-based modeling is more difficult and consumes more resources, it provides a much richer suite of information such as stable stage distributions, reproductive values, and elasticity matrices. This information is highly valuable to conservation biologists and can be used to focus management activities on life stages that have the most influence on population growth.

**1:45 - Fire Risk Assessment on the Wildland Urban Interface (WUI) of Goleta, California pre-Holiday Fire (2018)**

**First Author**
Corey Walker
**Berea Community School**

Fire hazard maps are important for promoting the safety of homeowners and firefighters and providing useful information to policymakers. In 2008, the California Department of Forestry and Fire Protection (CAL FIRE) created a fire hazard map for the state. This map considered broad variables of fire hazard such as weather patterns, slope and fuel levels. On July 6th, 2018 the Holiday Fire occurred on the Wildland Urban Interface (WUI) of Goleta, California burning over 40 hectares including 28 structures. However, CAL FIRE’s 2008 map did not identify Goleta as having high fire hazard. In this study, I created a fire risk assessment of Goleta using Airborne Visible / Infrared Imaging Spectrometer (AVIRIS) data taken 16 days prior to the Holiday Fire with 6.5m resolution. I built a spectral library that was optimized using Iterative Endmember Selection (IES). I then used Multiple Endmember Spectral Mixture Analysis (MESMA) to map land cover and classify the area into low, medium and high areas of risk. Areas of low fire risk were mapped around roads and soil. Areas of medium fire risk were mapped around green vegetation (GV). High levels of fire risk were mapped around non-photosynthetic vegetation (NPV). The Holiday Fire parcels showed high levels of fire risk. Medium regional values of fire risk were found north of the WUI while low values were found to the south. This study shows that highly specific and valid assessments can be developed around fire risk using a multifaceted remote sensing approach.

**2:00 - Treehoppers follow an experimentally imposed vibrational amplitude gradient when mate searching**

**First Author**
Jeremy Gibson
**Kentucky Wesleyan College**

Vibratory communication facilitates many social interactions, and often locating the source is important. Small plant-dwelling insects face a potential constraint in sensing vibration directionality, because they obtain only a tiny spatial sample of a propagating wave with their leg vibration sensors. Despite this, even insects under 1mm long can find a vibration source on a plant, but the mechanisms are still largely unknown. Previous work suggests that amplitude gradients may be important during localization. Here we investigated whether insects can follow an experimentally imposed vibrational amplitude gradient on a plant stem. Thornbugs (*Umbonia crassicornis*), are small (~1cm) plant-feeding insects that use vibratory communication throughout their lives. When searching for mates, males produce a
vibratory courtship signal to which a receptive female will respond. Males duet with the stationary female while homing in on her vibrational signals. The arena was a 24cm section of the mainstem of a potted plant. To simulate a receptive female, we affixed a playback device to the top of the arena. We imposed one of two opposing amplitude gradients (3dB/3cm steps) onto the arena: In one treatment the gradient increased in amplitude from the bottom of the arena to the top, while the other gradient increased in amplitude from the top of the arena to the bottom. A trial began when a male duetted with the artificial female call and initiated searching. As a male moved along the arena, his position would determine what playback amplitude he received back after his call. Most males ended up in the region with the highest amplitude, despite the potential conflict between signal amplitude and source location. This outcome, combined with previous work, suggests that thornbugs may use a hierarchical approach when making directional decisions, sometimes ignoring information about the direction of wave propagation when other cues are present.

2:15 - Unmanned aerial vehicles and multispectral sensors for locating invasive species

Invasive species serve as a threat to native biodiversity and ecosystem sustainability. Combating the spread of invasive species requires long-term physical and monetary commitments. In South Africa, Opuntia ficus-indica (L.) – (the prickly pear cactus or Barbary fig) is a relentless invader, displacing local flora. The goal of this project is to battle this invasive species using efficient and inexpensive technology: unmanned aerial vehicles (UAVs or drones) fitted with multispectral sensors. We used a 5-sensor Parrot SequoiaTM in tandem with a DJI Phantom ProTM 3 UAV to image test plots in the summer of 2018 on Balule Nature Reserve, South Africa, and surrounding areas. From the images collected, we created normalized distance vegetation index (NDVI) maps using Pix4D MapperTM. Vegetation indices highlight certain properties of plants and other landscape elements, assisting in plant location. Using geographical information system (GIS) software, we are conducting supervised and unsupervised classifications to determine if the cactus presents a unique spectral signature. Multispectral sensors capture images in varying bandwidths; using images combining red, green, red edge, and near-infrared bandwidths, unique spectral signatures specific to individual objects such as prickly pear may be determined. Given the signature, computerized unsupervised classification algorithms may identify prickly pear solely from georeferenced aerial images, aiding land managers in locating and destroying the plants.

2:30 - Immediate and Delayed Effects of Severe Winds on an Old-Growth Forest in Northern Kentucky: A Forty-Year Retrospective

Wind disturbance is an important factor that can affect the development of the forests of the Central Hardwood Region. Long-term studies of protected forests, such as Dinsmore Woods in northern Kentucky, are valuable as a resource to document and understand the effect of both abiotic and biotic challenges to forest systems. This study is a 40-year analysis of both overstory and understory changes at Dinsmore Woods as the result of damage caused by severe winds in the spring of 1974. The forest was surveyed before and immediately following the windstorm and then at 10-year intervals. The pattern of damage to the forest immediately following the windstorm was complex. The forest canopy (DBH ≥ 30 cm) experienced an irregular pattern of damage while in the subcanopy (DBH ≤ 30 cm) there was a 25% reduction in total basal area. However, the major effects of the windstorm were delayed and subsequently have altered forest recovery. Ten years following the disturbance declines were seen in total density and basal area in the canopy and subcanopy. In the past 20 years the canopy total basal area has increased and exceeds the pre-disturbance total basal area. In contrast, the subcanopy total basal area continued to decline 20 years post-disturbance. Further openings in the canopy and subcanopy due to the delayed windstorm effects helped establish a dense understory of native shrubs and sugar maple which have affected tree regeneration and is reflected in the continual decline in species diversity in the subcanopy and sapling strata.

3:00 - Understanding Interspecific Competition in Two Terrestrial Salamanders (Genus: Plethodon)
Species that occupy the same niche compete for limited resources and can exist stably only if they partition their niche, for example, by consuming food items of different sizes or found in different locations or at different times. At Mountain Lake Biological Station in Pembroke, Virginia, Plethodon glutinosus and P. montanus occupy the same niche around Hunter's Branch; a first-order high elevation. The stomach contents of the syntopic salamander species were compared to the stomach contents of P. glutinosus from another community that had little interference with P. montanus. No difference was detected in the diet of P. glutinosus and P. montanus from Hunter's Branch (Pr (>F) = 0.489). Additionally, no difference was detected in the diet of P. glutinosus from Hunter's Branch and P. glutinosus from the allopatric location (Pr(>|z|) = 0.471). If food is a limiting resource in these habitats, P. glutinosus and P. montanus from Hunter's Branch are in competition with each other and currently show no signs of niche partitioning.

3:15 - Effect of sleep loss on parental care in Arctic-breeding songbirds

Sleep loss is well known to impair cognitive function, immunological responses, and general well-being in humans. However, sleep requirements in mammals and birds may vary dramatically, especially with changes in environment. In circumpolar regions with continuous light, sleep requirements may be little, particularly in breeding birds. The effects of sleep loss on several fitness parameters were examined in two species of Arctic-breeding passerine birds: Lapland longspurs (Calcarius lapponicus) and snow buntings (Plectrophenax nivalis). Adult males were implanted during the nestling phase (4 days post-hatch) with osmotic pumps containing an anti-narcolepsy drug, modafinil, to induce sleep loss for 72 h. We measured nestling weights on day 2 and day 7 following hatching. In addition, we conducted 1 h observations of nestling feeding rates on day 6 post-hatch. Recent data show that adults undergo a 4-5 h quiescent period between 0000h and 0500h. We predicted that further inhibition of sleep may temporarily increase feeding rates, but eventually lead to decreased parental care and slower nestling development from birds needing to sleep after pharmacological inhibition. Alternatively, as high-arctic species are adapted to continuous light throughout their breeding season, mechanisms may exist that allow them to function normally despite loss of sleep.

3:30 - Effects of stream permanence on the stoneflies (Plecoptera) of the Mammoth Cave region

Stoneflies (Plecoptera), are an order of aquatic insects known to be very sensitive indicators of water quality. Stoneflies are often associated with inhabiting cold perennial streams, but many species also inhabit intermittent streams that experience channel drying late summer. Species that can survive in the harsh conditions of summer-dry streams have univoltine-fast development, where larva either hatch quickly from eggs and migrate downward to hyporheic regions where water is still available, or egg development is stopped until flow is returned. Stoneflies unable to survive in intermittent stream habitats have univoltine-slow or monovoltine history strategies where larva grow slowly through the summer or may take multiple years to mature. This means that species found in perennial runs cannot be found in summer dry runs due to differences in life history strategies. Since univoltine-fast species can inhabit both perennial and intermittent habitats, they should be more commonly distributed in the region. In this
study, species of stoneflies were collected in Mammoth Cave National Park and the Western Kentucky University
Green River Preserve. Collections were done using beating sheets, across 45 sites each month from December
through October. Sites fell into 5 category types, perennial spring runs, perennial spring seeps, upland perennial
streams, perennial riverine, and summer dry runs. The most prominent difference in stonefly community structure
was between all four perennial habitats and the summer dry streams. Species found with univoltine-slow
development were less common in the region and were limited to only perennial habitats.

3:45 - Arbuscular mycorrhizal fungi benefit switchgrass growth and root architecture under extreme
drought

First Author  Co-author
Binod Basyal  Sarah Emery
University of Louisville  University of Louisville

The functioning of plant-mycorrhizal fungal symbioses is dictated by a host of biotic and abiotic factors acting at
rhizosphere, community and ecosystem levels. These symbioses can span a gradient from mutualism to parasitism.
In this study, we investigated the effects of arbuscular mycorrhizal fungi (AMF) on a biofuel crop Panicum virgatum
(switchgrass) along a drought intensity gradient. We predicted that AMF would provide maximum growth benefit to
the plant under intermediate moisture stress and minimum benefit under extreme moisture stresses. We grew 90
pots with/without Clarodieoglomus etunicatum in growth chamber for 75 days. We manipulated drought based on
water holding capacity as following:- (Pot capacity, PC): 100% PC, 75% PC, 50% PC, 35% PC and 20% PC (near
permanent wilting point). We recorded biomass, shoot length, number of leaves, root architecture, root colonization,
and soil moisture responses. We found that AMF increased biomass, especially in dry conditions. AMF effects on
root architecture depended on drought. AMF was found more beneficial under dry conditions than on wet conditions.
Contrary to our hypothesis, plant benefits from AMF were highest near the permanent wilting point and continued to
decline linearly with increasing soil moisture. We are currently analyzing cell wall chemistry of switchgrass to see if it
responds similarly.

4:00 - Abundance of songbirds in Eastern Hemlock stands following chemical treatment for Hemlock
Wooly Adelgid

First Author  Co-author
Natalie Sweeting  David Brown
Eastern Kentucky University  University

Across North America, bird populations have declined by 30% since the 1970's, and invasive species may be one of
many contributing factors. In the 1960's Hemlock Woolly Adelgid (HWA) began to invade and kill hemlocks across
the Eastern U.S. Chemical insecticides, primarily imidicloprid, are being used to treat HWA, but the value of these
treatments for hemlock dependent avian species is unknown. A study that preceded the HWA invasion in Kentucky
indicated six focal bird species that were positively or negatively correlated with hemlock at 66 sites across the
Appalachian Mountain region of Kentucky. Since the infestation, 59% of the sites were treated with imidicloprid. Our
objective was to determine how the abundance of the focal species has changed over time in response to hemlock
decline and chemical treatments at the sites. We conducted vegetation surveys and avian point counts at the same
sixty-seven sites nine years later. The importance value of hemlock appeared to decline more in untreated sites over
the nine year period. There was no significant difference in abundance of focal avian species between treated and
untreated sites. Three of the four avian species predicted to have a negative response to hemlock decline showed a
non-significant, but apparent decrease across the nine years. Black-throated Green Warbler was the only species
with a significant decreases in abundance across the nine years (46% decline). Our results suggest that some
hemlock-dependent bird species are declining, but it's not clear whether treatments are beneficial to birds.

4:15 - Diet diversity and prey selection in Tidarren sisyphoides

First Author  Co-author  Co-author
Sarah Bell  Albert Meier  John Pickering
Western Kentucky University  Western Kentucky University  Discover Life Project

Little is known about the feeding ecology of the spiders in the Tidarren genus. There are two species (Tidarren
sisyphoides and Tidarren haemorrhoidale) commonly found in the United States and both frequently build their tangled webs and nests around building foundations. Here we present a partial list of prey items photographed in the webs of Tidarren sisyphoides near porch lights at a house in Clarke County, Georgia (33.8882N, 83.2973W). We examined over 2,200 photographs of the spiders, their webs, and potential prey items trapped in the webs that we monitored nightly between 2011 and 2018 as part of Discover Life's moth project. We tried to identify all potential prey and present a list of them, documenting the role this species plays in food web ecology. All images are on-line and can be viewed via Discover Life (www.discoverlife.org/moth). To date, we have tentatively identified 423 prey items from 13 different Orders, all of which were arthropods. These results indicate that T. sisyphoides is an opportunistic and polyphagous arthropod predator.

4:30 - Floral phenology influenced by soils, not urbanization

First Author  Co-author  Co-author
Aaron Sexton  Sarah Benton  Sarah Emery
University of Louisville  University of Louisville  University of Louisville

Pollinators provide vital ecosystem services but are in sharp decline due to a host of threats including increasing global temperatures. Even slight changes in temperatures may lead to drastic shifts in host plant phenology, which may cause pollination mis-matches or reduce resource availability. Urban heat islands are a growing problem in the US, as urban habitats can be several degrees warmer than nearby rural areas, providing a natural experiment for examining potential effects of global climate warming on plant-pollinator interactions.

We conducted an observational study of floral phenology in 18 prairie restorations in Louisville, Kentucky. Louisville is one of the worst urban heat islands in the US, where urban temperatures average 5°C warmer than rural regions. We hypothesized that urban sites would have earlier and shorter flowering durations, as shown in other manipulative warming experiments. However, this hypothesis was not supported. Land usage did not influence floral phenology in our system. We instead found that floral phenology was heavily influenced by soil parameters. Sites where soils harbored denser networks of mycorrhizal hyphae, and increased water holding capacity had significantly longer floral duration than sites with low mycorrhizae and water holding capacity.

4:45 - Preliminary Results of the Vascular Flora Survey of the Miller Welch-Central Kentucky Wildlife Management Area

First Author  Co-author
Nick Koenig  David Taylor
Eastern Kentucky University  US Forest Service

The Miller Welch-Central Kentucky Wildlife Management Area (CKWMA) in Madison County, Kentucky, is 747.5 ha (1847 acres) with roughly 60% open land and 40% forested with scattered streams and ponds throughout (Kentucky Department of Fish & Wildlife Resources). The CKWMA is in the Outer Bluegrass physiographic region and is a popular resource for shooting sports, hunting, hiking, bird dog training, and many other outdoor recreational activities. At this site a survey of the vascular flora is being conducted to document the biodiversity of the plant life in the area. Over 600 collections have been made during the 2019 growing season with surveying that will be continued into the 2020 growing season to search for species that were overlooked during the prior year. With a plethora of interesting collections made one taxon that has stood out is Monotropa uniflora L. which is only the third documented occurrence in Madison county which has been heavily collected. Once identified, mounted, databased, and imaged, all specimens will be deposited in the Ronald L. Jones EKY Herbarium. Once the floristic survey is finished the results will be distributed back to Kentucky Fish and Wildlife for assistance in land management. With increasing rates of loss in biodiversity throughout Kentucky and the temperate zone, cataloging of our natural world is needed to monitor changes in flowering plant diversity.

Friday, November 1, 2019  1:00pm - 4:00pm

Geology - Oral Presentations
15 min. break at 2:30  Room 251, MAC Science Building  Section meeting follows talks at 3:30
Ridge-top wetlands occur throughout the Daniel Boone National Forest (DBNF) and provide valuable ecologic services; they are rich in biodiversity and play a key part in nutrient cycling. Ridge-top wetlands are classified as geographically-isolated wetlands (GIWs) because they are perched on the top of a sandstone ridge, and there is a semi-impermeable clay layer that retains water away from other water bodies. This research focused on identifying the geomorphic characteristics of 34 ridge-top wetland watersheds in the DBNF in order to classify groundwater and surface water patterns that produce ecological services. We identified GIWs with high-resolution LiDAR data and used ArcGIS to analyze the size, slope, shape, and distribution of each watershed’s upland and lowland. The slope and coverage of uplands and lowlands are hypothesized to control the relationship between runoff and groundwater recharge, which will control the hydrologic patterns of the wetland. Four wetland types were identified: open valley, long valley, short valley, and amphitheater wetlands. Open valley and long valley wetlands had broad lowlands that were bounded by steep narrow uplands. These wetlands are likely dominated by runoff in the uplands. Amphitheater wetlands had broad flat uplands and smaller lowlands that would promote more groundwater recharge. Short valley wetlands had properties between amphitheater and long valley wetlands making them an even balance between the two. More upland runoff means that lowlands will be flooded quickly creating more ephemeral GIWs, while more upland recharge will create slower groundwater discharge to the lowlands that sustain water levels longer.

Wetland loss has prompted the construction of new wetlands in order to restore ecosystem services such as nutrient cycling and flood control. However, wetland construction methods involve soil disturbances such as organic matter removal, horizon mixing, and dense compaction. In general, these practices succeed in making permanently saturated wetlands that lack native wetland soil properties. In the Daniel Boone National Forest (DBNF), hundreds of constructed wetlands have been added to the ridge-top landscape, where native wetlands have ephemeral hydrology. The overabundance of these constructed wetlands has encouraged invasive plant and amphibian species to inhabit the region to the point that the US Forestry Service endeavors to deconstruct some of these wetlands to restore native hydrology. Our research goal was to test how different soil amendment procedures would change constructed wetland soil hydrology towards more native characteristics. We collected natural and constructed wetland soil samples from the DBNF and simulated restoration in the lab by altering soil compaction and/or adding sand, organic content, or non-swelling clay. We then determined the soil's permeability, characteristic moisture curve, density, and porosity in the laboratory. Changing the soil compaction controlled the bulk properties of the soil, where decompaction increased hydraulic conductivity three orders of magnitude. Soil additives had the largest impact on the characteristic curve, where sand increased the volume and retention of moisture to a more native range. We recommend decompaction and sand to partially restore the native soil hydraulic properties. Ongoing research continues to study the potential of mixtures of materials.

Ridge-top wetlands are an important hydrologic system in the Daniel Boone National Forest (DBNF) because they store groundwater at high elevation, which can sustain forest health through periods of drought. Total groundwater...
reserves in different ridge-top wetlands are unknown because they are geographically isolated across the DBNF. Furthermore, observations of wetlands have shown significant variation between seasonal wetting and drying times, making regional extrapolation difficult. The research objective was to create a water budget model for different regions of the DBNF in order to calculate the influence climatic factors have on the amount of groundwater available to wetlands. Primary climatic data were collected at a daily time scale from the PRISM Climate Group database for 23 sites across the DBNF for an 11-year period. With these data, we constructed a water budget that calculated the total amount of water available for potential groundwater recharge after accounting for tree canopy interception (revised Gash model), runoff (curve number method), and evapotranspiration (Turc method). Results of the water budget showed that there was significant seasonal variation in the amount and timing of water available for groundwater recharge across the DBNF. Overall there was more variability in recharge between the northern and southern portions of DBNF, where the north received more recharge in April and the south received more water in January. In sum, the timing of critical groundwater recharge was different between portions of DBNF, meaning that the timing of yearly wetting and drying could be driven by climatic differences between locations.

1:45 - Determining the Change in the Unsaturated Zone and Aquifer Thickness of an Isolated Ridgetop Wetland

First Author  Co-author
Selsey Stribling  Jonathan Malzone
Eastern Kentucky  Eastern Kentucky
University  University

In a wetland-aquifer system, the unsaturated zone plays an important role in recharge as thicker unsaturated zones impede groundwater recharge. Isolated ridgetop wetlands in the Daniel Boone National Forest (DBNF) experience groundwater recharge from precipitation events during the spring and winter, exhibit semi-permanent or ephemeral hydroperiods and support surrounding ecosystems during drought conditions. Our objective was to examine an isolated ridgetop wetland system to determine the unsaturated zone and vertical aquifer thickness to understand how changing aquifer thickness over time may affect groundwater recharge spatially. In 2017, we installed a dense PVC wellfield in a semi-permanent wetland in the DBNF and collected groundwater level data of the wetland's aquifer during 2017-2019. Change in unsaturated zone thickness and the aquifer's water column were determined from 2017-2019 data using elevation and borehole data. In the spring, the unsaturated zone was thinner around the wetland pool, especially to the south and one well to the north. As the wetland system dried during the summer, the unsaturated zone's thickness increased and expanded unevenly across the site. The unsaturated zone was thickest east and south of the wetland and thinned closer to the pool as seasonal drying continued. Thus, the system's aquifer experienced less groundwater recharge in these dry areas relative to zones with thinner unsaturated zones during summer precipitation events. Also, drought completely dried the aquifer in several locations, which effectively disconnected the soil from groundwater flow. Groundwater only returned to these areas after sustained wet periods that occurred in late summer.

2:00 - Origin and Tectonic Implications of the Lower Mississippian Sunbury Shale in east-central United States

First Author  Co-author
Jun Li  Frank Ettensohn
China University of Mining and Technology, Beijing  University of Kentucky

The Sunbury Shale is a fissile, Lower Mississippian, black-shale unit, containing an average of ~11% TOC. It is a widespread Mississippian black-shale unit and is prominent throughout eastern Ohio, eastern Kentucky and western West Virginia. The Sunbury is separated from the underlying Upper Devonian Bedford-Berea by an unconformity at the Devonian-Mississippian boundary. However, in east-central Kentucky, where the Bedford becomes a black shale, the Sunbury merges with the lower black Bedford and Ohio Shale equivalents in uppermost parts of the New Albany and Chattanooga shales. The unit is thickest at 26 m near the intersection of Kentucky, Virginia and West Virginia, and thins toward the Cincinnati Arch, where only a few centimeters of the unit remain. Sunbury equivalents also cross the Cincinnati Arch into the Illinois and Michigan basins. To the east in northern West Virginia, western Maryland and western Pennsylvania, the Sunbury grades into the much thicker (>70 m) and more clastic-rich, black Riddlesburg Shale.
Devonian-Mississippian black-shale units formed due to foreland-basin subsidence and deformational loading associated with Acadian Orogeny, representing a north-to-south, transpressive collision between the southeastern margin of Laurussia and Avalonian terranes, allowing Devonian black-shale basins to migrate southwestward in time. However, by earliest Mississippian time, Sunbury-Riddlesburg basin migration shifted abruptly to the east with the inception of the Neoacadian Orogeny, which represents initial collision of the exotic Carolina terrane with the New York promontory and the southwestern, transpressional migration of orogeny. In response, the initial Sunbury-Riddlesburg basin formed just cratonward of the orogen at areas behind the New York promontory and expanded southwardly accompanying dextral transpression in the orogen. The overlying Price-Pocono-Borden-Grainger clastic units represent an extensive subaerial (Price and Pocono) and subaqueous (Grainger and Borden) delta complex that developed during erosion of Neoacadian highlands at both the New York and Virginia promontories.

2:15 - High-Resolution Lithology and Stratigraphy of a Roadcut near Coldiron (Harlan County), Southeastern Kentucky

First Author Co-author
Andrew Hensley Walter Borowski
Eastern Kentucky Eastern Kentucky
University University

The United States Geological Survey (USGS) in conjunction with the Kentucky Geological Survey (KGS) mapped Kentucky's geology from 1960 to 1978, producing a comprehensive stratigraphic framework of Kentucky. Here we examine a single roadcut near Coldiron (Harlan County) Kentucky along KY 119 to determine its high-resolution lithology, stratigraphic relationships, and depositional environments. The outcrop is comprised of mudstone, siltstone, and sandstone with thin intervals of coal in the Grundy Formation (Pennsylvanian). Beds dip approximately 20° as the site lies within the Pine Mountain thrust sheet.

We measured 81 meters of stratigraphic section using a Jacob's staff and sampled pertinent rock units for a reference collection at the KGS Earth Analysis Research Laboratory (EARL). The stratigraphic section shows several coarsening-upward sequences from 6 to 20 meters in thickness, capped by coal and/or organic-rich shale only about a decimeter thick. Clastic lithologies are not bioturbated but pervasively exhibit lamination in mudrocks and fine cross-lamination in siltstones and sandstones. A 40-cm thick sandstone unit showed water escape structures such as convolute lamination, capped by a bed with tabular crossbeds. Woody fragments and plant material are common in several units. Lithologies and sedimentary structures are consistent with shallow-water marine shale (prodelta?) overlain by sandstones (deltaic), in turn capped by coal and/or organic-rich mudstone that formed in coastal, freshwater swamps.

Ultimately: contextual information, lithologic descriptions, the measured stratigraphic column, and photographs of key features and samples will be posted on the KGS website as a story map. Samples will be archived at the KGS EARL.

2:45 - Paleosols as a means of investigating African Humid Period paleo-Critical Zones at Gona, Ethiopia

First Author Co-author Co-author
Marie White Kevin Takashita- Gary Stinchcomb
Murray State Bynum Murray State
University Murray State University

The African Humid Period (AHP) resulted in more humid conditions across Northern and Eastern Africa from 15 to 5 thousand years ago. A lack of terrestrial paleoenvironmental reconstructions is a problem in East Africa, where most are done utilizing lacustrine or marine proxies. In the case of Gona, Ethiopia, terrestrial proxies are desired due to the rich archaeological and fossil concentrations that occur in the area. This study utilizes paleopedology, geochronology, and geochemistry to reconstruct the environment of Gona during the AHP.

We examine paleosols from the Erole, Kilaitoli, and Odele drainages within Gona. The Odele paleosol is between the Korina Tuff (
The Kentucky Geological Survey at the University of Kentucky is improving information available to researchers about the subsurface rocks of Kentucky with the support of three separate Federal grants. A grant from the Institute of Museum and Library Services is supporting a three-year effort to photograph and physically preserve 10,000 boxes of geologic rock core and provide the products for free through KGS online data services. The USGS National Geologic and Geophysical Data Preservation Program has funded an effort to rescue over 200 mineral-resource rock cores at risk of being lost due to physical deterioration of core housing and data. The USGS Earth Mapping Resources Initiative is supporting an upgrade to online access of documentation for rock cores from a national-priority strategic mineral area in western Kentucky. The scale and scope of this reorganization and upgrade represents a novel approach to data management and scientific data communication at the state level. The KGS Earth Analysis Research Library is the most comprehensive public repository of solid geologic samples in Kentucky, with thousands of rock cores, petroleum well-cutting samples, and limestone and coal chemical samples. These samples are all available for academic, industry, and government research. The KGS online data services are nationally recognized for providing geologic map, water, energy, and geologic hazards data. The current effort at EARL seeks to expand and enhance those online data to promote and support increased basic and applied research on the subsurface rocks of Kentucky.

3:15 - The Detection of Radioactivity in an Outcrop of Ohio Shale

The Ohio Shale is a fragmented rock that is part of the black organic shale family found all over Kentucky. An outcrop of Ohio Shale, found in Rowan County, Kentucky was used for this study. This project involves measuring the amount of naturally occurring radioactivity found in this outcrop. Eight Gamma-Scout radioactivity detectors were used to measure the radiation. These are commercially purchased detectors with a halogen filled Geiger-Müller counter tube. The outcrop can be split into two parts; the first part consists of only Ohio Shale while the second features a covering of Three Lick Bed on top of the Ohio Shale. This talk will focus on the radioactivity measured throughout the outcrop.

Friday, November 1, 2019  1:00pm - 5:15pm

Science Education - Oral Presentations

15 min. break at 2:45  Room 230, MAC Science Building  Section meeting follows talks at 5:00

1:00 - Bridging Optogenetics, Metabolism, and Animal Behavior for Student-Driven Inquiry at High School and College Levels

Biotechnology is an ever-evolving field of science that is instrumental in improving quality of human life, particularly in the medical arena. Optogenetics, an area of biotechnology, involves genetic modification of cells to express light-sensitive ion channels, which allows for use of light to manipulate behavior. This educational module utilizes an approach aligned with Next Generation Science Standards (NGSS) to bridge optogenetics, cellular metabolism, and animal behavior for student-driven inquiry at high school and college levels. Drosophila melanogaster larvae that have been modified to express Channelrhodopsin-2 (ChR2) in motor neurons serve as models for this module.
Students are able to connect temperature, metabolic rate, and gene expression through data collection of behavioral responses to light stimuli exhibited by larvae stored in various temperatures. Students are also able to observe the role of cofactors in metabolic processes via larvae that have been fed all-trans retinal (ATR), which is a cofactor to ChR2. Students will analyze and interpret data in order to make a claim about how the two variables investigated (temperature and cofactor) impact the behavior of the target organism. The final component of the module allows students to form connections between the application of neuroscience as exhibited in the module to trends in scientific publications related to optogenetics. This module is presented in a variety of ways to be readily modified depending on equipment available in the classroom and the academic level of students.

### 1:15 - Can children and young adults read analog clocks? Exploring potential misconceptions

**First Author**
Belinda Candra
**Co-author**
Logan Pennington
**Co-author**
Wilson Gonzalez-Espada

**University**
Morehead State

In Kentucky, school math standards for grades 1 and 2 require learning about analog clocks and how to read them. However, recent national and international media reports indicated that an ever increasing proportion of young students may be unable to read these devices because most of the clocks and watches they are familiar with are digital. In this presentation, the authors will summarize the literature on this topic and will present preliminary results from a survey completed by students enrolled in a school district in Eastern Kentucky. Responses will be analyzed using descriptive and inferential statistics, with a particular emphasis on incorrect ones, which can shed light on potential student misconceptions about reading analog clocks.

### 1:30 - Will notation for rotational directionality go the way of the 'broken record'? 

**First Author**
Kathryn Gallenstein
**Co-author**
Wilson Gonzalez-Espada

**University**
Morehead State

Although math standards in Kentucky teach how to read analog clocks in elementary school, recent national and international media reports suggest that many students are unable to read these devices because most clocks and watches they are familiar with are digital. As analog clocks become less common, students may struggle with conceptualizing the description of rotational direction as clockwise and counterclockwise, a common description that is essential for physics and chemistry courses. In this presentation, the authors will summarize the literature on this topic and will present preliminary results from a survey completed by students enrolled in a school district in Eastern Kentucky.

### 1:45 - Factors associated with STEM degree completion: Identifying early obstacles at a military academy.

**First Author**
Wilson Gonzalez-Espada
**Department of Physics, Earth Science & Space Systems Engineering Dept.**

**Co-author**
Jessica Dwyer
**Department of Physics, USAF Academy, Colorado Springs, CO**

**Co-author**
Kimberly de la Harpe
**Department of Physics, USAF Academy, Colorado Springs, CO**

**Co-author**
David Meier
**Department of Physics, USAF Academy, Colorado Springs, CO**

The U.S. is not graduating enough science, technology, engineering and mathematics (STEM) majors for the increasing number of available employment opportunities and national security needs. The purpose of this study was to quantify the magnitude of STEM attrition at the U.S. Air Force Academy (USafa) and to identify factors associated with STEM attrition among students. Despite a strong academic preparation, of the students who reported their intention to major in a STEM discipline as incoming freshmen, 36.4% switched and graduated with a non-STEM degree. Two binary logistic regressions revealed that the best predictors associated with students graduating with a STEM major were their initial intention and motivation to major in these disciplines upon arrival at USAFA and course
grades in Calculus I, General Physics I and Chemistry I. These findings suggest that students motivated to major in STEM may switch out if they struggle with pre-requisite quantitative courses.

2:00 - Flipping a mathematics classroom: A budget lightboard approach

First Author
Kyle Besing
Kentucky Wesleyan
College

There is currently a push for an increase in active-learning in post-secondary math and science classes. The benefits of this style are discussed in the Freeman report and advocated for in the recent Joint Statement on Active Learning from the Conference Board of the Mathematical Sciences. One well known style of active learning is the "flipped classroom," where traditional lecture content is provided to students prior to class to facilitate more active or engaging activities during class meetings.

Creation of this lecture material was done through the use of a lightboard, an internally lit pane of glass. The lightboard allows for online content to be presented in a way that is familiar to both the students and the instructor. In this talk, I will describe the specifics of the construction, including cost savings due to the use of open-source software.

This flipped classroom approach is currently being piloted in two sections of a general education probability and statistics class. I will discuss the current format of this course as well as initial observations.

2:15 - Gender Inequality in MSU's MPATE Rotational Physics Device

First Author
Donald Matthews
Morehead State
University
Co-author
Kevin Adkins
Morehead State
University
Co-author
Ignacio Birriel
Morehead State
University

At Morehead State University, we redesigned a device used during our annual Mathematics, Physics and Advanced Technology Exploration (MPATE) Day. The device is intended to stimulate high school students' interest in introductory physics concepts through a hands-on activity demonstrating the difference between kinematic and rotational motion. This study investigates the gender inequality present in the construction of the device, arising due to the difference in average height between men and women. The goal of this project is to remove the gender bias by optimizing the geometric constraints of the device.

2:30 - Journey toward making my documents more ADA compatible

First Author
Scott Miller
Kentucky Community and Technical College System

For the last year, since attending a conference on the subject and hearing how we were trying to move all courses in this direction, I have been working on getting documents that I use in my online courses ADA compatible. Most of this has been in the reconstruction of Word documents, using the built in checker of Word before moving them up to my courses on Blackboard. There, further checking is done by Ally. I would like to share what I have been able to do with these two tools as I continue to journey to better ADA compatibility.

3:00 - OoOps! What is 8/2x(2+2)?

First Author
Andy Martin
Kentucky State University

In a warm-up sheet for faulty and staff at KSU before the start of the fall semester, the above expression was
presented. Later it transpired that roughly half of the faculty who responded had one answer, and the other half another. Each half included STEM PhD's, although tellingly all of the mathematics PhD's agreed on one answer. Shades of the Monty Hall controversy! What is the right answer, and why the disagreement?

3:15 - Promoting an active understanding about global climate change in middle school students

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Climate change is a challenging subject to teach because the concepts are so abstract. For the last two years, we have been developing several activities in collaboration with Marion C. Moore Middle School in order to make this topic more tangible. These activities include a UofL Climate Science Day for the 6th graders, a canoe trip and nature walk for the 7th graders, and several hands-on activities in Moore’s 1-mile nature walk and stream using purchased Vernier scientific probes. The ultimate goal is for these students to understand climate change as a global phenomenon. To this end, we have set up partnerships with schools in the Philippines and South Africa, and the students have begun communicating with each other via Skype and a shared blog. We hope to expand the global part of the project, as well as identify a culminating activity for the 8th graders, in the coming year.

3:30 - Shifts in Student Attitudes and Confidence about Lab Work as a Result of General Biology Curriculum Changes

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A growing body of evidence supports a shift in higher education teaching labs from traditional ‘cook book’ labs with known outcomes to engaging students in authentic research experiences. The General Biology lab sequence at Kentucky Wesleyan College has been shifted from traditional labs to feature open educational resources and a semester-long research experience focusing on the Tiny Earth Project. The goal of this project was to examine shifts in student attitudes and perceptions during this curriculum transition. Students enrolled in General Biology I (BIO 215) and II (BIO 216) were invited to complete anonymous pre- and post-tests delivered in-lab at the beginning and end of each semester. Likert scale scores were converted to numerical values and analyzed for statistical significance across the semesters and academic years. Statistically significant differences were observed when comparing the two-year curriculum transformation of BIO 216, in which traditional lab exercises were replaced with the Tiny Earth Project. These results suggest that a shift in the curriculum of the General Biology sequence at Kentucky Wesleyan College has made a positive impact on student perceptions about science, confidence in lab-based skills, and attitudes about laboratory work. This aligns with current findings about the importance of authentic research experiences in undergraduate lab courses and will hopefully encourage more professors at Kentucky Wesleyan College to find ways to incorporate research projects into their lab courses.

3:45 - STEM majors’ views of the teaching profession: Implications for the recruitment of secondary teachers.

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STEM majors' views of the teaching profession: Implications for the recruitment of secondary teachers. HANNAH E. BREWER*, Department of Biology and Chemistry, WILSON GONZALEZ-ESPADA and ROBERT D. BORAM, Department of Physics, Earth Science & Space Systems Engineering, Morehead State University, Morehead, KY 40351.

The United States and many other countries are facing a shortage of secondary school teachers, particularly in
disciplines like science, technology, engineering and mathematics (STEM). The purpose of this study was to describe the perception of STEM majors about teaching as a career. The researchers used a mixed method approach to describe this perception. The quantitative findings emerged from the participants' completion of a version of the "Factors Influencing Teaching Choice" questionnaire. The qualitative findings emerged from interview data, a structured protocol where participants shared their views about personal and community perceptions about teaching, their experiences interacting with STEM teachers, and their views about the MSUTeach and MAT programs, options that allow for a STEM degree and a teacher certification. The findings of this study can be used to inform efforts to minimize STEM students' misconceptions about teaching as a career and to recruit pre-service STEM teachers more successfully.

4:00 - The Importance of Active Learning in Mathematical Classrooms

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As future secondary teachers, we have been working under the leadership of Dr. Justin Trulen, in efforts to create educational presentations and classroom materials that can be used in our future classrooms to reach the different learning styles of our students. The focus of the project is to develop stimulating questions and pose information in a way that assists in building students' understanding of the content and challenge them to think about concepts in an abstract manner. The approaches we have chosen to follow are Think-Pair-Share, Good Questioning, Grouping, and Scaffolding, yet we always have the opportunity to add more types where we see fit. Our goal is to develop materials for all four approaches however, depending on the content, all four approaches may not be applicable. Creating these presentations has allowed us to also expand our personal knowledge of the content and challenged us to think deeply about certain mathematical concepts. As future educators, we have begun to learn how particular approaches can best be applied and why it would serve as the most impactful method of learning. The project has stretched our abilities to use LaTeX, a software program that makes our research efficient and presentation slides effective. Through our study with Dr. Trulen, we have learned several techniques and styles we will carry into our future classrooms thus pushing us to grow our abilities to break down content to create material that will promote problem-solving and active learning among our students.

4:15 - Critical Thinking in the Microbiology Lab

First Author
Bill Staddon
Eastern Kentucky University

Many traditional microbiology labs that have been used for decades present little opportunity for critical thinking. After much trial and error, I have developed three projects that allow student groups to generate unique data and inferences. Two address antibiotic resistance, one using culture techniques, the other molecular. The third assesses the impact of inputs on soil enzyme activities. After students present their results, they critique the inferences made by each group including their own. In this presentation, I will go over this approach and discuss issues.

4:30 - Berea College Herbarium (BEREA): History, Student Research, and Status

First Author
Ralph Thompson
Berea College

The Berea College Herbarium (BEREA) is by far largest private college herbarium collection in Kentucky with specimens dating from 1877. The herbarium has grown from 450 mounted sheets in 1980 to over 26,000 today. BEREA provides a valuable biology student work facility as well as for teaching and research. BEREA has been the specimen depository for 125 articles, booklets, abstracts, presentations, and posters involving student and faculty research. Botanical articles have published from projects in AR, GA, IL, KY, MO, NC, OH, OR, PA, and TN. In 2017, the BEREA collection was combined with Ronald L. Jones Herbarium of Eastern Kentucky University (EKY) with a compactor system, a storage capacity of 200,000, and in a new Science Building. At EKY, all BEREA specimens are imaged and data-banked for SERNEC. The SouthEast Regional Network of Expertise and Collection (SERNEC) is
an active online database [http://sernecportal.org] for 233 herbaria in 14 southeastern United States. BEREA was designated the Berea College, Ralph L. Thompson Herbarium in June 2017. BEREA is now permanently housed at EKY alongside the Ronald L. Jones Herbarium. Together, these two herbaria contain over 100,000 specimens and represent the largest collection in Kentucky.

4:45 - Integrating organisms and disciplines for a K-12 symbiosis-based project.

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Faculty from several Kentucky colleges and universities have partnered with STEM teachers in urban and rural K-12 schools to develop multidisciplinary experiential modules based on seed-transmitted symbiotic fungi (endophytes) and their bioprotective alkaloids in wild and agricultural plants. Several Kentucky grasses have fungal endophytes of genus Epichloë (Fr.) Tul. & C. Tul. Of these, Epichloë coenophiala (Morgan-Jones & W. Gams) C.W. Bacon & Schardl is best known as the cause of fescue toxicosis in livestock but is also important for productivity and stand longevity of the forage grass, tall fescue. Other Epichloë species are known from native wild species of Agrostis L. (bentgrass), Brachyelytrum P. Beauv. (huskgrass), Elymus L. (wild rye) and Poa L. (bluegrass). A wide array of alkaloids produced by Epichloë species defend host plants against invertebrates and, in a few cases, against mammals. Now that scores of Epichloë genomes have been sequenced and the genetics of alkaloid biosynthesis have been elucidated, it is clear that alkaloid profiles are extremely diverse, and the next step is to explore the ecological and evolutionary significance of that diversity. This is an ideal system with which to involve K-12 students to participate in collections from local populations of wild grasses, catalogue and preserve botanical specimens for herbaria, identify and grow endophytes, conduct simple chemical and molecular tests of alkaloid profiles and genes, and even participate in genome and transcriptome sequencing and bioinformatic analysis. Students will apply scientific methods, integrate STEM disciplines, and enhance awareness of local biodiversity.

Friday, November 1, 2019 1:00pm - 2:15pm

Social Sciences: Anthropology, Psychology, and Sociology - Oral presentations

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1:00 - DECISION MAKING ACROSS CULTURES: A Study of Risk Aversion in the United States and Republic of Indonesia

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Culture affects one's decision-making process. When making a decision, oftentimes risk is involved. Furthermore, eastern cultures tend to be more collectivistic, and western cultures tend to be more individualistic. In this study, I assess whether a person's aversion to risk depends on whether the perceived risk could potentially affect one's community, or whether it could be assumed to impact only the individual himself. My hypothesis is that the collectivistic population would become more risk-averse in the setting where others will be impacted by their decision, while the individualistic population would show no changes across the two conditions. I also expected the collectivistic population to be more risk-averse than the individualistic population in the setting where no others except for the individual are impacted by the loss or gain.

Participants (N=103) from an individualistic culture (United Stated) and from a collectivistic culture (Republic of Indonesia) were given a set of questionnaires to assess their risk aversion. Participants were asked to make decisions under two conditions: one where others were impacted by their decision and the other where the decision
did not impact anyone but themselves. A 2x2 mixed ANOVA was performed indicating that Indonesians are more risk-averse in general, regardless of who is impacted. Therefore, one must be aware that some cultures could be more or less risk-averse than others, especially when working with individuals from different backgrounds.

1:15 - (Dis)ability Services for Student Success

First Author
Melony Stambaugh
Kentucky Community and Technical College System

This study looks at services available for students with disabilities in Kentucky in the context of Pre-Employment Transition Services (Pre-ETS). Pre-ETS services are federally funded and available to students between the ages of 15 - 21 which accounts for approximately 12.8% of the population within the state or 95,512 people. Through the services of the Kentucky Community and Technical College System, specialist are currently working to build service capacity in an effort to provide options and direction to a variety of students as they create plans for their future as adults.

1:30 - Flexibility in Social Organization in Crowned Lemurs and Sanford's Lemurs

First Author
Benjamin Freed
Eastern Kentucky University

Co-author
Nathanael Bartosch
Cultural Resource Analysts

Researchers have observed that primates in anthropogenic-affected habitats show remarkable behavioral flexibility. The purpose of this study was to determine whether crowned lemur (Eulemur coronatus) and Sanford's lemur (Eulemur sanfordi) social grouping and organization varies between a small, isolated forest fragment (near humans) and a large, continuous forest (not readily near humans). Quantitative behavioral observations of lemurs were collected in June-July 2016 and 2017 in Analabe Gallery Forest in northern Madagascar. These data were then compared with those that were collected in Mt. d'Ambre National Park, Madagascar in 1989-1991. In both locations, we observed that both species live in multimale/multi-female groups of 3-9 individuals. In Mt. d'Ambre, crowned lemurs lived in groups that frequently divided into subgroups, but Sanford's lemurs were highly cohesive. Only rarely did they ever spend time subdivided. In the fragmented Analabe forest, however, groups of both crowned lemurs and Sanford's lemurs frequently broke into smaller subgroups or into solitary individuals. In both sites, both species spend time associating with each other. The flexibility observed in these lemurs' social spatial cohesion may help them better access resources in a highly seasonal, rapidly-changing habitat.

Friday, November 1, 2019 1:59pm - 5:00pm

Poster Session I
Baird Lounge, Alumni Building
Poster presenters please check in at the table in the lobby of the Alumni Center

Friday, November 1, 2019 2:00pm - 5:00pm

Agricultural Sciences - Poster Presentations
Baird Lounge, Alumni Building

1. - The impact of animal manures on turnip, Brassica rapa biofumigants composition

First Author
George Antonious
ABSTRACT
The need for natural fumigants has increased due to the national prevention of synthetic soil fumigants, such as methyl bromide. In Brassica vegetables, biofumigation is the integration of plant residues that release isothiocyanates (ITCs) upon hydrolysis of glucosinolates (GSLs) into the soil as they decompose. Mixing Brassica dry or fresh plant tissues into agricultural soil defeats soil-borne pests and diseases owing to the release of ITCs, the most effective product of GSLs hydrolysis. We investigated the impact of soil amendments: sewage sludge (SS), horse manure (HM), chicken manure (CM), vermicompost (worm castings), commercial inorganic fertilizer, commercial organic fertilizer, and native bare soil on the concentration of GSLs in field grown turnip (Brassica rapa var. PTWG) root and shoot. GSLs, separated by adsorption on a diethyl amino-ethyl ether ion exchange resin, were quantified by measurement of enzymatically released glucose upon hydrolysis of GSLs by thioglucosidase. Results revealed that total GSLs concentrations were 4005 and 440 µM g-1 in turnip shoots and roots, respectively indicating 9 times more GSLs concentration in the shoots compared to the roots on fresh weight basis. Turnip plants grown in soil mixed with SS contained 2971 µM GSLs g-1 compared to plants grown in no-mulch bare soil (1350 µM g-1 fresh weight, which represents 55% increase in GSLs concentration. This increase in GSLs concentration revealed that turnip plants grown in soil amended with SS could play a significant role in controlling soil-borne diseases in conventional and organic agriculture as alternative to the use of synthetic soil fumigants.

2. - Connecting small-scale farmers to researchers via decision support systems and web-based applications for drone imagery.

First Author Co-author Co-author Co-author
Kevin Smeeks John Blair Jeremy Sandifer Buddhi Gyawali
Kentucky State University Kentucky State University Kentucky State University

Connecting small-scale farmers to researchers via decision support systems and web-based applications for drone imagery processing. K. Smeeks, J. Blair, J. Sandifer, B. Gyawali. College of Agriculture, Communities, and the Environment, Kentucky State University, Frankfort, KY 40601.

Decision support systems involve the extraction of relevant information to be used for decision making in the operation of agriculture and managed land areas from a multitude of sources, including unmanned aerial systems. Using the Python programming language and web framework Django, an application was created for connecting farmers to an automated analysis form for processing single, uploaded images from personal drone devices. Drone images are uploaded to the web application to use for analysis, extraction of meta-data, and geo-referencing. The site also contains a file repository for sharing information and can be tagged by topic and category to enable others to find useful data. A forum is available to users for discussion, questions, and sharing of information. A map can be constructed by combing images with the completed analysis layers and returned to the farmer quickly. Subsequent images may be uploaded to build upon or create layers to the map, enabling the user to see changes over time for the various imaged areas. The value of this project lies in the service provided to the user that bypasses the need for any paid subscriptions for mission planning or post-processing and decreasing the cost of this important technology to the user.

3. - Correlation of Nutritional Management and Fertility of Second Year Cows at the Berea College Farm

First Author Co-author Co-author Co-author
Sarah Whitaker Celine Skrivanek Esther Olabisi-Adeniyi Quinn Baptiste
Berea College Berea College Berea College Berea College

This research was conducted over an eight-week period in order to determine possible nutritional influences on the reproductive performance of second year cows reared at the Berea College Farm, allowing management practices to be established that mitigate the drop in conception rates, therefore increasing production efficiency. Weights and body dimensions were recorded for yearling heifers and second year cows to observe differences in growth and
Development; body dimensions indicate a slight increase in size between one and two years old in length (45.5cm vs. 49.01cm), girth (61.9cm vs. 66.2cm), shoulder height (44.5cm vs. 48.2cm), and hip height (47.6cm vs. 50.7cm), respectively. There is a marginal difference in the live weights between the age groups (682.9kg vs. 909.6kg respectively). Blood samples were taken from the second year cows to determine progesterone levels (from 0.2ppm – 7.25ppm) and return to cycling (92%) approximately one month after parturition. Dry matter (DM) and fiber (NDF) analyses were conducted on fecal samples collected from both age groups, with results indicating a low DM percentage in both age groups as well as a high fiber content in both groups (12.6% DM vs. 12.5% DM, respectively; 49.29% NDF vs. 51.52% NDF respectively). This data indicates the forage consumed in the postpartum period is lower in overall nutrients but higher in water content and fibrous material, allowing for nutrients to be utilized more quickly and efficiently. Present results suggest that tactics such as controlling pasture maturity in the postpartum recovery period would allow for increased in conception rates.

### 4. - Impact of biochar and soil amendments on turnip yields.

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KAS Agricultural Sciences
Impact of biochar and soil amendments on turnip yields. RANCE PAXTON, GEORGE ANTONIOUS, and ERIC TURLEY, College of Agriculture, Communities, and the Environment, Kentucky State University, Frankfort, KY 40601. Biochar and seven soil management practices were used at the University of Kentucky Research Farm in Fayette County, KY, to study the impact of soil amendments on the yield of three cultivars of turnip, Brassica rapa. The three cultivars were: (i) Purple Top White Globe (PTWG), (ii) Scarlet Queen Red (SQR), and (iii) Tokyo Cross (TC). The field contained a total of 126 plots, half amended with biochar. The seven soil management practices used were: (i) sewage sludge (SS), (ii) chicken manure (CM), (iii) horse manure (HM), (iv) vermicompost (VERMI), (v) organic fertilizer (ORG), (vi) inorganic fertilizer (INORG), and (vii) no-mulch (NM) native soil for comparison. Across all cultivars, biochar resulted in larger yields (3.85 kg/m) than no biochar (3.21 kg/m) and all amendments had larger yields than NM (3.04 kg/m). Overall, INORG (4.06 kg/m) made the largest impact and CM (3.97 kg/m) made the second largest impact on turnip yield. Comparing cultivars, PTWG produced the greatest yield (4.23 kg/m), followed by TC (3.74 kg/m) and SQR (2.62 kg/m).

### 5. - Impact of breed and sex on performance and fecal egg count of meat goats in a rotational grazing system

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Intestinal parasites (IP) are one of the most limiting factors in goat production. Control of IP is becoming more difficult and an increasing expense for goat producers. Because of this, management practices to reduce exposure are critical to sustainable meat goat production. To address this issue, a study was conducted to determine the effect of breed and sex on average daily gain (ADG) and fecal egg counts (FEC), at weaning and post-weaning in meat goats managed using rotational grazing. Data were used from a total of 403 meat goat kids of Boar, Spanish, or Savannah breeds and their crosses over three years. All kids were managed as a single group until weaning when the doe and buck kids were separated; all kids were dewormed at weaning. Data were analyzed by the GLMMIX procedure of SAS. There was a significant effect of breed on post-weaning ADG. There was no significant effect of sex on post-weaning ADG. There were no breed or sex differences in weaning and post-weaning (log transformed) FEC. These data indicate that good management within a program of selection for resistance to parasites reduces the impact of breed on parasite load in meat goats.
6. Impact of integrated crop-livestock on N and P concentration in soil water within organic grain production system

First Author
Arjun Chhetri
Kentucky State University

Co-author
Ellyn Anthony
Kentucky State University

Co-author
Blake Vansanford
Kentucky State University

Co-author
Kimberly Barmore
Kentucky State University

Co-author
Shawn Lucas
Kentucky State University

Impact of integrated crop-livestock (goats) on nitrate and phosphorus concentration in soil water within organic grain production system

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Abstract
Agriculture is one of the major non-point pollution source of surface waters contributing on degrading aquatic system. Nitrogen and phosphorus containing compound leached down from the agriculture field contributes on groundwater contamination, eutrophication and have negative effects on human health. Many studies have been conducted on cattle based integrated-livestock rotations and their impact on soil water, however, limited research has been done on goat or other small ruminant based rotations. This study is focused on evaluating the possible nutrient pollution - concentration of nitrogen and phosphorus in soil water underneath crop and pasture in an organically managed integrated crop-livestock (goat) rotation system. Ceramic tipped pressure vacuum water samplers were used to sample water from below the root zone of each plot, and the extracted water samples were analyzed by using Griess reaction to determine nitrogen concentration and by microplate method to determine concentration of phosphorus. Early data suggests that in the initial years of this study greater nitrate leaching is associated with cropped plots while greater groundwater phosphorus is associated with plots treated with goats on pasture. This study is ongoing and additional data is currently being processed.

7. Yellow foxtail and nimblewill control with Prowl H2O on horse pastures

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Muhlenbergia schreberi (nimblewill) and Setaria glauca (yellow foxtail) are weeds commonly found in horse pastures. Weed control has always been an issue for many horse farms. In this study we aimed to determine the specific spray timing for Prowl H2O on nimblewill control. We also wanted to evaluate the effectiveness of Pylex versus Tenacity on nimblewill. This research was conducted on private horse farms near Lexington KY area on summer 2019. Plots were measured out and marked where the weeds had occurred the previous years. The plots were sprayed at different rates and times. The results were evaluated by using quadrat method, transect method, or visual scoring. It was found that Pylex has a faster effect compared to Tenacity on nimblewill. Glyphosate is still proven to be the most efficient and economically feasible way to remove tall fescue from a pasture. After tall fescue removal (40.75% to 10.06%), nimblewill has increased from 11.13% to 21.13%. Although Prowl H2O was not able to control the spread of nimblewill, yellow foxtail was found.

8. Stable isotope ratios in association with the Nosema disease in honey bees.

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The honey bee colony is notable for its extensive food sharing among individuals. Adult workers share nectar, honey, and pollen among themselves and with the queen, drones, and larvae. The queen passes nutrients in the eggs she
lays. Parasites and pathogens also receive nutrients from the adult and larval bees they infect. This movement of nutrients from one individual organism to another can be considered a ‘trophic step’. The partitioning of stable isotopes of carbon, nitrogen, and other elements has been used to illuminate such nutrient dynamics within ecosystems. The isotope ratios reflect trophic relationships in the food web. The many trophic steps within the honey bee colony have not been explored with stable isotopes. We found that the partitioning of 13C relative to 12C and 15N relative to 14N was pronounced in honey bee midguts infected with the microsporidian Nosema ceranae. This supports other observations that N. ceranae is aggressive in its acquisition of nitrogen from its honey bee host cells.

9. - Production performance of freshwater prawn (Macrobrachium rosenbergii) reared at two stocking densities and fed only wet

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Production performance of freshwater prawn (Macrobrachium rosenbergii) reared at two stocking densities and fed only wet brewers grains. KALVIN RUCKER, SHAWN COYLE, and JAMES TIDWELL, Kentucky State University, College of Agriculture, Communities and the Environment, Frankfort, KY 40601.

Successful freshwater prawn (Macrobrachium rosenbergii) culture is based upon producing high-value outputs (prawn) from low-cost inputs (feed). Sinking catfish feed have traditionally been the recommended feed. The use of locally available by-products has the potential to reduce production costs. Wet brewers grains (WBG) are the solid residue left after the processing of cereal grains to produce beer. An increase in the number of small craft breweries has resulted in a surplus in the availability of WBG, which are typically free. A 97-day feeding trial was conducted to determine the potential for WBG to be used as feed for pond production of prawn. Juvenile prawn averaging 0.5±0.01 g were hand-counted into triplicate 0.04-ha earthen ponds at densities of 20,000 and 40,000/ha and fed only WBG based on a feed chart. Feed allocations were adjusted based on protein and moisture content. At harvest, there was no significant difference (P > 0.05) in survival between the two treatments, which averaged 97% overall. Stoking density had a significant impact on average wet body weight, total yield, feed conversion (FCR), and protein efficiency (PER). Prawn reared at the lower density had higher average weight (42.9 g), FCR (7.22), PER (1.6), and lower yield (855 kg/ha) than those reared at the higher density, which averaged: 31.2 g, 5.0, 1.2, and 1,231 kg/ha, respectively. Based on these results, WBG is a suitable feed for pond production of prawns at densities up to at least 40,000/ha, which may substantially reduce feed and production costs.

10. - Natural enemy populations in blackberries bordered by native perennial plants or pasture in Frankfort, Kentucky

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Conservation biological control uses native perennial plants next to or within an agricultural crop to attract natural enemies by providing pollen and nectar. The spotted-wing Drosophila (SWD), Drosophila suzukii (Matsumura), is an invasive fruit fly and pest of soft-skinned fruit, including blueberries, raspberries, strawberries and blackberries. Once an egg is inside the fruit, implementing management strategies is difficult since the egg is protected by the fruit. The objective of this research was to identify and enumerate natural enemies in blackberries bordered by native perennial plants or pasture. Research was conducted at Kentucky State University’s Harold R. Benson Research and Demonstration Farm in Franklin County, Kentucky. There were 14 flowering native perennial plants and 5 native grasses. Pasture border rows were a mixture of grasses, clover, and broad leaf weeds. Five sticky traps, 15 cm x 15 cm, were placed equidistant from the edges and each other in the border rows and blackberry rows. Traps were
changed weekly in 2016 and 2017 and deployed every other week in 2018. Traps were taken to the laboratory for identification and enumeration. Minute pirate bugs (MPB; Orius spp.) were the most abundant insects found in 2016-2018. MPB were not consistently abundant in any of the four habitats among years. In 2017, the numbers of insects present remained consistent, while MPB numbers were greatly reduced over time in 2018. Data are being processed from the remaining 2018 sticky traps. Results will include the additional data.

Friday, November 1, 2019  2:00pm - 5:00pm

**Chemistry: Analytical & Physical - Poster Presentations**
Baird Lounge, Alumni Building

<table>
<thead>
<tr>
<th>11. - Thermally-Activated Phase Transitions in Seven Spiro-Based Crystals</th>
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<tr>
<td><strong>First Author</strong></td>
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<td>Olivia Adkins</td>
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<td>Murray State University</td>
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Mechanical activation of chemical bonds targets early detection of failure and fatigue in polymers. Self-healing functional polymers based on spiropyrans (SP) have already been built. Their mechanism of action is based on the C-to-O bond (spiro bond) being selectively cleaved upon mechanical activation. The cleavage of a covalent bond and thus the failure of the spiro-based material is signaled by a sharp change in color from colorless to purple. This change also occurs upon heating (thermochromism) or illumination with light (photochromism). Since mechanical action as well as heating and illumination are capable of causing the spiro-bond to snap, it is necessary to establish detailed information on the thermal properties of these spiro-based molecules. We have applied Differential Scanning Calorimetry method to establish the thermal properties of seven SP-based crystalline materials. While some of them follow the well-established melting-freezing pattern normally seen for many crystalline substances, some show complex array of peaks with enthalpies that can only be assigned to polymorphic phase transitions within a crystal.

<table>
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<th>12. - Synthesis, Purification, and Characterization of 13-Alpha Epimer Estrogens</th>
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<tr>
<td><strong>First Author</strong></td>
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<td>Natalie Adriano</td>
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Estrogenic hormones derived from the agricultural and pharmaceutical industries are common pollutants. The concentration of steroidal pollution in natural bodies of water has therefore been increasing with rising demands. Wastewater with estrogenic pollutants may be detected with fluorescence and treated through photolysis; one property of their photolysis is the production of 13-alpha epimers. Photolysis breaks the estrogenic pollutants down, which may reduce their harmful effects. These products may themselves be a source of pharmaceutical precursors. In order to test 17-keto-estrogen products, a reliable source must be available. We have adapted a synthesis using a 17-keto-estrogen (estrone or estrone-3-methyl ether), o-phenylenediamine, and glacial acetic acid to produce the epimers more efficiently than with photolysis. In this synthesis, final yields of 86% were achieved after extraction and 84% after recrystallization. GCMS and NMR were used to verify the structures while spectroscopy was used to characterize their properties.

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<th>13. - Summer 2019 JEOL ECZR500 NMR Research</th>
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<td><strong>First Author</strong></td>
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<td>Zackary Boothe</td>
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<td>Berea College</td>
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During summer 2019, we spent the last 4 weeks working up at the Ohio State University in the laboratory of Philip Grandinetti (our long-time collaborator). We did some glass research (as I have done in the past) but we mostly focused on learning to use the new JEOL ECZR500 nuclear magnetic resonance (NMR) spectrometer. The first project involved new heteronuclear multiple bond correlation spectroscopy (HMBC, both CIGAR and ACCORD) sequences in concert with other traditional one and two-dimensional experiments to fully assign ten different
monoterpene molecules (10 carbon molecules found in many natural products). The HMBC-CIGAR is used to give correlations between hydrogen atoms located 2 or 3 bonds away from a carbon atom in the molecule. This will provide a new experiment to use in my CHM470 course this fall. The second project primarily studied mixtures of molecules using diffusion ordered spectroscopy (PFG-BPP DOSY.) We tried this experiment with two kinds of mixtures, one was a mixture of small organic molecules and the other was a mixture of various polyphosphate anions. In both cases, the various sequences proved challenging to reliably separate the various molecular species. The best sequence was one called ONESHOT-45 which was designed to remove J-coupling modulations from the final data, but even this had phase twisted lineshapes that proved difficult to measure diffusion constants. The third project involved my more traditional glass research where we prepared some lead pyrophosphate glasses to study with the SE-PIETA experiment to measure J-coupling constant distribution, and begin to map these onto bond angle distributions present in the P-O-P pyrophosphate units. These sequences were fairly straightforward to port from the old ECX-300 instrument and implement on the ECZR-500.

14. - Strontium Concentrations in Avian Eggshells and Egg Contents

First Author
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Chemistry Department

Heavy metal contamination to the environment has become an increasing concern over recent years. Heavy metals pose a threat to the environment and wildlife. Strontium in particular is known to displace calcium, for birds this can cause weaker shells and potentially lower survivability until they hatch. The strontium concentrations in locally sourced and commercial chicken eggs were investigated through Atomic Absorption Spectroscopy (AAS) to determine if there was a difference. Additionally, starling eggs from central Ohio were tested to determine if their origin location correlated to the amount of metal found. Strontium concentrations found in starling shells far exceeded that of the rural, control sample. However, strontium found in local chicken eggshells from different counties highly varied, and was significantly different in comparison to commercial eggs.

15. - Interactions of SO2 at a Vacuum-Water Interface

First Author
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Atmospheric aerosols are minute particles suspended within the atmosphere. These aerosols are involved in the formation of acid rain. Sulfur dioxide in particular is prevalent in aerosols due to it being emitted by motor vehicle exhaust, as well as oil refineries, which has become integral in today's society. While the effects of acid rain have been studied and observed throughout many experiments, the interactions of the aerosol, such as penetration depth of the molecule and angle of penetration at the molecular level has not been studied as intensively. A water slab with a vacuum on two faces of the slab was created using the AMBER suite of molecular modeling software. A sulfur dioxide molecule was fired at the slab at different positions in order to observe the interactions at the interfacial level. Sulfur dioxide shows a preference for the interfacial region, as the molecule floats around the interface for a few picoseconds before quickly passing through the slab to the other interface. Further analysis evaluates the impact of the velocity and angle of impact at the interface has on the penetration of the sulfur dioxide molecule with the interfacial regions. Studying the interfacial interactions can give insight as to how the sulfuric acid of acid rain is oxidized, from the interactions between the initial SO2 and the water droplet. This project can help model and study the rate of uptake of SO2 into aerosols to help determine the rate of formation of the sulfuric acid within the aerosol.

16. - Monitoring the Diffusion of Model Analytes Via Peak Parking Capillary Electrochromatography

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This investigation utilized Capillary Electrochromatography (CEC) in order to observe the diffusion behavior of a model class of analytes through a capillary containing a lauryl acrylate porous polymer monolith (PPM) as the stationary phase. A 75:25 acetonitrile:Tris solution served as the mobile phase. The focus of the experiments was to determine the diffusion coefficients of the analytes being monitored. The peak parking method was utilized. This method pauses the advance of the species in the stationary phase for specified amounts of time. A series of uninterrupted trials served as a baseline for each species, to help understand the unmanipulated behavior. Subsequent trials of 0.1, 15, 30, 45, 60, and 75 minutes pauses were administered on each analyte and recorded for analysis. The resultant diffusion coefficients were then compared to those obtained in open capillaries.

### 17. High-throughput fluorescence correlation spectroscopy enables analysis of surface components of cell-derived vesicles

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Jason DeRouchey  
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**Co-author**  
Chris Richards  
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Endogenous extracellular vesicles (EEVs) and cell derived vesicles generated by fragmenting cellular membranes have been explored as therapeutic delivery vehicles. Surface proteins on these vesicles are of great importance as they are characteristic to the cell of origin and modulate vesicle interactions with target cells. Here we introduced a high throughput fluorescence correlation spectroscopy (ht-FCS) approach capable of characterizing vesicle surface proteins across a large number of samples. We used automated screening and acquisition of FCS data to profile surface proteins of cell-derived vesicles with high fidelity based on changes in diffusion time upon antibody-vesicle interactions. We characterized vesicles generated from 4 cell types using antibodies for known exosome biomarkers. The ht-FCS technique presented here offers the capability to screen EEVS or cell derived vesicles against a library of surface markers or to screen a library of cell derived vesicles for a specific identifying marker at a high speed.

### 18. Detection and quantitation of biological polyions using chronopotentiometry with polyion-selective electrodes

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**Co-author**  
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**Co-author**  
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The polysaccharides heparin, low molecular weight heparin, dextran sulfate and pentosan polysulfate are widely used as anticoagulant and therapeutic agents. On the other hand, protamine and other similar polypeptides are used as antidotes of these anticoagulant agents. Accurate measurement of these biological polyions is critically important for clinical and biomedical applications. Thus, developing simple, rapid and inexpensive detection methods of these anticoagulant agents and their antidotes is very important. The aim of our research project has been to develop polymer membrane-based polyion sensors with chronopotentiometric method of detection of the polyanionic anticoagulants and the polycationic antidotes. The detection of anticoagulant-antidote binding affinities and ratios of these anticoagulants and antidotes has also been demonstrated.

### 19. Potentiometry with Ionophore Based Ion-Selective Electrodes for Rapid Measurement of Potassium

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**Co-author**  
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**Co-author**  
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Potassium ion (K+) is a vital cation for normal cell functions. However, abnormal concentrations of K+ (hyper- and hypokalemia) can be life threatening. Therefore, K+ is routinely measured in clinical laboratories for diagnostic purposes. The method most widely used for the measurement of K+ currently is potentiometry. Even though this method is simple and reliable, it requires routine calibration measurements. This can be performed rapidly in laboratories where sophisticated instruments that are automated are available. However, in the absence of such
automated instruments, potentiometric measurement of K+ takes long time. As such, this work focuses on effectively and rapidly measuring potassium using chronopotentiometric methods with potassium selective electrodes. Due to its high selectivity towards potassium (K+), valinomycin was used as the ion carrier (ionophore) in a plasticized poly-vinyl chloride (PVC) based membrane. The square root of the measured transition time is directly proportional to the concentration of the ion in chronopotentiometric measurements and therefore, calibration measurements are not required. This allows rapid and direct measurement of K+.

20. - Determination of Cannabinoids, Cathinones, and Synthetic Opioids Using Wastewater-based Epidemiology

First Author          Co-author
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University            University

Unregulated new psychoactive substances (NPS) in 'pure' or 'preparation' forms are designed to mimic the effects of controlled substances, and are introduced and reintroduced in the market as a cheap substitute of established regulated drugs in quick succession to loophole the law enforcement efforts on combating drugs. For example, carfentanil, a synthetic opioid activates the opioid receptors similar to morphine but it is astoundingly potent compared to a typical drug of abuse (100 times more potent than fentanyl and 10,000 times more powerful than morphine). Based on the cost- and time-intensive forensic analysis, National Drug Early Warning System reported a total of 632 identifications of NPS including 502 opioids/analgesics, 74 synthetic cannabinoids, 24 cathinone identifications in the second quarter of 2018 in the USA. The UPLC-MS/MS based analytical technique was developed capable of determining trace level NPS in wastewater. The cost-effective, comprehensive, and near-real-time approach, wastewater-based epidemiology, was used for the first time in the U.S. to determine the prevalence of 43 NPS in four U.S. communities. Methcathinone, 5-IT, 4-methylamphetamine, 1-(3-chlorophenyl) piperazine (mCPP), 4-methyl pentedrone, carfentanil, valerylfentanyl, and 2-methyl-4‘(methylthio)-2-morpholinopropiophenone were the most abundant NPS.


First Author
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One of the major issues concerning the increase in global temperature is with the elevating levels of CO2 in the atmosphere. Combustion of fossil fuels in power plants is a leading contributor to the elevated anthropogenic CO2 concentration. To help alleviate this issue, the investigation of aqueous amines being implemented for the capture of CO2 in the post-combustion carbon capture (PCCC) in power plants has been a growing interest to chemists. One of the concerns with aqueous amines, is their ability to thermally degrade. Thermal degradation is a prominent aspect for the loss of aqueous amines during the stripper process in powerplants. The focus of this research is to investigate the structural effect on the thermal degradation of aqueous amines. The proposed method for this investigation involves the degradation of a 30 wt% amine solution loaded with a 0.4 ratio of moles CO2 per moles of amine, over a one-week span at 125, 135, and 145°C. After which, the degraded species will be analyzed using ion chromatography (IC), high-performance liquid chromatography (HPLC) and 1H and 13C NMR. A computational analysis on the energetics of the CO2 binding and stripping to and from aqueous amines compared to the binding of an aqueous amine molecule to itself would help quantify the favorability of thermal degradation. The hope is to find a correlation between the computational results and the experimental result.

22. - Investigating the Morphology of Various Polymers via Scanning Electron Microscopy

First Author          Co-author
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University            University
Co-author             Madisyn Hayes
Co-author             Charlisa Daniels

The goal of this project was to discover the morphology of various polymers. A polymer that consisted of 25:75
BDDA: Lauryl Acrylate was studied with multiple porogens, pore size was observed and compared using a Scanning Electron Microscope (SEM). 75/85% DMAEMA:Polystyrene polymers were also studied in different pH environments using the SEM.

23. - Development and validation of a novel GC-MS method for determination of some (PEDs) in saliva

First Author  Co-author
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University  University

The World Anti-Doping Agency (WADA) currently utilizes urine and blood from athletes to assess for use of banned substances in sports. Despite strict procedures enforced by WADA that are supposed to sway athletes from trying to avoid detection of banned substance use, some athletes still attempt to do so. These athletes use methods like adulterating their urine with diuretics, alternating use of different substances at different times to escape detection in either blood or urine, and by using extreme measures like blood transfusions (this is referred to as blood doping). Performance enhancement is a goal some athletes are willing to do anything for. Besides the athlete harming his or her own health, the use of performance enhancing drugs (PEDs) takes away integrity and fair competition for all other athletes and their sports. Developing an accurate, sensitive and reliable method for detection and determination of PEDs, especially selective estrogen receptor modulators (SERMs), in oral fluid (OF) would greatly advance the World Anti-Doping Agency's ability to randomly, discreetly, and spontaneously screen for use of a modulator or other drug and serve as a complement to its use of urine and blood for screening and testing. Oral fluid screening and testing would be useful in determining recent use of a drug (targets the parent drug, typically 1 â€“ 48 hours after exposure) whereas urine tests are more useful in detection of drugs over longer exposure (targets drug metabolites, typically 3 â€“ 7 days). Saliva sample collection is non-invasive, and supervision

24. - Cyclicvoltammetric Study of 10-[5'-(N-Diethylamino)pentyl]-2-chlorophenoxazine (DEAPCP) and its Applications in Redox

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Northwest MS  Northwest MS  Community College  Community College  Community College
Community College  Community College  Community College  Community College  Community College

10-[5'-(N-Diethylamino)pentyl]-2-chlorophenoxazine (DEAPCP), undergoes a reversible one electron oxidation with cerium (IV) to form a pink colored radical cation in the presence of stoichiometric amounts [DEAPCP:Cerium (IV) 1:1] of the reactant. The radical cation further undergoes a second electron oxidation to form a brownish yellow colored dication in the presence of more than one equivalent of cerium (IV) which was characterized by UV-VIS, IR and mass spectrometry. The biological functions of phenoxazines are connected to a great extent with their ability to undergo reversible redox conversion and therefore the electrochemical behavior of DEAPCP is investigated by cyclic voltammetry. The cyclic voltomogram of 10-[5'-(N-diethylamino)pentyl]-2-chlorophenoxazine (DEAPCP) exhibited two anodic waves at 760 mV and 1170 mV and two cathodic peaks at 688 mV and 1020 mV at a scan rate of 50 mV/sec. The peak at 760 mV corresponds to the oxidation of the DEAPCP to the radical cation [DEAPCP +] and the second anodic peak at 1170 corresponds to the oxidation of radical cation to dication [DEAPCP2+]. Bromine in acid medium oxidizes 10-[5'-(N-diethylamino)pentyl]-2-chlorophenoxazine (DEAPCP) to three products as evidenced by the HPLC and the predicted structures based on the mass spectral data support the formation of the brominated oxidized products. In order to study the analytical applications, the optimum condition for the successful use of DEAPCP as a redox indicator in the macro and micro estimation of the ascorbic acid, methionine, isoniazid,
phenylhydrazine hydrochloride and biotin using chloramine-T as oxidant have been developed. The indicator gives sharp and stoichiometric end points.

25. - Electrodeposition of Photosensitive Metals across Micron-gap Gold Electrodes

First Author  Co-author
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Eastern Kentucky  Eastern Kentucky
University  University

A simple, low cost, and highly parallel electrochemical approach for fabricating nano-scale (metal/metal) or molecular (metal/polymer or self-assembled monolayer (SAM)/metal) junctions that should be useful in preparing working sensors and molecular electronic devices has been reported by Zamborini and coworkers. The fabrication of metal/metal junctions involves metal deposition on one set of electrodes (E1), where the metal grows and becomes connected to a second set of electrodes (E2) of a Gold interdigitated array of electrodes (Au IDA) with a 5 µm separation. Electrodeposition of silver (Ag) and palladium (Pd) at these micron gap electrodes and their application for H2 sensing have been reported. However, other metal electrodeposition at Au IDA's has not been explored. Here, we report the electrodeposition of photosensitive materials, specifically Cadmium sulfide at Au IDAs. We are currently investigating the impacts of applied potential and metal ion concentration on the morphology of the cadmium (Cd) electrodeposition on/across Au IDA electrodes. Cd was electrodeposited onto Au IDA electrodes from a cadmium chloride solution. Cd electrodeposition was performed at six different applied potentials and from a solution containing three different concentrations of Cd ions. The morphology of electrodeposited Cd was confirmed by scanning electron microscope (SEM). These devices will eventually be used for sensing light.

26. - Using Femtosecond Transient Absorption Spectroscopy to Study Photoinduced Ultrafast Charge Transfer Processes

First Author  Co-author
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University

Laser spectroscopy is a powerful technique that researchers can use to study energy dynamics and charge transfer processes. The frequency-domain spectra provide information on the molecular structure and electron energy levels, while the time-domain spectra can be used to analyze charge transfer processes. Most of charge transfer processes we studied in the field of chemistry and biochemistry are on the time scale of µs, ps, and fs, which cannot be measured by traditional techniques. Femtosecond transient absorption spectroscopy uses a pump-probe system to investigate those ultrafast charge-transfer processes. This technique was proved to be powerful in many different areas, especially in the studies of solid-state material sciences, bio-molecular processes, photovoltaic and photo-emission devices, and photosynthetic systems.

27. - Exploration of Heteroaryl Isocoumarin with OH or N Substituents

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Northern Kentucky  Northern Kentucky  Northern Kentucky  Northern Kentucky
University  University  University  University

Isocoumarin compounds are a class of bioactive natural products. These isocumarin compounds are potential aromatase inhibitors for breast cancer treatments. In our previous studies, we established a domino reaction via palladium catalysis under microwave irradiation to synthesize isocoumarin compounds. Computer modeling indicated that hydroxyl group (-OH) and/or N atom greatly enhances the binding affinity between the ligand and the enzyme,
which indicates that they could be effective potential drug candidates. In this presentation, the synthesis of domino compounds with â€OH or N moiety were explored using different reaction conditions. Medium pressure liquid chromatography was used to purify the crude products and nuclear magnetic resonance was used to characterize their structure. The products that were derived were then tested for their potential ability to be effective drug candidates using Lipinski’s Rule of Five. Computer modeling also showed a high docking score for one of the compounds, showing its potential effectiveness. Several compounds were produced throughout this study and the study provided useful information for the synthesis of aromatase inhibitors that potentially could be used in breast cancer treatment.

28. - Design and synthesizes of cadmium based metal-organic framework mimicking carbonic anhydrase enzyme

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WESTERN  WESTERN
KENTUCKY  KENTUCKY
UNIVERSITY  UNIVERSITY

Carbonic anhydrase (CA), a metalloenzyme catalyzes the important reaction of hydrolysis of carbon dioxide (CO2) to bicarbonates. Not only is that CO2 conversion is important in biological systems and marine life but can also be the basis to reduce the concentration of CO2 in the atmosphere. The natural CA enzyme being highly fragile, sensitive to thermal and environmental conditions and expensive is unsuitable for industrial use. A stable artificial CA enzyme can therefore be highly beneficial to overcome the drawbacks of the natural CA and be also used as an alternative or in conjunction with biomedical applications of natural CA. The purpose of our study is to design, synthesize artificial CA based on metal-organic framework. Cadmium (Cd) was one of the metal ions found suitable for this purpose because of its similarity to zinc (Zn) ion found in the natural CA. In this presentation, I will report the synthesis of a new metal-organic framework (\([\text{Cd(H2Hist)}]\), H2Hist = L-histidine) using cadmium nitrate and L-histidine as starting materials under hydro solvothermal conditions. The structure of the new compound was analyzed using X-ray crystallography diffracto-meters and FTIR. The catalytic properties of the new compounds were also studied.

29. - Efficient Oxidation of Organic Substrates by Ruthenium Light-Harvesting Porphyrin with Visible Light

First Author  Co-author  Co-author  Co-author
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Western Kentucky  Western Kentucky  Western Kentucky  Western Kentucky
University  University  University  University

High-valent metal-oxo porphyrin complexes are one of nature’s prime choices for enzymic oxidation within the majority of living organisms. In this study a novel ruthenium(II) carbonyl porphyrin complex with a light-harvesting ligand has been synthesized and spectroscopically characterized using 1H-NMR and UV-Vis spectroscopy. Boron dipyrromethene (BODIPY) acts as a photostable antenna for light absorbing a broad spectrum of energy between 400 to 550 nanometers and transferring it to the central ruthenium atom to increase the efficiency of catalytic oxidation. During preliminary oxidation trials conducted using sulfide and styrene substrates the porphyrin-metal complex demonstrated great photoreactivity under visible light irradiation.

30. - Heterodinuclear 3d-4d metal-organic framework for photocatalytic reduction of carbon dioxide

First Author  Co-author
Mary Begley  Bangbo Yan
Western Kentucky  Western Kentucky
University  University

Carbon dioxide reductions under sun lights and appropriate photocatalysts may offer the great potential of renewable energy. Among varies of photocatalytic systems, homogenous or heterogenous photocatalytic systems containing metal complexes have been studied for reduction of carbon dioxide. Ruthenium polypyridyl complexes have been the key components in early reported photocatalytic systems. However, very little work has been done on combining ruthenium complex sensitizer with 3rd row metal ions with open coordination metal sites to form extended structural materials as heterocatalysts. In this presentation, we will report our study on the self-assembly, structures and
31. - Naphthalenemonoimide based fluorescent chemosensors for detection of metal ions and anions

**First Author**
Pedro Herrera

**Co-author**
Temtsel Och

**Student**
Berea College/Student

1,8-Naphthalimide is an excellent fluorophore (fluorescent compound) with long emission wavelength band (400-600 nm), a large stokes shift, insensitive to pH and synthetic versatility. Triazole functional group has been used as binding sites for various metal ions, in particular, Zn(II), Cu(II) and Fe(III) metal ions. Based on naphthalimide as fluorophore and triazole as binding site, new tripodal chemosensors have been designed and synthesized by copper-catalyzed Huisgen Azide Alkyne cycloaddition reaction (known as click reaction). Its photophysical properties with various metal ions were investigated by absorption and fluorescence spectroscopy. Study shows compound is selective for Zn(II), Cd(II) and Fe(III) over other metal ions in acetonitrile solvent. Fluorescence is enhanced on the addition of these metal ions, which is attributed to PET (photoinduced electron transfer) effect.

Dipicolylamine (DPA) is another common chelating group used for binding of metal ions, in particular, Zn (II) ion. Moreover, DPA-Zn (II) complex has been used for detection of various anions such as pyrophosphate (ppi), adenosine triphosphate (ATP), adenosine diphosphate (ADP) and adenosine monophosphate (AMP). In this project, a fluorescent chemosensor is designed and synthesized by coupling naphthalenemonoimide with DPA unit by click reaction. Naphthalenemonoimide acts as a fluorophore while triazole and DPA unit as chelating groups. A detailed study of the compound with various metal ions and anions will be carried out in next summer.

32. - Palladium-catalyzed Isocoumarin Formation from Methyl 2-iodobenzoate

**First Author**
Sandra Onate

**Co-author**
Brooke Bailey

**University**
Northern Kentucky University

One in eight women will be affected by invasive breast cancer. Aromatase (estrogen synthase) inhibition is the focus of this summer to stop cancer cell division. The development of the aromatase inhibitors is done through a palladium-catalyzed domino reaction in a toluene solvent under microwave irradiation. The following conditions are used to prepare the isocoumarin compounds: 1.1 equivalents of ketone, 1 equivalent of heteroaryl, 2.4 equivalents of NaOtBu and 2 mol% XPhos Pd Gen 4 catalyst. The reaction is microwaved at 130 oC, 140 oC and 150 oC. The product was purified through medium pressure liquid chromatography (MPLC). Once the molecule has been purified, its structure is verified via nuclear magnetic resonance (NMR). These compounds will be used in the enzyme fluorescent plate assay to assess their inhibition potencies.

33. - Photoredox Catalyzed Oxidative Cyclopropanation of Ene-Ynamides via Facile Generation of Vinyl Radical

**First Author**
Bradley Bankhead

**Co-author**
Jonathan Markham

**University**
Western Kentucky University

Photoredox Catalyzed Oxidative Cyclopropanation of Ene-Ynamides via Facile Generation of Vinyl Radical:
Synthesis of 3-Aza-Bicyclo[3.1.0]Hexan-2-One

Recently, our group reported a novel strategy for the facile generation of vinyl radical through the photoredox catalyzed oxidative activation of alkynes with pyridine N-oxide. With our continuous efforts to explore new synthetic applications of this strategy, we report here a metal-free photoredox catalyzed synthesis of 3-aza-bicyclo[3.1.0]hexan-2-ones from ene-ynamides. The 3-azabicyclo[3.1.0]hexane skeleton is a type of important synthetic intermediate for several bioactive molecules and pharmaceuticals. We propose that this transformation undergoes the formation of a distonic cation vinyl radical intermediate from photoinduced oxidative addition of ene-Ynamide with pyridine N-oxide. Further investigation is undertaken to extend the reaction scope and to understand the reaction mechanism.

34. - Producing phenylethoxyxalixarenes via tert-butyldimethylsilyl protected Phenylethynylcatecols

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The purpose of this work is to develop methods to synthesize phenylethynyl-o,m,o,m-oxacalix[4]arenes. The oxacalixarene core forms tweezer-structure bringing the phenylethynyl substituents face to face. These molecules formed can provide insight on interactions between cofacial aromatic rings. Several analogues of p-substituted phenylethynyl-o,m,o,m-oxacalix[4]arenes are being synthesized. The substituents include a range of electron donating and withdrawing groups so that correlation can be drawn between the electronic nature of the substituents and the overall properties of the annulenes. This poster will discuss our current status in the preparation of the oxacalixarene series.

35. - Synthesis and Characterization of Ionic Liquid-Functionalized Cellulose

First Author
Vanessa Smith
Murray State University

Co-author
Sarah Byron
Murray State

Co-author
Kevin Miller
Murray State

Structural polysaccharide biomacromolecules such as cellulose favor a hierarchical organization, held together by hydrogen bonds and van der Waals dispersion forces, which can exhibit useful and novel properties including ionic conduction. Although native cellulose conductivity is poor, one can enhance the conductive properties through the modification of the structure (hydration, composites, etc.). Transforming natural resources from their native state to a more usable form through synthetic modification, however, is non-trivial and is the subject of intense scientific scrutiny. In this presentation, we discuss our progress towards the synthesis and characterization of a series of ionic liquid functionalized cellulose derivatives. These novel polymerized ionic liquids (PILs) were prepared by employing an azide-alkyne ‘click’ strategy, followed by quaternization of the triazole ring to form an ionic liquid (triazolium) moiety. Variables included the alkyne used in the cyclization and the counteranion of the final IL-functionalized cellulose material. Polymers were characterized by IR and 1H NMR spectroscopy and thermal analysis of the materials will be discussed. These materials ultimately open the door to new a new class of biomaterials which could be utilized in various biosensors and similar devices.

36. - Synthesis of Bis(imino)pyridine Ligands: Iron Catalysis for Nitrene Reactions

First Author
Isaac Howard
The purpose of this research is to synthesize both achiral and chiral variants of bis(imino)pyridine iron complexes as catalysts for nitrene reactions. Recent research has successfully demonstrated the catalytic activity of bis(imino)pyridine iron catalysts for carbene transfer reactions, therefore, there is great potential for nitrene catalysis. Nitrene reactions such as C–H insertion and nitrene cycloaddition were successfully catalyzed by our iron-based catalyst. Future work will involve testing our catalysts to synthesize enantiopure products from chiral asymmetrical catalysis. This project will produce a series of synthesized chiral and achiral ligands for bis(imino)pyridine-based iron catalysts that will have varying electronic, chiral, and steric environments for adjustable reactivity and selectivity; these new developments will improve metal catalysis as they will be based on abundant and less toxic elements.

37. - Synthesis of Fluorinated Thermoelectric Material

First Author
Jordan Pollard
Berea College

Co-author
Jacob Downs
Berea College

The goal of this summer research project was to synthesize a tetracene that has fluorine substituents. When tetracene is bonded by two thio bridges and doped with iodine it forms a substance known as a thermoelectric material (TM). Tetracene has already been successfully synthesized with electron donating groups (EDGs), but they have not been successfully synthesized with electron withdrawing groups (EWGs). The reason fluorine was chosen was because of its high electronegativity, and being one of the best EWGs. The possible benefit of a fluorinated tetracene would be that its electrical capacity would be increased, allowing for a better TM. The problem with synthesizing tetracene with EWGs, is that EWGs draw the electrons towards itself. This makes it difficult for tetracene to form from its previous substrate due to it using a nucleophilic attack to close the ring forming the tetracene. The research team discussed ways on how to form tetracenes with EWGs, and settled on a pathway. By starting with 2-butyne-1,4-diol the research team added iodine to form a diiodobutene diol product, with a 97.35%-97.65% yield, this step was the same for each of the groups. The next step was to add a fluorobenzyl compound to the diiodobutene diol product replacing the iodines, this was a 21.98% yield. The next step was to oxidize the hydroxyl groups giving aldehydes, giving 66.37% yield. The last step that was reached during this eight week period was replacing the aldehydes with dichlorogroups. The yields for this step was negligible. The final step that was not reached in this eight week period was the closing of the tetracene ring. Each product was observed by IR spectroscopy, 1H NMR spectroscopy, 13C NMR spectroscopy, and GCMS. Future research will be conducted in the spring semester of 2020 in which another attempt will be made to develop tetracenes.

38. WITHDRAWN - Synthesis of Platinum Based Peptides

First Author
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Eastern Kentucky University Department of Chemistry

Co-author
Margaret Ndinguri
Eastern Kentucky University Department of Chemistry

Despite new discoveries and many new treatments, cancer patients eventually relapse; patients experience incapacitating side effects from chemotherapy treatment and tumors become chemo resistant. Most chemotherapy drugs fail to have selectivity towards cancer cells, causing destruction of normal cells and undesirable side effects in cancer patients. In this research, we are looking at targeted delivery of cisplatin using Luteinizing hormone-releasing hormone (LHRH). Luteinizing Hormone Releasing Hormone (LHRH) receptor has been found in higher quantities on cancer cells than on normal cells, making it a good candidate for drug targeting. Results on synthetic methods and reaction of cis-[Pt-(NH3)2(H2O)2]+(NO3)2 and LHRH peptide will be discussed.
39. - Synthesis of triaryl aromatase inhibitors through a palladium-catalyzed heteroarylation

First Author         Co-author
Ayusha Bagale       Lili Ma
Northern Kentucky   Northern Kentucky
University          University

Synthesis of triaryl aromatase inhibitors through a palladium-catalyzed heteroarylation

Ayusha Bagale, Alexander Rosen and Lili Ma

Department of Chemistry and Biochemistry, Northern Kentucky University, Nunn Drive, Highland Heights, KY 41099

Heteroaryl compounds are valuable building blocks in medicinal chemistry and chemical industry. A palladium-catalyzed direct \( \beta \)-C(sp\(^3\)) heteroarylation of ketones under microwave irradiation was established in our lab in our previous study. In this presentation, this highly efficient palladium catalysis was used to synthesize triaryl compounds, a class of potent aromatase inhibitors. The optimized reaction conditions are 1.1 equivalents of ketone, 1 equivalent of heteroaryl, 2.4 equivalents of NaOtBu, 2 mol% XPhos Pd Gen 4. in toluene solvent under microwave irradiation for 10 minutes at 1400 °C. The computer modeling and bioassay testing was performed in our lab. This study provided useful information for the discovery of new aromatase inhibitors as breast cancer candidates.

40. - Synthetic and Catalytic Studies of Metalloporphyrin Complexes for Biomimetic Oxidations

First Author         Co-author         Co-author
Fox Bratcher         Christian Alcantar Rui Zhang
Western Kentucky     Western Kentucky Western Kentucky
University           University

In Nature, cytochrome P450 (CYP450) enzymes catalyze important oxidation reactions which serve as inspiration for use of synthetic metal complexes as biomimetic catalysts. Several different porphyrin free ligands containing different aryl groups were synthesized according to a well-documented procedure. Metals of iron, manganese, and ruthenium were inserted into the porphyrin ligands and the resulting metalloporphyrin complexes were characterized by 1H-NMR and UV-vis spectroscopies. With PhI(OAc)\(_2\) and 2,6-Cl\(_2\)PyNO as a mild oxygen sources, the catalytic ability of the metalloporphyrin complexes were evaluated in alkene epoxidation, alkane hydroxylation, and sulfoxidation. High conversions and excellent chemoselectivity without overoxidation of sulfoxides into sulfones were obtained with various substrates. Of note, visible light irradiation was found to promote the manganese and ruthenium porphyrin-catalyzed oxidation in a significant way, which will be discussed in the presentation.

41. - The Synthesis of Thermoelectric Materials with an Electron Donating Group

First Author
Areli Medina Hernandez
Berea College

The synthesis of tetracenes with electron-withdrawing groups (EWG) that could possibly act as thermoelectric materials, is the overarching goal of this research. Thermoelectric (TE) materials have the ability to use the free energy from waste heat to create a temperature difference that can then be used to conduct electrical energy. The synthesis of tetracenes with EDG has been successful in terms of producing them in high yields and in economically-friendly ways, yet the synthesis of tetracenes with EWGs, such as halogens remains unaccomplished. This specific project focused on the synthesis of tetracenes with electron-donating groups (EDG). By demonstrating that this new procedure is effective for substrates with EDGs, it gives hope that EWGs will also be successful. The synthesis of tetracenes was a multi-step project which began with the synthesis of (E)-2, 3-diiodobut-2-ene-1, 4-diol from 2-butyne-1, 4-diol, resulting in a yield of 94-98%. The following step of converting (E)-2, 3-diiodobut-2-ene-1, 4-diol to (E)-2, 3-bis (4-methylbenzyl) but-2-ene-1, 4-diol was done under an atmosphere of nitrogen producing yields ranging from 7% to 49%. The yield was improved as purification and recrystallization techniques improved. The diol was then oxidized into 2, 3-bis (4-methylbenzyl) fumaraldehyde under aerobic conditions with a 74% yield. The identity of all compounds was confirmed using thin layer chromatography (TLC), single pulse 1H and 13C NMR, all which matched
Breast cancer is the leading cause of cancer death in less developed nations. Worldwide, breast cancer is the second leading cause of cancer death. Our research is centered on the study of Aromatase inhibitors, which are used to reduce the growth of cancer cells. Previous studies have shown that heteroaryl isocumarins have significant aromatase inhibition activity. Research done by the lab in 2016 revealed that heteroaryl isocumarins can be synthesized through palladium-catalyzed domino reactions. Domino reactions, also called tandem reactions, are a series reactions that happen automatically once the first reaction is initiated. Previous students in our lab discovered a palladium-catalyzed domino reactions for the rapid access of heteroaryl isocoumarin scaffold. This scaffold can be modified to many valuable compounds for medicinal chemistry research. However, the heteroaryl isocoumarins with hydroxyl group (-OH) and/or N atom are extremely challenging to synthesize. In this research study, we investigated the substrate scope for heteroaryl isocoumarins with hydroxyl group (-OH) and/or N atom. In order to study the reaction mechanism, we use isotope labelled water (H218O) to synthesize ketones with 18O isotope. These isotope labelled compounds will be used to study the fundamental steps involved in heteroaryl isocoumarin formation.
Contaminated sediment trapped behind dam impoundments may adversely affect the downstream river ecosystem following dam removal. The functionality for most low-head dams in the United States is obsolete. They are failing, creating ecological barriers and safety concerns. However, dam removals lead to improvements in water quality, revitalized fish and wildlife populations, increased public recreation opportunities, improved human safety, and boosts in local economies. Research prior to dam removal is fundamental to protection of aquatic life from potential exposure to released toxic sediments and to ensure the stability of the downstream river system. The focus of this study was potential toxicity in accumulated sediments in the reservoirs behind two low-head dams targeted for removal in the Indian Creek watershed of southern Indiana. Six sediment samples were collected from above and below each dam using a bottom dredge at five transects: three in the reservoir and one each upstream and downstream of the dams. The sediment samples were tested for the presence or absence of total organic carbons, polychlorinated biphenyls, pesticides, and heavy metals-toxins that can adversely impact aquatic life. Pesticides and polychlorinated biphenyls were not detected. Of the heavy metals assessed, the majority were below probable effect levels. Our findings indicated that the dams on Indian Creek are not trapping contaminants at a concerning rate. This research supports conservation efforts in a biodiverse watershed by providing information for consideration prior to removal of two low-head dams.

98. - The Effects of Power Plant Condensation on Winter Precipitation

First Author
Olivia Campbell
Western Kentucky University

There have been multiple instances across the United States of condensation produced from power plant cooling towers creating snowfall and other precipitation downwind from the plant location. These microscale events are not heavily studied but can cause major disruptions in the daily activities of those caught in these bands of precipitation. This study is intended to explore the various occurrences and effects of power plant-induced precipitation in the late fall and winter months (NDJF), the conditions under which they form, and how it affects community logistics. Multiple events across Kentucky, Nebraska, Pennsylvania, and Indiana were selected to be compared and analyzed. Radar and satellite imagery were visually examined to observe the development and behavior of power plant-induced snowfall, and surface and upper-air data were used to study the various atmospheric conditions at the time of these selected events. Initial findings suggest power-plant induced precipitation, while not uncommon, tends to form in unique atmospheric settings.

99. - Detecting temporal variability in five water quality parameters of Kentucky Lake using time series analysis

First Author Co-author Co-author
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University University University

Kentucky Lake, a large man-made reservoir on the Tennessee River system, has been part of the long-term monitoring program of Murray State University since July 1988. Multiple studies have tracked the changes in water quality and productivity of the reservoir in the last three decades. In this study, we focused on five water quality parameters (Secchi depth, turbidity, total nitrogen, dissolved oxygen, and temperature) collected from the three main channel sites from 1988 to 2017. Time series analysis was used to detect the temporal patterns of these five parameters. The analysis of the data included the construction and decompositions of time series for each individual parameter, as well as fitting linear models for the trend and time components of the time series, and smoothing using LOWESS lines. We found significant increases in the Secchi depth (p = 2.24e-15) and dissolved oxygen (p = 0.04), and decreases in turbidity (p = 9.95e-16) over the total 30-year period. Total nitrogen and temperature show no significant long-term trend. Our analysis can be expanded to look at seasonal trends, lake phenology, short-term trends, or cross-correlations between parameters. By detecting the temporal changes in water quality parameters, we can explore the effects on organisms in the lake and monitor changes that may be caused by climate change, human land-use, pollution, etc. The results of our analysis can also be used to predict future changes under different global change scenarios, thus providing useful information for species conservation and lake management efforts.

100. - Amur honeysuckle (Lonicera maackii (Rupr.) Herder) removal and understory community
Lonicera maackii is a significant threat to the biodiversity and natural succession of forests and woodland communities of central Kentucky Palisades and surrounding region. The objective of this study was to investigate the effectiveness of L. maackii removal and glyphosate stump treatments with and without spicebush (Lindera benzoin) and Elymus spp. plantings. These species were chosen to facilitate the recovery and succession of native plant communities in the understory of a L. maackii. The following experimental treatments were implemented in Spring 2019 region: a) untreated control; b) L. maackii removal followed by 20% v/v glyphosate (cut-stump) treatment; and c) L. maackii removal followed by 20% v/v glyphosate (cut-stump) treatment plus L. benzoin and Elymus plantings. First year results indicated successful L. maackii control with minimal regeneration by basal stump sprouting. In contrast, L. benzoin mortality was high as we suspect as a result, in part, of mid- to late-summer drought conditions after initial plantings in April 2019. In experimental areas with L. benzoin plantings, Elymus spp. will be seeded in mid-October 2019 to further establish and promote native vegetation recovery and succession in the forest understory formerly invaded by L. maackii. A long-term goal of this study is to synthesize a small-scale forest and/or woodland management plan using native shrub and Elymus plantings to rehabilitate and promote native plant succession in formerly L. maackii invaded forests in central Kentucky.

Changes in the demand for moisture by the atmosphere can significantly impact the vulnerability of ecosystems to drought. Between arid and humid regions lies a transition zone where a significant gradient in aridity also exists. This aridity gradient can shift depending upon changes in precipitation and atmospheric demand. Thus, we employ a metric known as the aridity index which is defined as the ratio of precipitation to potential evapotranspiration (PET), where PET represents the atmospheric demand for moisture. The aridity index allows for identification of climatological patterns in atmospheric demand and any deviations from those patterns. The individual components of aridity, which are precipitation and PET, were also analyzed to better understand which variable contributed to changes in aridity. Using reanalysis and observational data, this study focused on the Great Plains of the United States, which is a climatological transition between arid and humid climates. We found the gradient becomes weaker with time across the Great Plains. The trends found using North American Regional Reanalysis data were compared to observations by calculating aridity using Oklahoma Mesonet data, and these trends could have significant implications for agricultural practices and drought management on the Great Plains.

Since its inception, Watershed Watch in Kentucky (WWKY) has been dedicated to conservation through citizen science and education. By training volunteers to observe and monitor our water resources, we strive to engage volunteers in protecting Kentucky’s lakes, rivers, and streams, and to become part of the solution to water pollution. WWKY’s volunteers have identified numerous water quality issues across Kentucky, and many watershed groups have formed to address these issues.

WWKY has four key programs that embody our mission of supporting a citizens monitoring effort to improve and protect water quality:

1. Core Monitoring Program â€’ trains volunteers to make scientific field observations and collect data about waters in their neighborhood. Data is reviewed by a team of science advisors from each basin organization to identify
potential problem areas.
2. Lake Monitoring Program â€“ trains volunteers to collect basic data showing the general condition of lakes in Kentucky that is then used in tandem with remote sensing models to identify waterbodies that may be impacted by various problems, including algal blooms.
3. Citizen Action Program â€“ provides volunteers with tools for interpreting monitoring data, allowing volunteers to impact change in their neighborhood by identifying the sources of problems and finding resources for determining appropriate remedies.
4. Youth Stream Team Program â€“ targets youth across Kentucky, training them to be citizen scientists that have a broader understanding and appreciation of our water by collecting samples throughout the year, analyzing their data, and completing a community service project.

103. - Chlorophyll a and Primary Productivity Dynamics in Kentucky Lake Mainstem and Embayment Habitats

First Author  Co-author
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University  University

Chlorophyll a (Chl-a) has been used as a proxy for phytoplankton biomass, while primary productivity (PP), the rate at which carbon is fixed into phytoplankton cells, is an indicator of how quickly carbon is turned over within the phytoplankton community. The purpose of this research was to examine the spatial distribution of and the relationship between Chl-a and PP seasonally in the main channel of Kentucky Lake reservoir and two embayments of contrasting land use. Correlation coefficients (r) for Chl-a versus PP were 0.45 in Ledbetter embayment, 0.55 in Panther embayment, and 0.57 in the main channel. ANOVA indicated that seasonal effects drove dynamics at all three sites with stronger correlations occurring during winter, spring, and fall; correlations were weakest or broke down completely during summer. We conclude that during times of high Chl-a standing stock (e.g., summer and fall), the Chl-a-PP relationship may be disrupted or decoupled by lower nutrient inputs later in the growing season as suggested by analyses of annual patterns of total nitrogen (TN) and total phosphorus (TP) at the sites. Chl-a and PP are positively correlated, in general, but the relationship may be confounded or disrupted at times by strong seasonal environmental effects such as nutrient inputs, light, and temperature. Further, predicting PP from Chl-a for the management purposes of identifying areas of vulnerability for future algal blooms, hypoxia, and habitat degradation should be viewed with caution; the predictive power between the two variables deserves further refinement.

104. - Waste management at Berea College Farm: Analysis of soils for available phosphorus

First Author  Co-author  Co-author
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Berea College  Berea College  Berea College

Berea College operated from 1972 to 2010 a small confined swine facility, using anaerobic lagoons to manage waste. The lagoons occasionally overflowed, delivering excess nutrients to a downstream stock watering pond and causing eutrophication. The site comprises two small watersheds below the lagoons, one watershed receiving lagoon overflow and the other not. From 2004 to 2019 we measured soil available (Mehlich III) phosphorus (P) in the two watersheds. Spatial analysis of the data using ArcGIS software in 2004, 2006 and 2010 showed a 'plume' of elevated soil P in the overflow drainage path, higher (P

105. - Three-Dimensional Visualization Aids for Cave Study and Protection

First Author  Co-author
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University  UNiversity

Obscure Magnificence Cave is located in Jackson County, Alabama. It is a textbook example of a plateau margin cave and also happens to be the deepest cave in the state. The cave is a significant karst feature located in a deeply incised cave within the Cumberland Plateau. To aid in providing a three-dimensional visualization of the cave, a survey was done that determined horizontal and vertical extent. The cave entrance was georeferenced and a resource inventory conducted that documented all of the features within the cave. A map (in 3 views) was developed,
scanned and georeferenced. Auxiliary data was also collected including Digital Elevation Modal data, areal photography, geological data, and county-level lidar.

All data were incorporated into a ArcGIS project. The results of this compilation is a digital 3-dimensional model of the cave that highlights its morphology and relationship to the surface topography. Features from the resource inventory were correlated to surface karst features such as sinkholes, sinking streams and springs and also to human infrastructure. The GIS provides base maps for future scientific studies, visualizations for public education and outreach, and geological and environmental data for future land development projects.

106. - Genetic Diversity Analysis of Amur honeysuckle (Lonicera maackii) of Kentucky Areas

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The Amur honeysuckle (Lonicera maackii) is one of the most problematic invasive species to the American East. It was first introduced into the U.S. as ornamental plant around 1898 from East Asia. Then it was additionally introduced in multiple occasions, possibly including multiple cultivars as well. The escaped plants quickly occupied a wide range of habitats. With its property of early leaf-out in the spring and late leaf-off in the fall, the Amur honeysuckle reduces growth of the native understory plants and lowers species richness. This project collected lead samples of Amur honeysuckle form 13 locations of Kentucky and used microsatellite DNA markers to analyze the genetic diversity of the these samples. The result will contribute to our understanding of honeysuckle's dispersal patterns. Performed by KSY undergraduate students as their summer research projects, this project promoted participation of underrepresented students in STEM education and research.

108. - Carbon dioxide exchange and productivity of a pasture agroecosystem in central Kentucky

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Site-specific soil and microclimate conditions play significant roles in driving the exchange of carbon dioxide (CO2) between land and the atmosphere. We used the eddy covariance method to measure and calculate CO2 fluxes and seasonal variations in net ecosystem exchange (NEE), gross primary productivity (GPP), and ecosystem respiration (Re) over a period of three years (2016-2018) in a pasture field grazed by goats for four weeks out of the year in north central Kentucky. In 2016, 2017, and 2018, annual NEE was 17 g C m-2, -177 g C m-2, and -535 g C m-2, respectively (negative NEE indicates a C sink). Annual GPP values were 1339 g C m-2, 1992 g C m-2, and 1563 g C m-2 in 2016, 2017, and 2018, respectively. Pasture productivity at this site is largely driven by seasonal precipitation and may have had a considerable effect on NEE.

109. - Temporal Changes in Dissolved Calcium in Stream and River Waters in Western Kentucky Watershed: An Update
Zebra mussels (Dreissena polymorpha) are an exotic and invasive mollusk that are known for their 'biofouling' capabilities costing billions of dollars in their removal from industrial, public, and power plant water supply lines. Calcium is one of the essential elements that contributes to the growth and reproduction of zebra mussels. Calcium concentrations of 20-22 mg/L are considered the threshold for survival and reproduction of zebra mussels. The purpose of this study was to determine if dissolved calcium levels in the lower parts of Kentucky Lake had increased and reached zebra mussels survival and reproduction threshold. Surface and bottom water samples were collected during Kentucky Lake Monitoring Program (KLMP) cruises as well from selected locations in the Ohio River and two tributary streams. Samples were filtered using 0.45 µm filters, acidified and analyzed for calcium using an Atomic Absorption Spectrometer. Calcium levels and long-term monitoring data on chloride levels in Kentucky Lake were examined for temporal trends. Results revealed that relatively higher concentration of dissolved calcium was found in Ohio River samples than Kentucky Lake. In general calcium levels show seasonal variation with increasing concentration during winter months. The higher levels of calcium recorded are likely from increased use of road deicing brine, of which CaCl2 is a major component. Increasing levels of these calcium ions may play a role in the elevated occurrences of zebra mussels in Kentucky Lake.

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**Geography - Poster Presentations**

**Friday, November 1, 2019 2:00pm - 5:00pm**

**51. - Assessing Effects of Wetland Soil Moisture on Flood Progress in Kentucky Using Multi-Temporal Satellite Data**

**First Author**
MacKenzie Nelson
Northern Kentucky University

The low-lying agricultural lands along the western region of the Ohio River has been subject to frequent and devastating flooding events from local streams. These lands have sustained severe economic losses through inaccessible crop fields, delayed seeding and missed planting and harvesting opportunities. The most affecting and critical of the dynamic hydrological factors in magnitude and rate of flooding are soil moisture content, surface topography and soil permeability. Rapid flood mapping and monitoring of their progress is crucial for crop health assessment, crop insurance and agriculture policy making.

The focus of our study is assessing the influence of soil moisture content on rapid surface runoff and flooding through the integration of satellite remote sensing datasets. Our initial results show various sites along the Ohio River using microwave satellite imagery. These high-risk flood zones will be examined further to determine the correlation between initial soil moisture contents and flood-induced surface runoff.

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**Health Sciences - Poster Presentations**

**Friday, November 1, 2019 2:00pm - 5:00pm**

**52. - Effect of Refrigerated Storage on Deboned Meat Quality of Asian Carp Fish**

**First Author**
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Co-author
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Harvesting Asian carp for human consumption has been proposed as one of the tools to reduce or eliminate Asian carp from Kentucky waters. Deboned Asian carp meat can be made into fish meat balls and sausages. Lipid oxidation is a very complex and important event threatening the quality of foods especially of those containing highly unsaturated fats. Fish are the main source of polyunsaturated fatty acids that, unfortunately, are highly susceptible to degradation process, such as oxidation. The thiobarbituric acid reactive substances (TBARS) assay with malondialdehyde (MDA) standard was developed for measuring lipid peroxidation. The TBARS values of sausages were lower than the meat balls probably because sausage casing can make better oxygen-free environment to inhibit the lipid oxidation. The TBARS values of the fish sausage from the meat frozen for one week with was significantly lower than the fish sausage from fresh meat or from the meat of frozen one week with initial conventionally frozen method, 0.56, 0.60 and 0.61 umol MDA/g, respectively, after frozen about one year. The results suggest that the initial chilling method of low temperature frozen is an applicable treatment for freeze storage. Sausage is better than meat balls in the freeze storage.

53. - Analysis of CBD Oil and Cannabinoid Products After Various Chemical Treatments

First Author Co-author
Thomas Wilder Bruce Branan
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HEALTH SCIENCE
Analysis of CBD Oil and Cannabinoid Products After Various Chemical Treatments. THOMAS WILDER* and BRUCE BRANAN, School of Science, Health, and Mathematics, Asbury University, Wilmore, KY 40390

Hemp, a low THC form of Cannabis, became available for industrial use with the passage of the 2018 Farm Bill. Hemp was significantly less available for industrial use in the past due to its similarities with higher THC containing Cannabis, also known as marijuana. One consequence from this new growth of industry is the rapid development of cannabidiol (CBD) products. The conversion of CBD to ?9-tetrahydrocannabinol (?9-THC), the psychoactive component in marijuana, both in the gastrointestinal system and in-vitro, have been reported in the scientific literature. This study examines a variety of conditions in which CBD oil undergoes conversion to ?9-THC in the laboratory.

54. - Collagen Type IV 7S Provides Novel Insights of Lysyl Oxidase-like 2 Kinetic Parameters

First Author Co-author Co-author
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Berea College VUMC VUMC

Fibrosis is a common result of disease-related injury in all organs, however, drug therapies to combat fibrosis are lacking. As LOXL2 has a well-documented pathogenic role in many fibrotic diseases, this enzyme has emerged as a strong candidate drug target for the prevention and potential reversal of fibrosis. LOXL2 has been shown to catalyze the formation of covalent cross-links in the 7S dodecameric region of type IV collagen. Currently, small amine-based substrates, are routinely used to determine the enzymatic activity of LOXL2 in the biochemical assays. Here, we hypothesize that a biological substrate, collagen IV 7S purified from a LOXL2 knock-out PFHR9 cell line (L2KO7S), will provide realistic LOXL2 kinetics insights. Active rLOXL2 was purified from HEK293 cell culture media nickel affinity chromatography. Kinetic parameters, of the LOXL2 inhibitor (BAPN) were determined using DAP, DAB, L-lysine, and L2KO7S, by use of the amplex red assay. Highly active, pure and specific to substrate human rLOXL2 enzyme was successfully produced. Using both collagenous and small-molecule substrates for the determination of rLOXL2 specific activity suggested a subjective nature of LOXL2 kinetics dependent on the substrate used. The determination of Km and IC50 constants provided unique values; demonstrating that a characterized biological substrate can provide enhanced confidence when determining kinetic parameters of LOXL2 in future biochemical assessments.

55. - A Measure of Intra-rater and Inter-rate Reliability on Ankle Dorsiflexion.
This was a recreation of a study published in the Australian Journal of Physiotherapy. The purpose of this study was to evaluate the inter-rater and intra rater reliability of weight bearing dorsiflexion lunge in 17 subjects. Four raters had no clinical experience tested all subjects in random order. All four raters repeated the measurements two weeks later. The dorsiflexion lunge was tested in two methods by measuring the distance from the great toe to the wall and the angle between the tibial shaft and the vertical using an inclinometer. The interrater intraclass correlation coefficients (ICCs) were 0.807 and 0.695 for distance and angle, respectively. Results signified reliability for both methods of assessing a dorsiflexion lunge.

56. - Effects of Titanium dioxide nanoparticles on the life cycle and gene expression in Caenorhabditis elegans

How does the exposure of Titanium dioxide nanoparticles affect the life cycle and gene expression in Caenorhabditis elegans?

Nanoparticles are widely used in industrial fields such as medicine, electronics, and agriculture. However, the consequences of increased use of nanoparticles and nanomaterials have not been systematically determined. This investigation examines how exposure to titanium dioxide nanoparticles affects the life span and motility of Caenorhabditis elegans (Maupas), the soil nematode that has recently been studied widely in molecular biology and toxicological investigations. When wild and ADR-2 mutant individuals were exposed to increasing doses of Titanium dioxide nanoparticles (TiO2NPs) (0-100 ppm), significant mortality of adult organisms occurred, depending on the dose of exposure. A two fold decrease in population with respect to the control was observed in both groups of the organisms at 50-100 ppm of TiO2NPs. Similarly, the movement study following the exposure also exhibited significant effects on the ability of the organism to display normal behavior (thrashes). Thrashes in wild type decreased from 50 (control) to 44 at 25 ppm and 36 at 50 ppm. A similar pattern was observed in the mutant variant. The mutant type demonstrated more severe loss of activity than the wild-type due to its genetic susceptibility. Analysis of expression patterns of notable genes (daf-1, sod-1, sod-3, dyn-1, act-5) involved in the life cycle development are being carried out.

57. - Prenatal Cigarette Smoke Exposure: Neurological and Behavioral Effects

Exposure to various teratogens during development can cause birth defects, neurological abnormalities, and behavioral impairments. With a composition of nearly 8,000 different compounds, cigarette smoke is one of the most prevalent toxins consumed by the human population during pregnancy. An increase in development of internalizing behaviors and mood disorders, such as anxiety, has been linked with prenatal cigarette smoke exposure (CSE) in humans. We hypothesized that litters of mice exposed to cigarette smoke for 6 hours/day during gestation (G1-G19) would exhibit higher levels of anxiety in adulthood than groups not exposed to cigarette smoke during development. We also measured possible interacting effects of sex and diets varying in fat content on anxiety in co-occurrence with prenatal CSE, so our three factors were prenatal CSE vs sham, male vs female, and high-fat vs low-fat diet from postnatal day 50 (PD 50). Anxiety-like behavior was evaluated via elevated plus maze and light-dark box starting at PD 77-80. The data collected from these trials includes the number of times each mouse entered the ‘safe’ parts of each maze and the duration of time spent in each section. Analysis by one-way ANOVA determined no statistically
significant differences among the eight treatment groups; however, more powerful statistical analysis might reveal differences between conditions and interacting factors. The results of this project could provide data to further support that prenatal CSE is detrimental to neural development and function, and could potentially yield insight into human behavioral irregularities in similar conditions.

58. Searching for a Voice: An Introduction to Transgender Voice and Communication Therapy

First Author: Nicholas Brock
Co-author: Sue Mahanna-Boden
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Over the last 50 years, the cultural shift in the ideologies that shape the minds of individuals have primarily focused on social progressivism. Specifically regarding the United States, prominent leaders such as Harvey Milk pushed for social freedoms for members of the LGBTQ+ community. While Milk and his following fought for freedom and recognition, other leaders and supporters of the LGBTQ+ movement across the world were also fighting with fire in their hearts in their search for social justice. Barriers broke and glass ceilings shattered during these movements, but there is more to be done, today. As recognition of the individuals that encompass the LGBTQ+ community increases, it is of upmost importance that the health care industry is taking time to understand the community and adopt language and practices that confirm their humanity and existence. Putting this into action, the world of communication disorders is colliding and intertwining with the transgender community. Although the field is starting to provide clinical services to individuals that are transgender, not all speech-language pathologists (SLP) have the training, specifically in the area of transgender voice and communication therapy (TVCT), to be able to assist clients that identify as transgender. The purpose of this resource is to provide knowledge to SLPs, the transgender community, and the general public regarding the variety of methods and techniques used to ensure ethical and successful execution of TVCT.

59. Prenatal Cigarette Smoke Exposure Effects on Liver Function

First Author: Isaiah Burciaga
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University of Louisville

Current research shows a relationship between cigarette smoke inhalation while pregnant and negative health outcomes for the developing fetus, including low birth weight. Despite this, a reported 18% of Kentuckian mothers smoke while pregnant. This study examines the effects of prenatal cigarette smoke exposure (CSE) on liver gene expression. The sirtuin1 (SIRT1) metabolic pathway was used as a maker for changes in liver function. It was predicted that prenatal CSE, feeding status, and sex would affect the expression of genes in the SIRT1 pathway. C57BL6/J mice were bred in pairs. Plug positive female mice were then exposed to either cigarette smoke or ambient, filtered air for six hours a day from gestational day 1 to gestational day 19. The offspring were reared and then euthanized on postnatal day 19. Before euthanization, half of the offspring were fed, while the other half were fasted for four hours. Tissues were kept in RNALater, then processed for real-time PCR. Sirt1 levels were affected by fasting, with interactions of CSE and sex that were not detected in fed animals. Because SIRT1 is an NAD+-dependent nutritional status marker, the fasting effect was expected, but the sex effects are novel. Sex and exposure effects were also observed in other genes in the SIRT1 regulatory pathway such as Farnesoid X receptor and Tumor Protein 53. These findings support the hypothesis that prenatal CSE and sex affect the SIRT1 pathway, especially in the fasted state.

Friday, November 1, 2019 2:00pm - 5:00pm

Mathematics - Poster Presentations
Baird Lounge, Alumni Building

61. Coasters Done Quick: Reducing Walk Times

First Author
This research focuses on reducing walk times for Kings Island visitors. We create a mathematical model for the park and measure walk times along sidewalks in the park. From these measurements, we calculate the shortest path between rides and then the fastest route that visits all rides in a sample day at the park. This research sets the stage for future exploration into optimizing people's time during a day at Kings Island using a branch of Mathematics called Graph Theory.

62. - Do Submarines Fly?

First Author
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This project offers a theoretical/computational approach to the field of fluid dynamics concerning the relationship between airships and submarines. We will specifically be looking at the relationship between two fluids and their interactions with two different machines that have specific functionalities. We will cover some trivial historical and physics concepts in order to obtain a better understanding of the material. Then we will look at some approximated calculations for each vessel in its respective fluid. We then conclude by showing submarines fly based off theoretical buoyancy and drag forces, specific gravity, the overall shape of each machine, and then comparing these findings with modern technology.

63. - Finding an Optimal Strategy: Gobblet Gobblers

First Author
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Co-author
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Competitive players of any game has always tried to perfect their play. Given a simple game of tic-tac-toe, it does not take too long for a player to figure out what a perfect strategy may be. The field of combinatorial game theory looks to study these types of games and decide if such a perfect strategy exists. Gobblet Gobblers is a game similar to tic-tac-toe that adds many different types of moves into the game. These additional moves expands the number of possible strategies exponentially. This additional complexity causes a study of Gobblet Gobblers by hand to be near impossible. The processing power of computers can assist in these types of situations, giving a researching avenues to explore all possible combinations of play.

Friday, November 1, 2019 2:00pm - 5:00pm

Microbiology - Poster Presentations
Baird Lounge, Alumni Building

64. - Does Lysogeny with Bacteriophage HK022 Affect Host Cell Physiology?

First Author
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Co-author
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Western Kentucky University

The core genome of a bacteriophage contains genes for infection, replication, and production of new viral particles. Temperate phages have additional genes that promote lysogeny of the host and thus temperate phages have two lifestyle options available to them: lytic growth or lysogeny of the host. There are many well studied examples of the impacts of lysogeny. For example, some temperate phages carry 'accessory' genes that directly affect host biology.
and often contribute to their own fitness. The term 'lysogenic conversion' is used to describe the outcome of such infections where the new host properties are imparted by a resident prophage. E. coli cells that have been lysogenized with bacteriophage HK022 are resistant to infection by bacteriophage lambda. The ability to exclude superinfection by lambda is due to the activity of the HK022 Nun protein which is constitutively expressed from a dedicated phage promoter. Here, we asked if lysogeny by HK022 has any additional phenotypes by examining the growth of lysogenic and non-lysogenic host cells. HK022 lysogens were created and verified by polymerase chain reaction. Although no differences in growth on plates or broth was observed, phenotypic microarrays will be used to rapidly and simultaneously explore multiple metabolic pathways. Our results may provide further insight into how phages affect important cellular properties such as survival in particular environments.

65. - Exploring the Antimicrobial Potential of Essential Oils

First Author  Co-author
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Wittenberg University  Wittenberg University
Chemistry Department  Chemistry Department

Antibiotics are known for their lifesaving ability: attacking and killing the bacteria that cause dangerous diseases in humans. One complication with antibiotics is bacteria's ability to develop resistance and continue surviving in the body. This investigation focuses on essential oils (EOs), alternatives to traditional antibiotics that possess antimicrobial properties as well, and tests whether the same resistance patterns are observed. Essential oils were selected for this investigation because of their disinfecting properties and possible uses throughout the home, in food preservation, and in medicinal applications. Our work focused on four oils: oregano, peppermint, cinnamon, and a disinfecting oil blend. Each oil was purchased from two different vendors, Young Living and Plant Therapy, with two drastically different price points. The research included verifying that the oils could kill E. coli (ATCC 25922) and testing this bacterium's ability to resist them. The minimum inhibitory concentration (MIC) values determined for the oils were the same for both brands, with the exception of peppermint, which was 2.5 µL/mL for Young Living and 1.2 µL/mL for Plant Therapy. The MIC of the cinnamon oils was 0.3 µL/mL and the MICs for the remaining oils were 1.2 µL/mL. Resistance propagations conducted over five days for the Young Living oils indicated that bacteria gained resistance and tolerated higher concentrations of peppermint oil before becoming stagnant, while the bacteria took multiple days to resist the oregano oil, and never grew past the highest tolerable concentration (HTC) of cinnamon oil or Thieves (blend) oil.

66. - Identification of protein-protein interactions during infection of Silene latifolia by Microbotryum lycnchas-dioicae

First Author  Co-author  Co-author
Ming-Chang Tsai  Venkata Kuppireddy  Michael Perlin
University of Louisville  University of Kentucky  University of Louisville

Identification of protein-protein interactions during infection of Silene latifolia by the fungal phytopathogen Microbotryum lycnchas-dioicae. MING-CHANG TSAI*, VENKATA S. KUPPIREDDY and MICHAEL H. PERLIN, Department of Biology, University of Louisville, Louisville, KY 40292

Anther smut is a fungally-caused plant disease. One example is that of Microbotryum lycnchas-dioicae infection of Silene latifolia. It provides a popular model to elucidate the interactions between biotrophic fungi and host plants. After invasive hyphae penetrate into tissues of developing flowers, dark-colored teliospores replace the pollens in the anther of the male plant. The fungus can also inhibit the development of the ovary, leading to pseudoanther formation in the female plant to bear teliospores. The parasitism of fungi on plants is a long-term arm race with chemicals and proteins targeting each rival's specific structures and mechanisms. M. lycnchas-dioicae has evolved small secreted proteins (SSPs), also known as protein effectors, to facilitate fungal infection. However, the targeted plant tissues and proteins affected by these SSPs remain unclear.

We applied the yeast 2-hybrid screening to identify the potential plant protein interactors. This revealed host interactors of two M. lycnchas-dioicae SSPs, MVLG_06175 and MVLG_05122. MVLG_06175 interacts with the Casparian strip membrane domain like protein 2C1 (CASPL2C1) of S. latifolia. CASPL2C1 might be involved in the formation of the Casparian strip which blocks the apoplastic diffusion. MVLG_05122 with the S. latifolia orthologues of Constitutive photomorphogenesis 9 signalosome subunit 5a and 5b (CSN5a and CSN5b) which reduce the activity of the Cullin-Ring E3 ubiquitin ligase, and in turn inhibit the following degradation of ubiquitin-labeled proteins by
proteasomes. We hypothesize that the MVLG_06175 alters the structure of Casparian strip and MVLG_05122 modulates protein degradation to facilitate fungal colonization in the host plant.

67. - Genomic Annotation of the F1 Sub-cluster Mycobacteriophage OfUltron

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<th>First Author</th>
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Genomic Annotation of the F1 Sub-cluster Mycobacteriophage OfUltron

Mycobacteriophages are viruses that infect bacteria in the genus Mycobacterium and are readily found in environmental samples. The Science Education Alliance-Phage Hunters Advancing Genomics and Evolutionary Science (SEA-PHAGES) is a mycobacteriophage research project that has two distinct portions: phage isolation and phage genome annotation. In the spring of 2016, a mycobacteriophage was discovered in a soil patch next to a residence hall, Mignon Tower, in Morehead, Ky. The mycobacteriophage was isolated and characterized using Mycobacterium smegmatis as a host. The phage was later named OfUltron. The genome was sequenced in NC State Genomic Sciences Laboratory which determined the phage belongs to the sub-cluster F1. Phages of this sub-cluster typically have a 10 bp 3’ sticky overhang, turbid plagues, and a temperate life cycle. OfUltron's genome was annotated using Phage Evidence Collection And Annotation Network (PECAAN). The genome is 58,617 base pairs in length and consists of 114 genes and no tRNAs. OfUltron's genome was compared to other F1 sub-cluster mycobacteriophages. Although phages of this sub-cluster do not infect M. tuberculosis, further research into these mycobacteriophages can still help with the goal of discovering new lab techniques and treatments for infections caused by other Mycobacterium species.

68. - The Effects of Organic and Nonorganic Cosmetics on Normal Facial Bacteria

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<th>First Author</th>
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<td>Kentucky Wesleyan</td>
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Cosmetic regulations vary across the world, and in the United States cosmetics are FDA regulated but not FDA approved. Cosmetic trends change all the time and certain trends or lack of finances have cosmetics users applying products outside of the products intended areas. This experiment details how cosmetics affect normal facial bacteria. The goal of this research was to determine the effect of organic and nonorganic cosmetics on facial flora bacteria. The hypothesis of this research is that organic foundation does not harm normal or pathogenic facial bacteria but rather may slightly promote their growth. The two types of bacteria tested were Staphylococcus aureus and Staphylococcus epidermidis. Each bacteria was diluted to a 0.5 McFarland standard and 0.25mL was added to 0.5 mL of organic or nonorganic foundation in a sterilized tube. Tubes were left to sit for a week, at which point 0.25mL was removed and used for a 1:10 serial dilution in sterile water that was plated on LB agar and incubated at 37°C for 24 hours. Sampling and plating was repeated each week until no bacteria remained in the product. Both bacteria could not survive a week in organic foundation, but could survive up to two weeks in nonorganic foundation. This experiment disproved the hypothesis and suggests more research should be done on how cosmetics affect the human microbiome.

69. - Investigation of Antibiotic Resistance Patterns and Mechanisms in Escherichia Coli

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Bacterial species have shown remarkable adaptability to antibiotics. Resistance has been observed with nearly all antibiotics that have been developed and multi-antibiotic resistant strains are emerging. The overuse and misuse of antibiotics has fueled the evolution of resistance in bacteria. By understanding the evolutionary pathways bacteria follow in developing resistance towards antibiotics, we can better develop methods for combating resistance. One of the two mechanisms by which bacteria can develop resistance is through the accumulation of mutations. These mutations can alter pathways important for the antibiotic's activity or produce systems that nullify the antibiotic. The goal of this project was to investigate E. coli's ability to develop resistance towards the aminoglycosides kanamycin, gentamicin, and neomycin, as well as examine mutations in genes previously determined to be resistance-conferring.
With E. coli (ATTC 25922), kanamycin resistance was propagated up to 40 times the minimum inhibitory concentration (MIC: 25 µg/mL). This strong resistance pattern was consistent with several culture lines. There was a resistance increase to gentamicin and neomycin initially but after a few propagation days, the cultures collapsed and became non-viable. The genes dnaQ and fusA were successfully isolated from wild-type and kanamycin resistant strains and sent to MCLAB for sequencing. Specific mutations in these genes have been found in resistant isolates from other resistance studies.

70. - On the DNA and mRNA mechanism of low glucose-induced CD8T cell's and NK cell's production of Cytokines.

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CD8 T cells cultured in low concentrations of the metabolic fuels of glucose or glutamine have deficient INF-g and TNF-a protein production, while NK cells do not. Therefore, activated CD8 T cells become hypo-responsive in their IL-12/IL-18 induced cytokine secretion in low glucose. To understand the mechanisms behind this phenomenon we: 1.) investigated promoter methylation of the INF-g, TNF-a, and granzyme B genes, and analyzed the levels of transcription of these genes and other genes to determine if there was methylation of the respective sites. 2.) We investigated if there was massive RNA degradation in low glucose. 3.) We checked signs of low glucose-mediated anergy. What we found was that in both NK and CD8 T cells, we saw that the promoters responsible for cytokine production do not have increased methylation in the presence of lowering glucose. We also saw that mass mRNA degradation did not likely occur in bead-activated CD8 T cells in low glucose. Lastly, we saw that some of the markers for anergy that we tested (EGR2, EGR3, Cbl-b) increased expression in bead-activated CD8 T cells in low glucose, but one (HSPA1) did not.

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72. - Determining Important Residues in THADA Responsible for the Methylation of Residue 32 in tRNAs

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Post-transcriptional modifications of tRNA are important for their biological functionality. Modifications in or around the anticodon loop of tRNA aid in translation, while modifications in the body aid in its stability. Trm7 methyltransferase 2'-O-methylates residue 32 (C32) and residue 34 (N34) of tRNAPhe, tRNALeu(UAA), and tRNATrp in yeast. Trm732 is a binding partner of Trm7 and must be bound for methylation of C32 to occur. THADA is the human ortholog of the yeast protein Trm732. The goal of this research is to determine the region(s) of THADA required for methylation of C32. Sequence alignments of Trm732 orthologs from eukaryotic organisms were used to determine conserved regions within THADA. Site-directed mutagenesis was used to generate THADA variants within plasmids, which were expressed within trm732aΔ+trm734aΔ+ yeast to determine if the mutated segments of THADA are important. When wild type THADA is expressed within trm732aΔ+trm734aΔ+ cells, THADA rescues their growth. If a THADA variant doesn't rescue their growth as much as wild type THADA, the mutated segment is likely important. The results show that the segments of RRS1160, GLP1164, RH1105, and FF1286 are likely important to THADA.
73. - Physiological and behavioral indicators to measure crustacean welfare

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The purpose of this project was to determine how neural circuits are affected during warming by examining sensory neurons, the neuromuscular junction, and the cardiac function and behavior of the commercially important crustacean species, the red swamp crayfish (Procambarus clarkii). Rapid inactivation of neural function in crustaceans prior to slaughter is important in order to limit exposure to noxious stimuli, thus improving animal welfare. In this study we demonstrated that as the animal is warmed at 1°C/min the heartbeat stops at 44°C. When temperature is rapidly increased, at 44°C synaptic transmission at the neuromuscular junction ceases and primary sensory neurons stop functioning. Even though animals do not respond to stimuli after being warmed to 44°C, if sensory neurons are returned to 20°C saline after two minutes they may regain function. Conversely, the neuromuscular junction does not regain function after two minutes in 44°C saline. Examining behavior and heart rate while warming at 1°C/min, 12°C/min, or 46°C/min to 80°C indicated that at approximately 40°C the heart rate is altered. Within 10 seconds at 80°C the heart stops with the highest heating rate. Directly placing crayfish in boiling water stopped the heart quickest, within 10 seconds, which likely represents denaturing of the tissue by heat. Using an impedance measure to detect heart rate may also be influenced by movements in the denaturing process of the tissue. A rapid increase in the temperature of the crayfish above 44°C is key to limit its exposure to noxious stimuli.

74. - The effects of tricaine mesylate (MS-222) on arthropods: Crayfish, crab and Drosophila.

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Tricaine mesylate, also known as MS-222, was investigated as an approach for anesthetization or sedation of invertebrates for research, shipping, and euthanasia. Three species were examined: Drosophila melanogaster, blue crab (Callinectes sapidus), and red swamp crayfish (Procambarus clarkii). The effect of MS-222 on sensory neurons, synaptic transmission at the neuromuscular junction, and heart rate were physiological measures addressed. Intracellular measures of action potentials in motor neurons of the crayfish demonstrated that MS-222 dampened the amplitude, suggesting that voltage-gated Na+ channels are blocked by MS-222. This is likely the mechanism behind the reduced activity measured in sensory neurons and depressed synaptic transmission in all three species as well as reduced cardiac function in the larval Drosophila. To address public access to data, a group effort was used for analysis of given data sets, blind to the experimental design, to gauge analytical accuracy. The determination of a threshold in analysis for measuring extracellular recorded sensory events is critical and is not easily performed with commercial software.

75. - Disruption of the R789-D708 Salt Bridge in Discoidin Domain Receptor 1 To Test Its Effect on the Kinase Activity of the

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Discoidin domain receptor 1 (DDR1) is a tyrosine kinase receptor that binds to collagen, an extracellular matrix component. DDR1 regulates fundamental cellular functions in tissue development, however, increased expression and activation of DDR1 following injury contributes to the progression of fibrosis and chronic kidney disease. As such, DDR1 may be a viable therapeutic target. Importantly, this receptor shows promiscuity towards kinase inhibitors making it challenging to design selective DDR1 inhibitors. A current hypothesis is that DDR1 is less active and more promiscuous than other receptor tyrosine kinases due to the R789-D708 conserved salt bridge that stabilizes the inactive conformation of DDR1 and enables it to bind both type I (active) and type II (inactive) kinase inhibitors. We tested this hypothesis by mutating D708 to N in order to destabilize the salt bridge through site-directed mutagenesis of the human DDR1 cDNA and introduced the mutated DNA in the human embryonic kidney (HEK) 293 cells through
liposomal transient transfection. The HEK-transfected cells were treated with collagen I, to activate DDR1, and analyzed for DDR1 kinase activity. The results indicated only slightly higher phosphorylation in DDR1-D708N mutant in comparison to wild type DDR1, which does not support the current hypothesis. To confirm our findings, we will express the D708N mutant at levels similar to the wild type DDR1 since the expression level of this mutant was lower than wild type.

**76. - TGFβR1 Germ Line Variants Alter Nuclear pSMAD Expression in Ovarian Cancer**

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Ovarian cancer (OvCa) has the highest mortality rate of all reproductive cancers since it is diagnosed at later stages, making it more difficult to treat. Identifying a genetic marker could allow for early detection of women at risk for OvCa. Two germline variations in the TGFβ receptor-1 gene (the Int7G24A intronic variant and the *6 nine base pair deletion in exon 1) are associated with increased risk of developing ovarian, breast and bladder cancers. The location of the responsible alteration(s) in the TGF-β signaling pathway is the subject of this investigation. TGFβR1 is a receptor on the surface of a cell that can turn on and off various downstream events that affect cell division and tumor metastasis, including phosphorylation of the SMAD 2/3 complex (pSMAD) and activation of Pak1. Determining two germ line variants of TGFβR1 in OvCa patients and measuring immunohistochemical expression of two alternate TGF-β signaling pathways, pSMAD 2/3 and Pak1, in their tumors allowed us to determine if TGFβR1 signaling is altered based on the presence of a variant. Patients with metastatic tumors were more likely to have TGFβR1 variants than patients with low malignant potential tumors. Patients who inherited one of the variants had a greater expression of pSMAD 2/3 in their OvCa, while Pak1 expression was similar in all OvCa types and stages. This suggests that increased expression of pSMAD 2/3 could be the responsible alteration in the TGF-β signaling pathway that results in the association of TGFβR1 variants with risk for metastatic ovarian cancer.

**77. - Cobalt protoporphyrin stimulation induces heme oxygenase-1 expression in mouse peritoneal macrophages**

First Author  
Sarah Shaikh  
Berea College

A previous study showed that Hmox1 mRNA abundance was markedly increased in abdominal aortas from female compared to male AngII-infused Ldlr-/- mice. In addition, Hmox1 expression in microarrays was increased in smooth muscle cells (SMCs) or whole aortas exhibited differential sex- and/or AngII- dependent regulation. These results suggest that Hmox1 may protect females from AngII-induced AAAs, and that activation of HO-1 may have efficacy against AAA formation and/or progression. Studies have shown that cobalt protoporphyrin (CoPP) has the ability to significantly up-regulate HO-1 protein and activity levels when administered to rodents at a dose range of 1-5 mg/kg. The hypothesis of this study was that CoPP would induce HO-1 in naïve C57BL/6 female mice. These preliminary results demonstrate that CoPP administration can stimulate HO-1 expression in some target tissues, but there was no effect of CoPP on HO-1 expression in aorta, the primary target tissue for future studies. Results also demonstrate that multiple dosing is necessary for CoPP induced stimulation of HO-1.

**78. - Cathepsin L and Cell Proliferation are Inversely Correlated in Bladder Cancer Cell Lines**

First Author  
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Co-author  
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Wood Hudson Cancer Research Laboratory

A previous study showed that HMox1 mRNA abundance was marked increased in abdominal aortas from female compared to male AngII-infused Ldlr-/- mice. In addition, Hmox1 expression in microarrays was increased in smooth muscle cells (SMCs) or whole aortas exhibited differential sex- and/or AngII- dependent regulation. These results suggest that Hmox1 may protect females from AngII-induced AAAs, and that activation of HO-1 may have efficacy against AAA formation and/or progression. Studies have shown that cobalt protoporphyrin (CoPP) has the ability to significantly up-regulate HO-1 protein and activity levels when administered to rodents at a dose range of 1-5 mg/kg. The hypothesis of this study was that CoPP would induce HO-1 in naïve C57BL/6 female mice. These preliminary results demonstrate that CoPP administration can stimulate HO-1 expression in some target tissues, but there was no effect of CoPP on HO-1 expression in aorta, the primary target tissue for future studies. Results also demonstrate that multiple dosing is necessary for CoPP induced stimulation of HO-1.
Bladder cancer is the 5th most prevalent form of cancer and an estimated 56,000 men and 18,000 women will be diagnosed with bladder cancer within the US every year. The metastasis of these cancers poses great difficulty to therapeutic intervention and greatly decreases long term survival. Degradation of extracellular matrix, catalyzed by proteases allows for the metastasis of cancer cells from their initial tumor site to distant locations. In previous studies we have shown, by IHC, in a series of 150 formalin-fixed paraffin-embedded human bladder cancers, an expression of the cysteine protease, Cathepsin L, that increased from high to lower tumor grade. This was inversely associated with the expression of the proliferation marker Ki-67 in the same tissues. In order to determine if a similar Cathepsin L/cell proliferation-dependency could be seen in vitro, a series of western blotting and cell proliferation studies were initiated using five commercially available human bladder cancer cell lines: 5637, TCCSUP, HT1376, RT4 and T24. Proliferation was determined in the cell lines by cell counts using a hemocytometer at intervals over 72 hours. Cathepsin L was measured by western blotting of lysates prepared from cultured cells. Conclusions of these studies agree with previous IHC findings in which expression of Cathepsin L was inversely correlated with the increase in grade, loss of differentiation of the original tumor, and proliferation. This correlation shows that as grade, loss of differentiation, and proliferation increase, expression of Cathepsin L decreases.

79. - The Effects of a Bacterial Endotoxin on Behavior and Sensory-CNS-Motor Circuits in Drosophila melanogaster

First Author
Abigail Greenhalgh
University of Kentucky

The effect of bacterial sepsis on animal behavior and physiology is complex due to direct and indirect actions. The most common form of bacterial sepsis in humans is from gram-negative bacterial strains. The endotoxin lipopolysaccharide (LPS) and/or associated peptidoglycans from the bacteria are the key agents to induce an immune response, which then produces a cascade of immunological consequences. However, there are direct actions of LPS and associated peptidoglycans on cells which are commonly overlooked. This study showed behavioral and neural changes in larval D. melanogaster fed commercially obtained LPS from Serratia marcescens. Locomotor behavior was not altered, but feeding behavior increased and responses to sensory tactile stimuli were decreased. In driving a sensory-central nervous system (CNS)-motor neural circuit in in-situ preparations, direct application of commercially obtained LPS initially increased evoked activity and then decreased and even stopped evoked responses in a dose-dependent manner. With acute LPS and associated peptidoglycans exposure (10 min), the depressed neural responses recovered within a few minutes after removal of LPS. Commercially obtained LPS induces a transitory hyperpolarization of the body wall muscles within seconds of exposure and alters activity within the CNS circuit. Thus, LPS and/or associated peptidoglycans have direct effects on body wall muscle without a secondary immune response. Future directions of study will focus on the effects of repeated LPS exposures to the CNS.

80. - The combination of valsartan and sacubitril does not improve effectiveness against AngII-induced AAAs

First Author
Jenny (Ching Ling) Liang
University of Kentucky

Objective: Abdominal aortic aneurysms (AAAs) are a sexually dimorphic disease where males have 4-10 fold higher
prevalence than females. Preliminary data demonstrated that angiotensin II (AngII), plus testosterone, were powerful stimulants for expression of neprilysin in abdominal aortic smooth muscle cells from XY male mice. Neprilysin is a known competitive inhibitor of neprilysin. Valsartan is an angiotensin receptor blocker that has been shown to reduce the formation of AngII-induced AAAs in male mice. The combination of sacubitril and valsartan has been utilized in the treatment of heart failure to lower AngII while promoting natriuretic peptide effects. However, this combination has not been tested against AAA formation. Therefore, we evaluated the effects of valsartan, sacubitril, and their combination on the formation of AngII-induced AAAs.

Methods and Results: Valsartan was infused to the Ldlr-/- male mice at 0.3, 0.5, 1, 6, and 20 mg/kg/day for seven days prior to administering AngII and then along with AngII infusion for 28 days. Sacubitril was infused at 1, 6, and 9 mg/kg/day in the same manner. Vehicle-treated males were given solvent only prior to and then along with 28-day AngII infusion. Day 27 ultrasounds show that valsartan dose-dependently inhibited AAA formation compared to vehicle treated mice, except for the 0.3 mg/kg/day dose (P>0.05). Combinational drug therapy using 0.3 mg/kg/day valsartan with 1 mg/kg/day sacubitril or 0.5 mg/kg/day with 9 mg/kg/day sacubitril also showed no additional effect (beyond that of valsartan alone) on internal abdominal aortic diameters by ultrasound (P>0.05).

Conclusions: Valsartan antagonized AngII-induced AAA formation in a dose-dependent manner. In contrast, sacubitril did not affect AAA formation. Moreover, the combination of sacubitril

### 81. Pharmacological profiling of stretch activated channels in proprioceptive neurons

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Proprioception in mammals and invertebrates occurs through stretch activated ion channels (SACs) localized in sensory endings. Many invertebrates (i.e., arthropods) use chordotonal organs which monitor joint movements. The PIEZO channels are a subtype of SACs and are comprised of a distinct type of protein sequence; PIEZO channels are similar among species from mammals to invertebrates. Relatively new agents have been identified to have action on the PIEZO 1 subtype of SACs: Yoda1, Jedi2, OB-1, and Dooku. Yoda1 and Jedi2 are predicted to activate PIEZO 1, and the action by Yoda1 can be reversed by Dooku. Additionally, OB-1 is predicted to modulate activity of PIEZO 1 channels. To date, the SACs of the crustacean proprioceptors have not been satisfactorily pharmacologically classified, nor has their molecular makeup been identified. We are screening the pharmacological profile of these sensory organs in crustaceans with the listed compounds to determine if they may serve as a model for mammals. The firing frequency of primary sensory proprioceptors in the crab propodite-dactylopodite (PD) organ was used to assess the effect these compounds had on the function of the proprioceptive neurons. The PD organ contains sensory endings separate from muscle fibers which enables for the exploration of the direct effects of the pharmacological agents.

### 82. The effects of bacterial endotoxin Lipopolysaccharides (LPS) on synaptic transmission at neuromuscular junctions

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Lipopolysaccharides (LPS) are found in the outer membranes of gram-negative bacteria and can elicit direct cellular responses, in addition to inflammatory immune responses in an infected organism. When the cutaneous pectoris muscle of Lithobates pipiens is exposed to LPS from Serratia marcescens, the evoked excitatory junction potentials (EJPs) completely diminished after 10 minutes. These EJPs were able to be partially recovered after removal of LPS. The spontaneous miniature excitatory junction potentials (mEJPs) did not change with LPS exposure and evoked release returns after removal of LPS. These findings suggest that LPS acts in frogs by inhibiting the activity of the voltage-gated Ca2+ channels in presynaptic motor neurons. A previous report stated an increase in spontaneous vesicle fusion contrary to our findings and that the evoked release was not able to reversed. The effects of LPS vary depending on the model neuromuscular junction. In Drosophila larvae the glutamatergic NMJ is blocked by LPS and at the crayfish glutamatergic NMJ evoked release is enhanced. The effects are partially reversed with removal of LPS in both crayfish and Drosophila preparations. We also present a dissection in a step by step manner for use of the frog cutaneous pectoris muscle for student laboratory experimentation and for conducting research projects.
83. - Engineering novel TALEs for detection of antibiotic resistance genes using 2D-graphene oxide nanosheets

First Author: Narayan Neupane
Co-author: Colleen Jackson
Co-author: Moon-Soo Kim

Western Kentucky University
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Western Kentucky University

Antibiotic resistance is a burden to global society. A method that can prevent the spread of antibiotic resistance genes (ARGs) and antibiotic resistance bacteria (ARB) is currently unavailable. A simple, facile and sensitive detection of ARB is crucial for the prevention and earlier treatment of any infectious disease. Transcriptional Activator like Effector (TALE) is a novel class of DNA-binding protein that has modular and flexible structure making it able to bind any DNA sequences. Graphene oxide (GO) is a 2D-nanosheet formed by the oxidation of graphite. It has many oxygen-containing functional groups such as carboxyl, hydroxyl, carbonyl and epoxide on its structure. Here, we design a novel diagnostic method to screen and identify ARGs in bacteria using engineered TALEs and quantum dots (QDs) biosensors. QDs are metallic, semi-conducting nanoparticles having unique electrical, physical and optical properties. We measure the fluorescent restoration of the QD where the signal of the QD-labeled TALEs is quenched by a 2D-nanosheet graphene oxide (GO) through fluorescent resonance energy transfer (FRET). Our device produces on and off responses in presence and absence of target ARGs respectively.

84. - Investigation of amyloid precursor protein and small molecules interactions in bicelles

First Author: Kamila Nurmakova
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Co-author: Charles Sanders
Berea College
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Vanderbilt University

The Amyloid Precursor Protein (APP) is a single-pass type I transmembrane (TM) protein that is well known for its role as the precursor of Amyloid ?, an agent involved in Alzheimer's disease. In general, single-pass transmembrane proteins have been largely neglected by drug discovery efforts because they have been traditionally considered 'undruggable' targets. Previous studies have shown that the transmembrane APP fragment, C99, is able to bind cholesterol, motivating the concept that C99 has potential to form complexes with other small molecules. In this study, we employ C99 as a disease-relevant model to probe interactions between single-pass TM proteins and small-molecules, using the Notch-1 TM protein fragment as a control for non-specific effects. Using NMR-based high-throughput screening (HTS): previous research discovered two compounds that were able to bind C99 in detergent-based model membranes. To determine binding events in more physiologically relevant conditions, we titrated the two compounds against C99 protein in D6PC/DMPC (dihexanoylphosphotidylcholine/dimystristoylphosphotidylcholine) bicelles, a lipid environment which more closely resembles a biological membrane. Only one of the compounds reproducibly bound C99 in the bicelles, inducing chemical shift perturbations in residues in and around transmembrane domain. We did not observe chemical shift perturbations in the Notch-1 transmembrane domain, suggesting that the binding is unique to C99. These results are preliminary evidence of C99 complexing specifically with a small molecule, validating the utility of the NMR-based HTS for single-pass TM proteins.

85. - Effects of bacterial endotoxin on regulation of the heart, a sensory-CNS-motor nerve circuit and neuromuscular junctions

First Author: Christa Saelinger
Co-author: Micaiah McNabb
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Eatable crustaceans are susceptible to bacterial septicemia from injury or a compromised immune defense, which can possibly have detrimental effects in mammals that consume them. Since many crustaceans (i.e., crabs, lobsters...
and crayfish) are used for animal food and human consumption, it is of interest to understand the effects potential bacterial infections can have on their health, as well as ours, including effects on cardiovascular and neuromuscular activities. The Red Swamp crayfish (Procambarus clarkii) was used as a model crustacean to investigate the effects of direct exposure to isolated endotoxin lipopolysaccharide (LPS) and the associated peptidoglycans from gram-negative bacteria (Serratia marcescens). S. marcescens is a common strain identified to cause septicemia in mammals and is prevalently found in nature. LPS injection into the hemolymph of crayfish reveals acute changes in heart rate and effects on survival. Direct LPS exposure on an in situ sensory-CNS-motor circuit produces a decrease in recruiting of the motor nerve at 500 µg/ml but has no significant effect at 100 µg/ml. At the isolated neuromuscular junction, the direct action of the LPS endotoxin (500 µg/ml) enhances evoked synaptic transmission, but does not alter facilitation. Also, the amplitude and the frequency of spontaneous vesicle fusion events is not altered by LPS exposure. However, the resting membrane potential of the muscle transiently hyperpolarizes. These direct actions on tissues appear to be independent of innate immune responses and suggest the LPS targets on these tissues have a role in excitability of cellular function.

87. - Detection of Antibiotic Resistance Genes via Zinc Finger Protein and Quantum Dot Complex with Graphene Oxide Nanosheet

First Author
Kenneth Schlabach
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Co-author
Dat Thinh Ha
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Co-author
Moon-Soo Kim
Western Kentucky University

With the accelerating threat of antibiotic resistant pathogens, rapid specific gene detection has become critical in healthcare. Current methods suffer in time constraints as well as requiring specialized equipment. This research uses Zinc Finger Proteins (ZFPs), which can bind to specific sequences in double-stranded DNA, to detect antibiotic resistant genes (ARGs). ZFP construct tetM-1332 was engineered to bind tetracycline resistance gene (tetM) and cloned into a pMAL vector. The ZFP was expressed in E. coli and then purified using an amylose affinity column chromatography via a maltose binding domain in the pMAL vector. Through EDC NHS chemistry ZFP was covalently labeled with quantum dots (QDs) (photo-fluorescent nanoparticles) and adsorbed onto graphene oxide (GO) 2 dimensional nanosheet which quenched the quantum dot fluorescence through Frequency Resonance Energy Transfer (FRET). In the presence of its target DNA sequence the ZFP-QD complex detaches from the GO, preventing FRET and restoring fluorescent signal. The limit of detection was determined with different concentrations of target DNA. This system allows for accurate detection of ARGs faster and simpler than traditional methods. Overall, the combination of ZFP detection specificity and GO shows promise for this novel technology in a point-of-care application.

88. - Identification of motifs important for function of TRM732 in yeast

First Author
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Transfer RNAs (tRNAs) are molecules that transport amino acids to the ribosome to facilitate protein synthesis. Post-transcriptional modifications of tRNA are critical for proper functioning. Yeast Trm7 is a methyltransferase enzyme which interacts with Trm732 and Trm734 to modify tRNAs at residues C32 and G34, respectively. Trm7 and its accessory proteins are highly conserved amongst eukaryotes, including yeast and humans. Yeast mutants lacking both Trm732 and Trm734 are sick, indicating that these proteins are required for proper cell growth. Variations in the human homolog of Trm732, THADA, have been linked to polycystic ovary syndrome and type 2 diabetes. To better understand the function of Trm732, variants have been generated via site-directed mutagenesis and transformed into S. cerevisiae. Analysis of these variants, when compared to wild type, allows for the identification of the Trm732
residues involved in the methylation of tRNA. Function has been investigated quantitatively by measuring tRNA nucleoside modification levels with Ultra-Pressure Liquid Chromatography, and qualitatively through growth assays. After studies of Trm732 in S. cerevisiae are complete, we will see if our findings translate to THADA in human cells. We have begun to analyze THADA knockouts in the HAP1 human cell line; tRNA Phe has been isolated from these cells and C32 modification levels are being measured. Quantification of Cm levels will provide information about the function of THADA in human cells.

Friday, November 1, 2019 2:00pm - 5:00pm

Zoology - Poster Presentations
Baird Lounge, Alumni Building

89. - Wet Rock Crevices Impact Egg Deposition and Survival in Green Salamanders, Aneides aeneus

First Author
Paul Cupp
Eastern Kentucky University

Green salamanders, Aneides aeneus, occur in rock crevices that are humid but not wet. This is true for deposition and brooding of eggs. Females usually do not deposit eggs in crevices with standing water. Eggs are usually attached to the crevice ceiling in a horizontal plane with a space below the egg clutch. The brooding female often has her head in this space. Also, the space may allow water accumulation without damaging eggs. Females may move into and out of contact with eggs to minimize water uptake. In two crevices that produced hatchlings over ten years, young were not produced in summers of 2004 and 2005. Periods of extended rainfall led to wet crevices and thus failed egg clutches, or eggs were not deposited although gravid females were observed. Extensive rainfall during egg deposition in July 2011 resulted in some breeding crevices with standing water. In one crevice that had been monitored for several years, a female deposited eggs 10 cm away from the regular crevice to the ceiling of a larger more exposed crevice visible from outside the rockface. Due to the large space below the eggs, the female was unable to brood them. She was located to the left of the eggs with head oriented toward them and snapped at introduced probes. The clutch failed and the eggs had disappeared by Aug 10, 2011. Adaptations of A. aeneus to this microhabitat resulted in return of brooding females and eggs to these crevices in 2014 and 2015.

90. - Changes in the fish community of Triplett Creek following restoration of a channelized reach.

First Author
Austin Spradlin
Morehead State University

In the early 1970s, Triplett Creek in Morehead, Kentucky, was straightened, deepened, and widened, resulting in a rather homogenous aquatic habitat. In summer of 2018, a section of the stream was ‘restored’ in order to alleviate the bank instability and flooding problems created by the 1970s channelization. Our goal was to examine changes in the fish population resulting from the extensive changes to the channel and substrate during the restoration. We studied the fish populations at four sites (two sites in the restored area and two unaltered reference sites) in June 2018 (before restoration) and October 2018 and June-July 2019 (after restoration), just before and just after, respectively, the restoration work occurred. Fishes were qualitatively sampled using backpack electrofishing and seining and assessed using the Kentucky Index of Biotic Integrity (KIBI). In June 2018, prior to any restoration work, the four sites had KIBI scores between 59 and 70, all of which rated as ‘good’. However, the two sites in the restored area had a higher proportion of nonnative species, and fewer darters compared to the reference sites. Following stream restoration, stream health indices declined, especially at the upper restored site. In summer of 2019, KIBI scores improved in the restored areas, indicating a slow improvement of the fish community in the restored area. In the future we expect the fish communities of the restored section to improve, as riparian vegetation becomes established, the substrate stabilizes, and invertebrate communities (i.e., food for fishes) colonize the new habitat.

91. - EFFECTS OF ASIAN CLAMS, CORBICULA FLUMINEA, ON ADULT FRESHWATER MUSSELS
The Asian Clam is an invasive species found throughout the United States that can reach densities of greater than 1000/m². Given these high densities, Asian clams have been linked to declines in native mussels. Hypothesized mechanisms include competition for food and space and depredation of glochidia. We are conducting a mesocosm experiment to assess the influence of Asian Clams on adult native mussels. We have constructed a flow through system whereby 0.69 m² mesocosms are supplied with constant water flow from Kentucky Lake. Our experiment consists of a 3 x 2 factorial design with density (high, medium, low, and none) and organism (Asian clams or native mussels) as factors. Prior to adding Asian clams or native mussels at these densities we individually marked and stocked four Amblema plicata and four Plectomerus dombeyamus into each tank as our base condition. Our high, medium, and low Asian clam treatment corresponded to 1000, 100, and 10 clams, respectively. We stocked native mussels such that the filtration rates of native mussels were equal to those of Asian clams at each density. Asian Clams and native mussels were placed in mesocosms in July 2019. After 8 weeks, we will measure glycogen, total protein, and filtration rates in each native mussel and are considering other potential biomarkers. We will also complete a survey of mussel fauna in the Little River in western Kentucky. We will conduct time search surveys for mussels via snorkeling and using bottom view buckets at 50 locations throughout the Little River and its tributaries. We will record the presence of native mussels and Asian clams. We will also collect shells found along the banks of the river by walking the shoreline for 20 minutes. We will add any shells collected to the Murray State University mussel collection.

92. - Effects of nicotine on activity rhythms of zebra finches (Taeniopygia guttata)

First Author: Darby Tassell  
Co-author: Wesley Payette  
Co-author: Noah Ashley  
Western Kentucky University  
University

Many field studies in birds have assessed circadian rhythms, and recently sleep, but few have examined the use of pharmacological intervention to potentially manipulate sleep/wake rhythms. We examined the effect of nicotine, a stimulant, on behavior and activity of captive zebra finches (Taeniopygia guttata) using video tracking software. Birds were injected with various doses of nicotine, at 0.12mg/mL, 0.16mg/mL, 0.20mg/mL, or only the distilled water vehicle for the control group and activity was assessed based upon distance traveled in the cage per 10 minute increments over a period of 24 hours of light. Results of this study will address whether this stimulant can be safely and effectively utilized in captive and field studies to manipulate circadian rhythms and sleep in birds.

93. - Effects of temperature variation on rainbow darters' (Etheostoma caeruleum) aerobic scope

First Author: Kaylee Simmons  
Co-author: Sam Bauer  
Co-author: Richard Durtsche  
Northern Kentucky University  
University

The projected climate change and increase in thermal conditions globally over the next 60 years has the potential to alter the metabolic scope and potential fitness of aquatic ectotherms. To investigate phenotypic response of mid-temperate freshwater fish to altered thermal states, we measured the metabolic scope of bottom dwelling fish from Kentucky streams. We collected a sample of 80 rainbow darters, Etheostoma caeruleum, from three streams (3-Mile, 4-Mile, Banklick) in northern Kentucky. After a 5 day quarantine period, these fish were acclimated to four temperatures (13°, 18°, 23°, 28°) for two weeks. Metabolic rates of fish (30-65 millimeters in length), were then measured individually in 450mL chambers within a static flow respirometry system that records oxygen consumption in four chambers at one time. Trials tested 15-16 fish at each temperature. Standard (resting) metabolic rates (Rs) were initially measured for each fish. This was followed by a 2 min. chase in a circular tank so the fish maintained active swim-glide movement, after which the fish was immediately returned to the respirometry chamber and their active (maximum) metabolic rate (Rm) was measured. Fish length and mass measures were used in a regression analysis (P
Elevated temperatures in higher latitudes due to climate change predicted over the next 60 years can potentially alter the metabolic scope and fitness in aquatic ectotherms like the partial migratory brown trout, Salmo trutta. We tested the counter gradient hypothesis of reduced metabolic scope, and consequently fitness, in juvenile brown trout as a phenotypic response to future warmer water incubation temperatures under Nordic climate change conditions. By extension, metabolic scope would also be predicted to be lower in offspring from resident fish vs anadromous fish. Cohorts of brown trout from anadromous and resident crosses were raised in southern Norway through embryogenesis in either natural river temperatures (cold) or in elevated (+3°C, warm) temperature waters to the point where these fish could begin feeding exogenously. Standard (resting) metabolic rate (Rs) [confirmed with ventilation rates], active (maximum) metabolic rate (Rm), and the absolute aerobic scope (AS = Rm – Rs) of juvenile trout from four anadromous-resident crosses and from both incubation temperatures were then determined. Our results support the counter gradient hypothesis that metabolism (Rs, Rm, and AS) was lower in warm than cold fish, but differences among anadromous-resident crosses were not found. Under future climate change conditions, lower metabolic scope could mean energy savings and therefore larger brown trout, or it could mean reduced fitness in the loss of their ability to be a top predator, their reduced capacity to escape predators, or modification of their migratory behavior based on a diminished response to environmental pressures.
and rectified in the development of a new, visual application. Finally, code support, or the code behind the code, allows future maintenance and development to be performed quickly and with more clarity. This includes a robust testing and logging system. This research moves the digital humanities field towards shared tools and data sets, allowing for increased collaboration between developers and digital humanists across the globe. These innovations have the power to aid in the discovery and analysis of texts once thought to be lost forever.

44. - Migration of Virtual Machines and Revision of Workshop Manual

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The Essentials of Next Generation Sequencing (NGS) Workshop, a collaboration between Bluegrass Community and Technical College, University of Kentucky, and University of Louisville, is designed to introduce life science researchers and students to tools they will use to analyze data they collect in their laboratories. Attendees gain practical experience in bioinformatics, both in DNA sequencing wet labs and in classes on using command-line software, such as BLAST, MAKER, and QIIME, on Linux. Each year's participants are given access to a personal virtual machine (VM) to practice the sequencing tools taught in the workshop and, optionally, to run analyses on their own data during and after the workshop.

In preparation for the NGS Workshop, the Bucks for Brains team of students, with assistance from their faculty mentors, migrated these virtual machines from Amazon Web Services to an Openstack cluster hosted at the University of Kentucky and revised the workshop manual from the previous year's NGS Workshop. Migrating the virtual machines involved recording the amount of data held on each virtual machine, using shell scripts to transfer data to the virtual machines hosted on the Openstack cluster, and verifying the data transferred correctly. The team also revised the workshop manual to prepare it for the 2019 NGS Workshop, including proofreading, clarification of instructions, measurement of the run time of commands, and updating commands to work with the newest software versions.

The presented work was a part of the Bucks for Brains Summer 2019 research program.

45. - Mechanical Properties of 3D welded Matals

**First Author**
Seyed Allameh  
*Northern Kentucky University*

**Co-author**
Roger Miller  
*Northern Kentucky University*

With the new advances in 3D printing, it is now possible to print metallic structures by 3D welding. This technique allows the incorporation of reinforcement such as rebars in a matrix of concrete which is particularly applicable to construction of concrete buildings. The reliability of the material is very important since human life is at stake. To assure the reliability of the 3D welded metals and alloys, mechanical testing must be conducted to assure the required mechanical properties. This study investigates the mechanical properties of 3D welded steel fabricated on metallic and ceramic substrates. It is found that yield, fracture strength and ductility of the metal varies with the type of substrate upon which the welding takes place. Ceramic substrates provide slow cooling allowing a softer steel weld bead interface. On the other hand, a metal substrate cools the molten steel resulting in a harder steel at the interface.

46. - Anisotropic material behavior and design optimization of 3D printed structures
Traditional manufacturing processes such as injection or compression molding are often enclosed and pressurized systems that produce homogeneous products. In contrast, 3D printing is exposed to the environment at ambient (or reduced) temperature and atmospheric pressure. Further, the printing process itself is mostly 'layered manufacturing', i.e., it forms a three-dimensional part by laying down successive layers of materials. Those characteristics inevitably lead to inconsistent microstructure of 3D printed products and thus cause anisotropic mechanical properties. In this paper, the anisotropic behaviors of 3D printed parts were investigated by using both laboratory coupon specimens (bending specimens) and complex engineering structures (A-pillar). Results show that the orientation of the infills of 3D printed parts can significantly influence their mechanical properties. Parts with 0-degree filament orientation are seen to have the most favorable responses, including Young's modulus, maximum strength, failure strain, and toughness. The findings also suggest that the 3D printed products could be theoretically 'designed' or 'tailored' by adjusting the infill angles to achieve optimal performance. The 3D printed A-pillar structure has been designed by utilizing the multilayered composite theory through a finite element method. With the mid-plane model, the layers in a 3D printed product can be properly designed and optimized based on given loading conditions. The designs have been evaluated through both computational and physical tests and consistent results have been obtained.

47. - Hands-on Robotics at Bellarmine University's Robotics Lab

First Author  Co-author  Co-author
Jordan Dowdy   M. Saleem   Akhtar Mahmood
Bellarmine University  Bellarmine University  Bellarmine University

We will present several robotic devices that were built using microcontrollers, servos, motors, and various sensors for imaging in the Physics Department's Robotics Lab at Bellarmine University. Additionally, some of the parts for the robotic devices were made using a 3D printer in the Robotics Lab. One of our goals was to build semi-autonomous human-operated robotics with wireless technology. Some of the robotic devices can be used in search-and-rescue missions. These robotic devices are - (i) an upgraded semi-autonomous Robotic-Spider (Hexapod). The Hexapod is composed of six legs that are powered by 18 servo-motors and is built with a Servo Controller and BotBoarduino, which has been programmed to move like an actual spider that can be operated by a PlayStation-2 controller; (ii) a Robotic-Crane built with Arduino-based MegaPi-Microcontroller that can pick-up small objects and move them to another location. It can be controlled wirelessly with smart phone through Bluetooth technology; (iii) Table-Top Robotic Grip-Hand built with servo controller board that has advanced inverse kinematics positioning control capabilities which can be controlled by a laptop; (iv) Bionic-Robot Hand built with Arduino and Veyron servo driver, where every finger can be controlled separately that can grab objects. All the finger actions can be controlled wirelessly; and (v) 3D-printed Gen 2-Physical Therapy Robotic Device to help move a patient's wrist that has been damaged from an accident by pulling their hand inward and outward.

48. - The Virtual Unwrapping Pipeline: the Process and its Challenges

First Author  Co-author  Co-author  Co-author
Tam Nguyen   Anthony Tamasi   Chad Nelson   W. Brent Seales
University of Kentucky  University of Kentucky  University of Kentucky  University of Kentucky

At the Digital Restoration Initiative, millenia-old documents too badly damaged to be opened or studied physically are digitized without incurring additional damage. To achieve this, the authors demonstrate a custom software pipeline, which consists of specific steps to virtually unwrap documents and reveal text that has been hidden for thousands of years. The pipeline begins with acquisition to scan the physical object into digital form, and moves to segmentation, differentiating the specific layers or pages of the manuscript so that the program clearly understands what is a page
and what is not. Then, texturing is run to find ink on the pages and the result is flattened onto a 2D image for readability. Often these datasets are too large and the pipeline too computationally intensive for a single computer, causing performance issues within our software. Cloud computing is a solution to this problem, which will create a server to allow volume data to be accessed anywhere. This will lead to other tools from the pipeline, such as segmentation and texturing, to also be on the cloud and be accessed by everyone. This research enables and empowers collaborative scholarship by simplifying and democratizing the complex technical process of translating an ancient artifact into legible and interactive digital objects.

49. - A Dynamic Interface for Understanding Neuronal Spiking Behavior

First Author: Mike Unuakhalu
Kentucky State University

Co-author: Camron Abner
Kentucky State University

Working with faculty at the University of Kentucky's F. Joseph Halcomb III, M.D. Department of Biomedical Engineering we developed interactive models that let the user explore concepts of neuroscience, specifically how neurons generate action potentials, or 'spikes', to convey information in response to a stimulus. The development is comprised of I) Numerical integration in space and time of the FitzHugh-Nagumo mathematical model of an excitable system. II) Simulation of the spread of action potentials in one and two-dimensional excitable media. III) An engine based on connected graphs rather than matrices, that would permit virtually any shape and configuration of neuronal circuitry. IV) An ongoing development of client-facing applications, building upon I, II, and III. The developed prototypes and their source codes are available online and can be run on any device with an up-to-date web browser. This project was made possible by National Science Foundation Grant No. 1539068.
Film Screening and Discussion: We Believe in Dinosaurs
Phelps-Stokes Chapel

We Believe in Dinosaurs
A 137 Films Production
Directed by Monica Long Ross and Clayton Brown
Produced by Amy Ellison, Monica Long Ross, and Clayton Brown
97 minutes, 2019

A documentary film about creationism, Noah's Ark, and America's troubled relationship with science.

A discussion will follow the film. Panelists include Director Clayton Brown; Dan Phelps of the Kentucky Paleontological Society (featured in the film); Megan Hoffman, Professor of Biology at Berea College; and Trent Garrison, Geology Professor at Northern Kentucky University and Chair of KAS Advocacy & Education Committee.

Saturday, November 2, 2019 7:00am - 2:30pm
Registration
2nd floor atrium, MAC Science Building

Saturday, November 2, 2019 7:30am - 10:00am
Coffee & Tea
MAC Science Building and Baird Lounge

Saturday, November 2, 2019 7:59am - 10:45am
Oral Presentations and Section Meetings
MAC Science Building

Saturday, November 2, 2019 8:00am - 10:45am
Agricultural Sciences - Oral Presentations
Room 357, MAC Science Building
Section meeting follows talks at 10:15

8:00 - Enzymes activity in tomato soil following animal waste application
First Author
Enzymes activity in tomato soil following animal waste application

ABSTRACT
Soil enzymes activities in the rhizosphere of field-grown tomato plants were used to monitor the impact of seven soil amendments (SM) and SM mixed with biochar on soil microbial activity before and 4 months after addition of amendments. The soil amendments were sewage sludge (SS), horse manure (HM), chicken manure (CM), vermicompost (worm castings), commercial inorganic fertilizer, commercial organic fertilizer, and native bare soil (used for comparison purposes). Each of the seven amendments was mixed with 10% (w/w) biochar to make total of 14 treatments. The results showed large differences in enzymes activities, secreted by soil microbes, before and after incorporation of soil amendments. Soil analysis revealed that urease activity increased 53% in HM amended soil and about 4 times in CM amended soil 4 months following treatment. CM amended with biochar increased urease activity by 11%. Similarly, significant increase in urease activity in all soil treatments, even in the no-mulch bare soil, were detected. Invertase activity increased significantly after the addition of all soil amendments. Organic manure treatments (SS, CM, HM, and vermicompost) enhanced soil biological activity (microbial biomass and release of urease, invertase, and phosphatase). Using organic manures rather than inorganic fertilizers in crop production is an affordable and more sustainable agricultural production systems.

8:15 - Improving sustainability utilizing cover crop grazing to improve soil health while increasing livestock production

Improving sustainability utilizing cover crop grazing to improve soil health while increasing livestock production
Ewing, K. P., P. A. Gunter, A. M. P. Netthisinghe, H. O. Galloway
Cover crops have become an increasingly popular option for alleviating agronomic and environmental concerns, such as erosion. Dual utilization can increase forage efficiency and increase immediate economic return but understanding the impact on soil health may affect viability of this strategy. In a two-year study conducted in Bowling Green, Kentucky, soil health was analyzed comparing three treatments: grazed wheat (Triticum aestivum) to un-grazed wheat and tall fescue (Festuca arundinacea). Sixteen cow calf pairs were randomly allocated to grazed wheat or tall fescue for two weeks. Soil samples were analyzed following grazing to quantify soil physical and chemical parameters. Nitrogen (N) varied among all three treatments (P=0.03) and was greater in year 2 (2.21% vs. 4.11%; P=0.0001). Nitrate (NO3) and ammonia (NH4) concentrations varied between year at 4.40 ppm vs. 9.21 ppm (P=0.0001) and 19.17 ppm vs. 5.29 ppm (P=0.0001) respectively. Variance in organic matter (OM) was observed between the three treatments (P=0.0001) and year (25.74% vs. 30.12%; P=0.0001). Decreased ammonia levels in year 2 may be due to conversion to nitrates, which were significantly higher in the second year, while N fertilizer application may have contributed to overall increased N. Differences in OM could have been due to lack of residue in un-grazed wheat. Overall, minimal location x year interaction suggests that grazing had minor impact on soil health after one grazing period. Further research is required to thoroughly investigate the impact of cover crop grazing on soil health.

8:30 - Investigating the impact of soil amendments on Brassica biomass

Brassica plants, such as mustard and arugula release biotoxic compounds, known as glucosinolates (GSLs) or their metabolic byproducts against bacteria, fungi, insects, nematodes, and weeds. In addition, Brassica plants are a good source of antioxidants, such as vitamin C and total phenols. Food demand is increasing and many future plant
production systems will depend on the use of fertilizers. The use of soil amendments, such as animal manures provides not only a means for beneficial disposal of some forms of waste, but also soil organic matter and plant nutrients. Four soil management practices (sewage sludge, chicken manure, horse manure, and native bare soil) were used to grow arugula, Eruca sativa and mustard greens, Brassica juncea, under field conditions in a randomized complete block design at the University of Kentucky South Farm, Fayette County, KY. The main objective was to investigate the impact of these amendments on arugula and mustard biomass production. Each of the soil amendments was mixed with native soil at 15 t acre\(^{-1}\) on dry weight basis. Plant shoots and roots were weighed at harvest. Sewage sludge produced the greatest root, shoot, and plant weights (74, 291, and 365 g/plant, respectively) in arugula and greatest plant weight (488 g/plant) in mustard compared to the other three soil treatments. Overall, results indicated that soil amended with sewage sludge increased plant biomass production in arugula and mustard by 26% and 21%, respectively, compared to the no-mulch bare soil.

8:45 - Applicability of microbial phytase to increase phosphorus availability in soy-based diets for largemouth bass.

First Author  
Kala Mallik Meesala  
Kentucky State University  
Applicability of microbial phytase to increase phosphorus availability in soy-based diets for largemouth bass, Micropterus salmoides. KALA MALLIK MEESALA*, KASONDRA K. MILLER, KRISTY M. ALLEN, and WALDEMAR ROSSI, JR., Kentucky State University, College of Agriculture, Communities and the Environment, Frankfort, KY 40601.

Most of the phosphorus (P) in feeds containing high inclusion levels of soy-protein feedstuffs occurs as phytic acid (PA), which is not digestible by fish. Supplementation of microbial phytase into soy-based formulations to degrade PA can increase P availability to fish and minimize P excretion to receiving waters. A twelve-week feeding trial is underway to evaluate the effects of supplementing phytase (PTS) in soy-protein-based diets on the growth performance and mineral composition of largemouth bass (LMB). A total of seven diets were formulated to contain 40% crude protein and 12% lipid and were amended as follows: the first diet (PTS-0) was not supplemented with phytase or inorganic P to serve as the negative control; the second diet (PTS-0 + IP) was identical to PTS-0 except that it was supplemented with inorganic P to meet LMB P requirements and serve as the positive control; the remaining five diets (PTS-250 to PTS-2000) were supplemented with a commercial phytase product (Natuphos, BASF, Ludwigshafen, Germany) to obtain final dietary phytase levels ranging from 250-2000 units/kg that were used to assess the effectiveness of the enzyme in increasing P availability by breaking down PA. Each diet is being fed twice daily (8:00 and 16:00) at apparent satiation to triplicate groups of 20 LMB (initial weight ~10.25g) stocked in 110-L aquaria operating as a recirculating aquaculture system. Results, including growth, survival, feed efficiency, and P retention in whole-fish, will be presented after the conclusion of the feeding trial.

9:00 - Financial Assessment of Food Waste Composting

First Author  
Ian Storrs  
Western Kentucky University  
Financial Assessment of Food Waste Composting. IAN STORRS* and SARA BARRENS, STEPHEN KING, MARTIN STONE, Department of Agriculture and Food Science, Western Kentucky University, Bowling Green, KY, 42101. Western Kentucky University spends $300,000 annually to transport trash to a landfill 80 miles away. Much of that waste is organic material. Recently, the Baker Arboretum constructed an in-vessel composter which consolidates food waste from select WKU dining locations, transforming it into compost for on-site use. This machine can process up to 330 pounds of food waste a day, and through the course of approximately a month, the material becomes nutrient-rich compost. This solution reduces environmental emissions, repurposes food waste, and lessens the amount of material we send to landfills. The operating budget for this system is funded by WKU's Resource Conservation Department, but is currently less cost-efficient than taking waste to a landfill. Our project takes an economic approach to this issue, focusing on the benefits and costs associated with this machine. To project the financial feasibility of composting, we will utilize investment analysis techniques such as payback period, return on investment, net present value, benefit-cost ratio, internal rate of return, and partial budgeting analysis. After
developing an initial understanding of this system, we will look at the large-scale economics of a project, potentially incorporating the Warren County Public School System, Warren County Public Libraries, and the City of Bowling Green.

9:15 - Do Beginning Farmers Feel the Same about Finances as Experienced Farmers?

**First Author**  
Spencer Langford  
Western Kentucky University

**Co-author**  
Dominique Gumirakiza  
Western Kentucky University

Small beginning farmers face unique difficulties compared to large and experienced producers. This study focused specifically on small beginning farmers in Kentucky and analyzed feelings about financial and profitability for their farm operations. We used survey data collected in 2017 from 129 small & mid-scale farmers that are registered with Kentucky Department of Agriculture. Analysis was done using regression applying an ordered probit model. Findings demonstrated that those who possessed knowledge of agricultural marketing techniques and agricultural economics were much more likely to feel positive. Additionally, beginning farmers were less likely to feel positively, compared to experienced farmers. Those under the category of either educated beginner, married, fifty or older, or female were all likely to feel fairly. Another important finding is that despite increased representation in recent years, feelings among beginning female farmers are significantly lower compared to their counterparts. Reasons on why exactly this is the case will require further research. This study shows the importance of training and technical support for agricultural producers to improve their farm financial standings.

9:30 - The Likelihood for Online Shoppers to Purchase Fresh Produce Online

**First Author**  
Autumn Milliner  
Western Kentucky University

Although more consumers are purchasing their groceries online, less than 10% of American consumers are willing to buy fresh produce online (Shoup, 2018). The purpose of this study was to determine the probability of an online shopper's willingness to purchase fresh, local produce online. This online survey was conducted in 2016 from a random sample of 1,205 individuals who live in the southern region of the United States and classify as 'online shoppers.' Online shoppers are defined as individuals who made at least two online purchases in the last six months before completing the survey. Overall, the likelihoods for online shoppers to not be interested at all, slightly uninterested, undecided, slightly interested, and definitely interested in purchasing fresh, local produce online is 9%, 25.7%, 31%, 21.7%, and 12.4%, respectively. The results show that a consumer's willingness to shop online for their fresh produce is positively and significantly correlated with a consumer's consideration of joining a Community Supported Agriculture program, and how much they spend on fresh produce. Conversely, results also indicate that a consumer's willingness to shop online for fresh produce is negatively correlated with the consumer's age and their interest in attending various types of markets. This information should be used by producers who wish to continue selling their product in a physical space. Results from the survey could aid in the identification and retention of customers who prefer to purchase produce offline.

9:45 - Characterization of Mass Reduction in an in-vessel Composter.

**First Author**  
Monika Decker  
Western Kentucky University

**Co-author**  
Martin Stone  
Western Kentucky University

Monika Decker and Martin Stone, Department of Agriculture and Food Science, Western Kentucky University and the Baker Arboretum

Composting has been around for centuries, yet we are just beginning to perfect in-vessel composting machines. The Baker Arboretum near Western Kentucky University hosts such a digester. Pre and post consumer food waste from restaurants on the campus of WKU is composted. However, the composer is a proprietary design and little research
is available to understand and optimize its operation. In addition to food waste, sawdust is also added as a carbon source to optimize the C:N ratio of 30:1, increases temperatures, and decreases anaerobic conditions. Because of the vessel's closed format, moisture management has become very important to the operation. Our goal is to analyze and characterize the optimal parameters needed to efficiently produce quality compost. We will correlate inputs and variables to determine optimal ranges for microbial composition. We are monitoring input and output weights to understand mass loss. Temperatures are being monitored in five sections down the distance of the composter as well, to identify optimal those optimal areas between 130-160 degrees F. There has been great interest by municipalities and school systems in this pilot program and will base their decision to purchase, in part, on our data.

10:00 - Farm Food Safety: Irrigation/Agriculture Water Testing for Produce Growers in Kentucky.

First Author
Chinmay Tope
Western Hills High School

Co-author
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College of Agriculture, Communities and the Enviro

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Kentucky Horticulture Council

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More than 75% of Kentucky's farms are small-scale farms and 2,100 farms supply fresh produce to markets. In recent years, the occurrence of foodborne illnesses linked with fresh produce meant for human consumption. Source and quality of irrigation water are the key components of the PSR that require farmers to conduct water quality assessments to ensure compliance with FSMA. To reduce produce related outbreaks, PSR requires third-party audits to document that the grower meets buyer's requirements for food safety. Currently, the sanitary quality of irrigation water refers to 'recreational water quality' with a permissible Escherichia coli (E. coli) geometric mean (GM) less than 126 cfu/100 mL. The objective of this study was to provide efficient and accurate testing of irrigation water for Kentucky's produce growers. Between April to August 2019, samples (n=52) of irrigation water were collected from participating farmers from 6 counties in KY and analyzed for E. coli count using the IDEXX Colilert Test Kit. In all, 7 of 16 groundwater samples and 33 of 35 surface water samples tested positive for E. coli. The one municipal water source that was analyzed tested negative for E. coli. The Microbial Water Quality Profile (MWQP) for 2 water sources indicated that the GM exceeded the permissible E. coli level. Strategies for corrective actions were discussed with the growers.

Saturday, November 2, 2019 8:00am - 10:45am

Chemistry: Organic / Inorganic - Oral Presentations
Room 355, MAC Science Building
Section meeting follows talks at 10:30

8:00 WITHDRAWN - A structural and spectroscopic comparative study of a series of dichalcogenidodiphenylphosphinate complexes, M(E2PPh2)3

First Author
Jessie Brown
Transylvania University

The synthesis, isolation, and characterization of a series of transition metal chalcogenido complexes, M(E2PPh2)3 (M = V, Cr; E = S, Se), is reported. All reported complexes were structurally characterized by X-ray crystallography; the complexes were also analyzed by solid-state IR spectroscopy and CH elemental analysis. The solution-phase spectroscopic signatures were collected by UV/vis and NMR spectroscopies. A detailed comparative analysis regarding the trends and differences in bonding and electronic structure within the series, and within the broader context of the field, will be discussed.

8:15 - A new series of bis(imino)pyridine iron complexes for catalytic carbene reactions

First Author
Transition-metal-catalyzed carbene transfer reactions occurring through metal carbene intermediates encompass a vast array of reactants and catalysts to achieve novel and selective strategies for organic synthesis. Dirhodium complexes have been established as the most successful catalysts for carbene transfer reactions of diazo compounds; great achievements have also been accomplished recently by copper and other precious metal catalysts (e.g. ruthenium, palladium, gold). However, iron catalysis is comparatively underdeveloped, with the enduring dominance of precious metal catalysis in metal carbene chemistry. The bis(imino)pyridine iron complex, for the first time, is developed as an effective metal carbene catalyst for carbene transfer reactions of donor–acceptor diazo compounds. Its broad catalytic capability is demonstrated by a range of metal carbene reactions, from cyclopropanation, cyclopropenation, epoxidation, and Doyle–Kirmse reaction to O–H insertion, N–H insertion, and C–H insertion reactions. The asymmetric cyclopropanation of styrene and methyl phenyldiazoacetate was successfully achieved by the new chiral bis(imino)pyridine iron catalyst, which delivers a new gateway for the development of chiral iron catalysis for metal carbene reactions.

8:30 - Development of N-benzyl-2-(bis(2-aminoethyl)amino)acetamide

First Author
Sara Reitz
Eastern Kentucky University

Co-author
Carrie Black
Eastern Kentucky University

Co-author
Lindsay Calderon
Eastern Kentucky University

Co-author
Margaret Ndinguri
Eastern Kentucky University

It is projected that in 2019, approximately 1,762,450 new patients will be diagnosed with cancer in the United States. With a hope to continue the decline in cancer mortality rates, novel techniques for cancer imaging and treatment are highly sought after. Concerning radiopharmaceuticals, technetium (Tc) is ideal for use in diagnostic imaging due to its excess nuclear energy. The study of facially coordinated tridentate ligands with a [99mTc(CO)3]+ core is of particular interest, given their superior pharmacokinetic properties when compared to similar bidentate ligands. The purpose of this research is to gain a more complete understanding of 99Tc radiopharmaceuticals by utilizing fac-[ReI(CO)3L]n analogues as a model. Furthermore, fac-[ReI(CO)3L]n analogues may also be considered useful for imaging in nuclear medicine. Results on the synthesis of facially coordinated tridentate ligand N-benzyl-2-(bis(2-aminoethyl)amino)acetamide will be discussed.

8:45 - Examination of intramolecular hydrogen bonds using NMR and quantum chemistry

First Author
Robert Rosenberg
Transylvania University

The goal of this work is to measure the strength of intramolecular hydrogen bonds between OH groups and acceptors such as N, O and F. High level ab initio calculations are performed to provide values for a large variety of systems. Currently, there is no convenient way to validate these calculations experimentally. In this work, 1H NMR spectroscopy is used to monitor the chemical shift of the bound OH proton in the presence of varying amounts of a hydrogen bonding acceptor such as DMSO. The resulting saturation curve can be used to derive binding constants and free energy. Variable temperature NMR is used to generate separate enthalpy and entropy components.

9:00 - Molecular mechanics analysis of a platinum triamine complex and its possible products with biologically relevant targets

First Author
Nitin Katare
Western Kentucky University

Molecular mechanics (MM) methods are used for predicting and designing new structures and properties, and to model solid-state geometries of molecules. MM and dynamics calculations have been used to study the
Ethylguanine and N-Ac-L-methionine complexes with platinum triamine compound. The AMBER force field has been supplemented with previous modifications and has been further modified to include parameters for platinum bound to 2-(4-Methyl-1,4-diazeplan-1-yl)ethanamine. By utilizing the modifications made previously to the AMBER force field, we were able to model the Chloro[2-(4-Methyl-1,4-diazeplan-1-yl)ethanamine]platinum(II) complex with methionine and 9 Ethylguanine adducts. Minimum energy structures were calculated for the all possible rotamers of target molecules. For the methionine adducts, we found that certain orientations of the methionine residue led to much lower energy structures, which could help explain the experimental observation that an initial methionine product can be replaced by a more stable product. We modeled 9-ethylguanine products in which 9-EtG displaced either the chloride only or both the chloride and one nitrogen atom of the triamine ligand, as experimental results suggested both types of guanine products are possible.

9:15 - Proposing a Mechanism for Fischer-Tropsch Synthesis on the Basis of Carbon-Carbon Bond Formation

First Author
Zach Callihan
Eastern Kentucky University

Co-author
Brad Shoopman
Christian White
Buchang Shi
Eastern Kentucky University

Today's society relies heavily on hydrocarbons, and while the established methods of production via natural petroleum currently meet our needs, the limited availability of that commodity has been realized, in addition to its impact on the environment. Thus, alternative methods of hydrocarbon synthesis have become a vital area of interest to scientists, as well as many industries and companies. Specifically, gas-to-liquid (GTL) processes appear to be promising options for the future of sustainable hydrocarbon production. Of particular interest among GTL options is the Fischer-Tropsch synthesis (FT), a non-selective method of hydrocarbon production via a polymerization reaction of a syngas composed of H2 and CO to form various compounds, including n-alkanes, 1- and 2-alkenes, oxygenates, and branched hydrocarbons. Despite nearly 100 years of research, the mechanism of FT is still heavily debated and considered unknown, as none of the currently proposed mechanisms can explain all of the products produced. Understanding the mechanism, however, would allow scientists to tailor reaction conditions to synthesize only the desired product(s), limiting or eliminating the need for purification steps. Our approach to understanding the FT mechanism is to utilize deuterium tracer techniques, To explain deuterium enrichment in hydrocarbons produced through FT reactions, we proposed a new mechanism. In this presentation, we conducted theoretical calculations of H/D ratio based on that mechanism, which will be compared to experimental data in the future.

9:30 - Visible light generation and kinetic studies of a chromium(V)-oxosalen complex

First Author
Seth Klaine
Western Kentucky University

Co-author
Rui Zhang
Western Kentucky University

The use of high-valent metal complexes as biomimetic catalysts in the oxidation of organic compounds is one of the most significant processes used daily to produce fine chemicals, generate energy, and mitagate pollution. In this presentation, we will describe a novel photochemical approach using visible light to produce a salen-chromium(V)-oxo intermediate bearing the well-known Jacobsen ligand. As determined by its spectral and kinetic behavior, the photo-generated chromium(V)-oxo salen was spectroscopically and kinetically equivalent to the species formed by the chemical method using the mild oxidant, iodobenzene diacetate [Phl(OAc)2]. The mechanism of the photochemistry is explained by the heterolysis of the oxygen-halogen (O-X) bond in the axial counterion which proceeds via a two-electron oxidation of the metal to conceive the chromium(V)-oxo species. The kinetic studies of oxidation reactions will be discussed, providing mechanistic information on the reaction pathways of the photo-generated transient oxidant.

9:45 - Synthetic Approaches to Phenylethynyloxacalixarenes and Annulene-Oxacalixarene Hybrids

First Author
Anna Vernier
Northern Kentucky
The purpose of this work is to synthesize annulene-o,m,o,m-oxacalix[4]arene hybrid molecules. Due to the chalice-like nature of oxacalixarenes, the hybrid molecules take on a tweezer-like conformation with cofacial annulenes. Thus, these hybrid molecules will provide insight on interactions between cofacial aromatic and antiaromatic rings. Before synthesizing these hybrid molecules, various analogues of p-substituted phenylethynyl-o,m,o,m-oxacalix[4]arenes will first be synthesized, so that the electronics of the oxacalixarene core can be studied and a synthetic methodology can be developed. These oxacalixarenes will have substituents of varying electron donating and withdrawing ability. We have already found that oxacalixarenes cannot be formed when the substituent is too electron deficient, and oxacalixarene formation takes place relatively easily with strongly electron donating substituents. In an attempt to synthesize as many unique oxacalixarenes as possible, we are pursuing two different synthetic approaches; one in which an electron donating substituent is added prior to the formation of the oxacalixarene ring, and another in which electron withdrawing substituents may be added to an already-formed, common oxacalixarene core. More research remains to determine whether the latter approach can be used with a full range of electron withdrawing/donating substituents, which synthetic approach gives the highest yield, and how to perform each synthesis with the lowest number of steps possible.

10:00 - Photoexcited State Behavior of Indium-Based Colloidal Semiconductor Nanocrystals

First Author
Kyle Schnitzenbaumer
Transylvania University

Nanocrystalline materials have been the subjects of intense research due to their size dependent optical properties and potential for use in the healthcare, optoelectronic, and energy sectors. Through this work, physical characteristics such as material interfaces, surface chemistry, and particle morphology have emerged as important determinants of a material's ultimate properties and behavior. Much of this work has been performed on cadmium- or lead-containing materials, the toxicity of which prohibits their widespread use in many applications. This presentation will discuss my research group's efforts to contribute to the evolving understanding of structure-property relationships in cadmium- and lead-free colloidal semiconductor nanocrystals, with a particular focus on indium-based materials. Utilizing techniques established by studying cadmium- and lead-based materials, we focus on how chemically controllable parameters such as size, composition, and surface chemistry influence optical properties and photoexcited state behavior.

10:15 - Computer Modeling Study on Heteroaryl Isocoumarin Aromatase Inhibitors

First Author
Ayanav Roy
Northern Kentucky University

Co-author
Quynh Nguyen
Northern Kentucky University

Co-author
William Renzenbrink
Northern Kentucky University

Co-author
Lili Ma
Northern Kentucky University

Isocoumarin compounds are reported to have a variety of bioactivities. Heteroaryl isocoumarin compounds are expected to have strong inhibition against aromatase due to their heteroatom/heme ion chelation, thus they are a promising class of new aromatase inhibitors. In this study, computer modeling programs (GOLD and MOE) were utilized to predict the crucial interactions between heteroaryl-containing aromatase inhibitors and the enzyme active...
site. Their docking scores were compared with their IC50 values to gain an insight of the structure-activity relationship of the heteroaryl isocoumarin aromatase inhibitors.

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**Health Sciences - Oral Presentations**

**Room 257, MAC Science Building**

**8:00 - Sympathetic nervous system regulation of pro-inflammatory cytokines in sleep fragmented mice.**

*First Author* Nicholas Wheeler  
*Co-author* David Ensminger  
*Co-author* Noah Ashley  
*Western Kentucky University* Western Kentucky  
*Western Kentucky University* Western Kentucky  
*University* University  
*University* University

Sleep is a restorative activity, however, when dysregulated, there are cognitive, metabolic, immunological, and inflammatory consequences detrimental to human health. Understanding sleep-immune interactions has important public health implications due to the rising occurrence of sleep loss in modern society, particularly in close association with individuals experiencing obstructive sleep apnea. This study examined the influence of the sympathetic nervous system upon inflammatory responses to sleep loss in female C57BL/6 mice using adrenergic blockade. Mice were injected with a non-selective β-adrenergic receptor antagonist (propranolol), a non-selective ß-antagonist (phentolamine), or saline (vehicle). Thirty minutes later, mice were exposed to control or 24 h of experimental sleep fragmentation. Tissues were collected for assessment of cytokine inflammatory gene expression using RTPCR. Preliminary data suggests that mice subjected to acute sleep fragmentation experience an increase in mRNA expression of the pro-inflammatory cytokine, IL-1 (interleukin 1) in white adipose tissue and the brain. We have observed a tissue dependent response to the pharmacological treatments, for example, both propranolol and phentolamine decreases the expression of IL-1 in the hypothalamus. However, only phentolamine decreases IL-1 expression in the frontal cortex and propranolol decreases IL-1 expression in fat. These results indicate that catecholamines are pro-inflammatory regulators in sleep loss stress responses.

**8:15 - Comparison of the effects of low intensity cardiovascular exercise after fasted, fed, and high fat meals in adults**

*First Author* Logan Taylor  
*Co-author* A.J. Mortara  
*Berea College* Berea College  

Objective: To examine the effects of fasted, fed, and a high fat meal on metabolism during low intensity cardiovascular exercise (60% of maximal heart rate) in adults.

Methods: 21 healthy participants (9 female, 11 male; ages 18-58) performed five sessions; the initial session tested for basic anthropometric data: body composition, resting metabolic rate (RMR), height, body mass, and blood pressure. Participants then performed four 30 minute, low intensity, treadmill runs/walks. Fed conditions were comprised of participants consuming a shake equivalent to 25% of their individual daily needs one hour prior to testing. The fed conditions were modified to produce the varying fed states: high carbohydrate (75% carbohydrates), high fat (60% fats), and the mixed meal which contained the proper proportion of carbohydrates, proteins, and fats (50%, 30%, and 20% respectively). For the fasted session, subjects were asked to fast for a minimum of 10 hours prior to the test.

Results: The average RER of the fasted, mixed meal, and high fat meals were 0.802, 0.861, and 0.817 respectively. The standard deviations of the previously stated variables were Â± 0.092, 0.087, and 0.083. There was a significant difference between the RER values for the fasted and mixed meal states (p= 0.009). However, there was no significant difference between the fasted and high fat conditions (p=1.000) nor the mixed meal and high fat states (p=0.089).

Conclusion: More fat is burned during a fasted state during low intensity cardiovascular exercise compared to a fed state.

**8:30 - Early Detection of HPV-driven OPC using E6 Sero-marker?**
The incidence of oropharyngeal cancer (OPC), a type of head and neck cancer, is rapidly increasing in the US and has been attributed to human papillomavirus (HPV) infection. OPC cases now outnumber cervical cancer cases in the US, approximately 85% of which occur among men. Unlike cervical cancer, where the introduction of highly effective screening has significantly reduced the incidence and mortality of cervical cancer in women, there are no methods for early detection of HPV-OPC in men. Recently, HPV16 E6 antibody positivity has been identified as a promising early biomarker for HPV-OPC. Previous work from our group showed that HPV16 E6 antibodies are present in up to 90% of HPV-OPC patients and appear more than 10 years prior to diagnosis. The object of this study is to use the HPV16 E6 biomarker to develop a cohort of individuals who are at highest risk of HPV-OPC. We will capitalize on the pre-existing infrastructure at Vanderbilt to test residual blood samples from healthy men aged 45-70 without diagnosed cancer for the presence of HPV16 E6 antibodies to estimate the seroprevalence of HPV16. OPC.

8:45 - Effects on Fat Metabolism during Aerobic Exercise in High Carbohydrate Diet, Fasted, and Mixed Meal Conditions

Food intake and exercise are essential for fat oxidation and weight loss. There are various approaches to the idea that different diets help the body burn fat at a faster rate. One of these strategies is to consume a high carbohydrate meal hours before exercising to achieve fat oxidation at a greater rate compared to fasted and mixed meal conditions. The purpose of this study is to compare the effects on fat metabolism during aerobic exercise in high carbohydrate diet, fasted, and mixed meal conditions. In order to perform this study, substrate utilization was examined using the respiratory-exchange ratio (RER) in 21 healthy participants who performed a 30 minute run in a treadmill at low intensity (60% of maximum heart rate) during four sessions. During the high carbohydrate diet participants received a drink one hour prior testing containing 75% carbohydrates of their body daily needs. For the mixed meal condition, participants were given 25% of body daily needs in a drink containing the same amount of macro-nutrients (carbohydrates, fats, and proteins). For the fasted state, participants were asked to fast 10 hours prior to testing. There was statistical significance between high carbohydrate and fasted state (p=0.005), and between fasted and mixed meal conditions (p=0.001). However, there was no statistical significance between mixed meal and high carbohydrate conditions (p=0.857). Average RER during fasted, mixed meal, and high carbohydrate conditions were 0.81 (±.016), 0.87 (±.014), 0.86 (±.020), respectively. Fasted conditions during a 30 minute run at low intensity burns more fat compared to high carbohydrate and mixed meal conditions.

9:00 - One-Carbon Metabolism Biomarkers and Risk of Barrett's Esophagus and Esophageal Adenocarcinoma

Esophageal adenocarcinoma (EAC) is a cancer that has had a substantial increase in incidence in the United States. Although it is the sixth most common cause of cancer death worldwide, its etiology is not yet clear. Most EAC develops from a condition known as Barrett's esophagus (BE), characterized by metaplasia of the cells that make up the internal lining of the esophagus. However, not all cases of BE develop into EAC and it is imperative to identify the factors that contribute to the metaplasia-dysplasia-carcinoma sequence that is thought to give rise to EAC. Evidence suggests an inverse association between one-carbon metabolism --the set of reactions that mediate amino acid and nucleotide metabolism through the transfer of one-carbon groups-- and risk of esophageal carcinogenesis because of its role in DNA methylation that can affect gene expression and contribute to the progression from BE to EAC. This study evaluated the associations between multiple metabolites of one-carbon metabolism (S-adenosylmethionine (SAM), S-adenosylhomocysteine (SAH), methionine, total homocysteine, betaine, choline, cystathionine,
methylenetetrahydrofolate (MTHF), and pyridoxal-5-phosphate (PLP)) and risks of BE and EAC using a case-control study from Ireland (n=259 controls, n=218 BE cases and n=208 EAC cases). Stable-isotope dilution liquid chromatography-electrospray tandem mass spectrometry (LC-ESI-MS/MS) was used to determine plasma levels of metabolites. Logistic regression analysis was used to calculate odds ratios and 95% CI. After adjusting for confounders, the highest plasma level of PLP was associated with a substantially reduced risk of EAC (OR 0.12; 95% CI 0.04, 0.30) compared with the lowest level. High plasma levels of methionine, choline, and betaine were associated with 60-80% reduced risk of EAC. Low levels of SAM and cystathionine decreased risk of EAC. No significant association was observed with BE.

9:15 - Assessing Total Viable Bacterial Count in Commercially Available Probiotic Dietary Supplements

Tavin Marshall
Kentucky State University

SHREYA PATEL
Kentucky State University

Avinash Tope
Kentucky State University

Probiotics are live bacterial strains of the genera Lactobacillus and Bifidobacterium that are abundant in human intestines with numbers as high as 1011 cells/g of intestinal content. Probiotics and supplements containing probiotics attract considerable interest due to their claimed health benefits. The market value of this industry is anticipated to increase to $7.1 billion by 2026 (the current value is $5.8 billion). Some genera, such as Lactobacillus and Bifidobacterium species, are commonly used in yogurt products and many dietary supplements. The US Food and Drug Administration (FDA) categorizes probiotics as ‘Generally Recognized as Safe’ (GRAS) so they are not regulated by the FDA. Thus, these products can be vulnerable to non-compliance, especially pertaining to the claimed viable bacterial counts. The objective of this project is to assess viable cell counts of bacteria in various commercially available probiotic supplements and compare those with the claimed values. Commercially available supplements containing Lactobacillus acidophilus and Bifidobacterium species were obtained from various online and local pharmacies (n=9 to date). Each sample was digested in a stomacher at 2300 rpm for 5 minutes in sterile Ringer's solution, serially diluted and plated on De Man, Rogosa and Sharpe (MRS) and Bifidus Selective agar, and incubated under anaerobic conditions at 37°C for 72 hours. Viable colonies were counted and percentage difference from the expected count was calculated. So far, 75% of products had lower than specified viable counts and the remaining 25% of products exceeded the specified viable counts on the label. This is an on-going study.

9:30 - Identification of risk factors and their association with neck and lumber fracture

Victoria Pham
Berea College

Identification of risk factors and their association with neck and lumber fracture

Victoria Pham, Math & Economics, Senior, Berea College

1) The objectives of this research were: 1) to identify major causes for cervical and lumbar fractures and 2) association of risk factors with both type of fractures. Evaluation of best treatment approaches in cervical and lumbar fractures

Introduction: There are about 6.8 million vertebral fractures occurring each year in the U.S. Incidence of vertebral fractures differ with the age. The age of vertebral sufferer impacts with the intervention and rehabilitation process. Therefore, it is important to identify age related causative factors of vertebral fractures in the population.

Methods: This presentation emerged from my internship at the Hospital of University of Pennsylvania. This study uses national data from National Electronic Injury Surveillance System (NEISS) 2009 to 2018 available in public domain. It is a cross-sectional research design that attempted to identify major causes of neck and lumbar injuries and their association.

Results: Causes of neck and lumber fracture were not found significantly different (x² = 253.00, df = 255, p=0.524) among people from 0 to 19 years of age. Our results indicates that prevention strategies developed to address all types of risk factors can reduce occurrence in both types of fractures.

Conclusions: Findings of this study suggests that different risk factors play role in neck and lumber injuries at different age. Public health preventive strategies targeted to the specific causes of injuries can reduce burden of neck and lumber fracture in the population.
9:45 - The Effect of Fatigue on Muscle Recruitment within Healthy Young Males and Females

First Author Co-author
Jose Gonzalez AJ Mortara
Berea College Berea College

Background: While performing resistance training exercise, participants regularly manipulate exercise types, equipment, sets and repetitions to maximize muscle fiber recruitment and performance. The primary purpose of this study was to determine the effect of bar type on muscle fiber recruitment. A secondary outcome was to examine differences in muscle fatigue during a recovery period. Methods: Three males and two females 20-22 years of age participated in this study. Participants were physically active and were experienced weightlifters. One repetition maximum (1RM) protocol for deadlift was completed with two different bars; 1) the Olympic and 2) the hexagonal or trap bar. The subjects were fitted with electromyography (EMG) sensors on the right side of their body. The rectus femoris, biceps femoris, gluteus maximus, and the multifidus were examined under both the Olympic bar and Trap bar protocols. After the warmup, participants were asked to perform the one-repetition max (1RM) deadlift protocol followed by ten repetitions recovery. Results: The results from this study show that there were no significant differences between muscle fiber type, and repetition number (p

10:00 - Novel Vaccine Platform for Immunizing Against Viral Pathogens

First Author Co-author Co-author Co-author Co-author
Samuel Adams Tre Powers Ryan Fitzpatrick Ashley Wentworth Joseph Mester
NKU NKU NKU NKU NKU Biological Sciences

Herpes simplex virus (HSV)-based vectors are efficient vehicles for genetic transduction of many cell types. While replicating HSV-based vectors are capable of eliciting potent immune responses, the immunogenicity of non-replicating HSV-based vectors is largely unexplored. We developed several HSV-1-vectored vaccines for hepatitis C virus (HCV) by genetically modifying an HSV-1 backbone in a bacterial artificial chromosome (BAC). These BAC-derived vectors allow for the rapid introduction and expression of foreign DNA in a replication-defective HSV backbone that does not express any HSV-specific genes post-infection. The vaccines were evaluated using human primary cell culture and mouse models of immunogenicity. Primary human dendritic cells were infected by the vaccines and monitored for changes in gene expression by polyA mRNA sequencing. Vector-infected dendritic cells demonstrated immune activation by upregulated expression of multiple inflammatory cytokines and chemokines, and by enhanced expression of cellular maturation markers. Mice immunized with the vaccines developed HCV-specific IgG antibody and memory T cell cytokine responses, including IFN-gamma expression, to HCV proteins. These results demonstrate the immune activating potential of non-replicating HSV-vectored vaccines. While the current vaccine target is hepatitis C virus, genes from any other infectious agent could be inserted into this vaccine vector to generate immunity to that agent.

10:15 - Top Causes of Cervical and Lumbar Fractures Using Python Data Visualization

First Author
Victoria Pham
Berea College

Identification of risk factors and their association with neck and lumber fracture

Victoria Pham, Math & Economics, Senior, Berea College

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fractures differ with the age. The age of vertebral sufferer impacts with the intervention and rehabilitation process. Therefore, it is important to identify age related causative factors of vertebral fractures in the population.

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Results: Causes of neck and lumber fracture were not found significantly different ($x^2 = 253.00, df = 255, p=0.524$) among people from 0 to 19 years of age. Our results indicates that prevention strategies developed to address all types of risk factors can reduce occurrence in both types of fractures.

Conclusions: Findings of this study suggests that different risk factors play role in neck and lumber injuries at different age. Public health preventive strategies targeted to the specific causes of injuries can reduce burden of neck and lumber fracture in the population.

10:30 - Physical Activity and Early Childhood Vocabulary Skills.

First Author: Juan Chavez Casiano
Co-author: Michelle Thornton
Berea College

Purpose: The purpose of this research was to analyze the relationship between PA and early childhood vocabulary development, using the Expressive Vocabulary Test (EVT). Method: Seventeen pre-school children from two classrooms in central Kentucky, participated in a 6-week study. General questionnaire and consent forms were complete by the participants' guardians. Prior to the study all participants completed the pre-EVT. Participants wore a GT3X accelerometer to measure daily PA. One classroom served as the control group and the second received 10-minute PA lessons daily. Post-EVT was completed following the six-weeks. Results: Paired t-test indicate statistical significance between the pre- and the post-EVT for both classrooms. Multiple linear regressions determined statistical significance between post-EVT score and average PA intensity levels for the experimental class. There was no significant difference for the control classroom in PA intensity levels. There appears to be a trend in significance for the experimental class in the PA steps taken, suggesting incorporating more time spent in PA may show a significance between EVT score and PA. Conclusion: It appears that structured PA may be more beneficial to older (4 year) children to improve vocabulary. This could indicate that longer bouts of structured PA should be incorporated into educator's daily or weekly lesson plans. In order to find stronger results, future studies could be performed with a larger classroom or for a longer period of time.

Saturday, November 2, 2019  8:00am - 10:45am

Mathematics - Oral Presentations
Room 206, MAC Science Building  Section meeting follows talks at 10:45

8:00 - P-adic Numbers and Quadratic Equations

First Author: William Boultinghouse
Co-author: Justin Trulen
Kentucky Wesleyan College

This brief presentation will highlight the key ideas of the author's research diving into p-adic numbers - specifically 2-adic numbers. These 2-adic numbers can be directly applied via 2-adic valuations - to understand latent patterns hidden within quadratic equations resembling $f(x)=ax^2+bx+c$ with conditions of $a$ being a positive, even integer and $b,c$ being positive, odd integers. Data, regarding the interested quadratic equations, was gathered by utilizing programs in Octave to discover such patterns. After acquiring data, the Binomial Theorem was used to calculate the convergence of specific quadratic equations. Further analysis of the data revealed an emerging pattern in quadratic equations; however, this research mainly focuses on the specified quadratic equations.

8:15 - Evaluating NBA Players Using Wins Produced
David Berri designed a process for evaluating NBA players by assigning each player a number of wins, the idea being the sum of wins for players on a team would equal the total team wins. This research attempted to apply Berri's process to the 2013-14 NBA season. In doing so, the results were not as accurate or precise, as what Berri produced in an earlier year. We have concluded the NBA has changed dramatically in the last 25 years, and Berri's process needs updating. This project will detail how the NBA has changed and what we would do to update Berri’s process given the time and resources.

8:30 - Graph Theory of Metabolic Pathways

First Author  Co-author
Emma Rose Robin Blankenship
Morehead State Morehead State
University University

The human body is home to numerous biological pathways, whether they are throughout the body or localized within a particular cell type. The biological pathways will be evaluated in four steps beginning with the interactions between organs and ending with the understanding of metabolic pathways. The graphs are designed to give the viewer a clear image and mastery of the connections between organs, cells, substrates and products.

8:45 - Valuable Basketball: Using Adjusted +/- To Evaluate The Morehead State Basketball Team

First Author
Will Pitts
Morehead State
University

In today’s world of sports, the question of player value has taken center stage. In basketball, there are many different statistics to model how valuable a basketball player is to his team. The most common of these is the Plus/Minus Rating, which simply measures how a player’s team does when he is on the court. The problem with this rating, however, is that it doesn't take into account any of the other players on the court at the same time. To remed this, we will use the Adjusted Plus/Minus rating to evaluate the Morehead State basketball team over the 2018-2019 conference season, before taking a more in-depth look at coaching decisions and lineup usage to try to see what MSU could have done to produce more wins last season. Using these findings, we will also try to find out what lineups MSU can use this upcoming season to have better success.

9:00 - How can linear algebra be used to improve middle and high school students mathematical concept.

First Author
Caleb Robinson
Morehead State
University

This talk takes a look at how using application heavy forms of math like linear algebra can improve students mathematical concept. Students at a middle school in eastern Kentucky are given a mathematical inventory, and after being exposed to linear algebra, students will be given the same mathematical inventory to see how students perception of math is linked to performance in the classroom as well as how students respond to linear algebra.

9:15 - How Different Mindsets affect Student's Mathematical Performance and Attitudes

First Author
Madeline Morgan
Morehead State
There are two types of mindsets: growth mindset, the belief that intelligence is malleable and can be changed with effort, and fixed mindset, the belief that intelligence is biological and cannot be changed. This survey-based research project looks for correlations between mindsets and mathematics success, as well as personal attitudes towards mathematical ability. As a future mathematics educator, the analysis of respondent data will be used to inform classroom pedagogy.

### 9:30 - Predicting Success in College Math Classes: GPA Versus ACT

**First Author**
Megan Pauley  
*Morehead State University*

Students are placed in entry level college courses based on an equation from the university’s admissions office considering the student's high school grade point average (GPA) and American College Testing (ACT) score and multiplying each by a specific weight. The goal of this capstone project is to see how well these students are placed by evaluating correlations and logistical regression between entry level math courses (specifically MATH 123, MATH 131, MATH 135, MATH 152, and MATH 175) and student high school GPA, ACT composite score, and ACT math score to calculate which is the best predictor of student success in these classrooms, and potentially create a better formula for Morehead State University to use for their admissions index.

### 9:45 - Tic-Tac-Toe: A Mathematical Nostalgia

**First Author**
Axel Brandt  
*Northern Kentucky University*

Remember when playing tic-tac-toe was fun? Viewed simply as a game for children, tic-tac-toe is perhaps not very interesting. However as a combinatorial game, it can motivate a variety of mathematical concepts. In this student-accessible talk, we discuss a variety of mathematical ideas embedded in tic-tac-toe.

### 10:00 - Who? - American Mispronunciations of Great Mathematicians' Names

**First Author**
Andy Martin  
*Kentucky State University*

Growing up in Ohio, I wondered how the city of Lima ("Lye-ma") got its name. Surely not from the Peruvian capital, else it would have been pronounced "Lee-ma." Of course, I later learned it WAS named for the Peruvian capital, and the pronunciation was and is just another example of American mangling of foreign words, even those very easy to pronounce. From Paris to Versailles, we in Kentucky are equally guilty, although we might be forgiven some, seeing as we haven't settled on the right way to pronounce "Louisville." The same occurs in science and mathematics. Come to this talk to hear a baker's dozen of illustrious names from mathematics and physics routinely mispronounced in American classrooms. Correct pronunciations will be attempted by the speaker.

### 10:15 - Newton vs Leibniz; The Great Calculus Feud

**First Author**
Dwight Smith  
*Kentucky Community and Technical College*
System

Isaac Newton and Gottfried Leibniz are both credited with the invention of Calculus. This led to a famous feud between them and their supporters as to who should get the credit. The battle was still raging when Newton died in 1727. It still is a subject of conversation, even today.
In this talk, I plan to present the facts on the controversy, and encourage the participants to form their own opinions. Even a debate here is welcome, but please keep it civil!

10:30 - 2-adic Valuations for Certain Sequences

First Author
Justin Trulen
Kentucky Wesleyan College

In this talk we will look at the nature of the 2-adic valuation of the sequences of the form of $f(n)=an^2+bn+c$ where $a$ is odd, $b$ is even, and $c$ is an integer. We will define the 2-adic valuation of a number. Time will be spent on describing the different ways to graph the resulting sequences of the 2-adic valuations. We will discuss how to classify the behavior of the 2-adic valuation of the sequences $f(n)$ with the aid of $p$-adic numbers. We will then finish the talk with a discussion of future research related to the above work.

Saturday, November 2, 2019  8:00am - 10:30am
Poster check-in - Poster Session II
Alumni Building, main lobby

Saturday, November 2, 2019  8:00am - 3:30pm
Practice Room
Room 304. MAC Science Building

Saturday, November 2, 2019  8:29am - 10:45am
Poster Session II
Alumni Building, Baird Lounge

Saturday, November 2, 2019  8:30am - 11:00am
Cellular & Molecular Biology- Poster Presentations
Baird Lounge, Alumni Building

1. - Computational Identification of Prenylated Proteins in Physcomitrella patens.

First Author       Co-author       Co-author
Ephraim Otieno     Mikayla Demetrakis  Dr. Mark Running
University of Louisville  University of Louisville  University of Louisville

Prenylation is the lipid modification of specific target proteins that have a consensus motif of CaaX at the C terminus, with the prenyl group being attached to the cysteine, representing aliphatic amino acids, and X generally being one of six specific amino acids. Prenylation plays major roles across eukaryotes, with implications in the progression of many cancers and other diseases in humans, and governing many aspects of development, differentiation,
metabolism, and environmental responses in plants. Specifically, we have found that mutations in various prenylation processes in P. patens have potential biofuel and biotechnology applications. To understand those processes better, it is necessary to identify potential prenylation targets in the genome. Our work involves database searches of the annotated genome of the moss Physcomitrella patens for targets of protein prenylation. The general project first involves finding potential target proteins based on the presence of a C-terminal CaaX motif; running the protein sequences through a prenylation prediction program to determine how likely the protein is a bona fide target; then determining the potential function(s) of the target proteins based on sequence similarity to previously-characterized proteins from other organisms (using BLAST). After identification of promising putative target proteins with potentially interesting functions, these proteins will be characterized by knocking them out in moss to determine their biological function, as well as biochemical characterization of their activities.

2. - Are telomeres required? Genetically engineering a eukaryote with circular chromosomes

First Author
Nadia Richardson
Morehead State University

Co-author
Dr. Melissa Mefford
Morehead State University

Telomeres are regions of repetitive DNA at the ends of linear eukaryotic chromosomes. While telomeres play important roles in protecting the ends of chromosomes, they cannot be fully copied by the DNA replication machinery. To overcome this end-replication problem, an enzyme called telomerase adds sequences to the 3’ end of the chromosome. Without telomerase activity, telomere lengths decrease and may be a leading cause of aging; while up-regulation of telomerase activity is implicated in >85% of cancers. On the other hand, prokaryotes have circular chromosomes that lack telomeres and these organisms have no need for telomerase. So, why did linear chromosomes, telomeres and telomerase evolve?

To begin to address this broad question, I am genetically engineering a circularized version of chromosome XVI in the yeast Saccharomyces cerevisiae. The method involves inserting DNA cassettes containing selectable markers at both ends of chromosome XVI, and then selecting for a recombination event between the cassettes that causes circularization. I have successfully confirmed integration of the DNA cassettes in both arms of chromosome XVI. I am currently attempting to select for the recombination event that will cause circularization. In an effort to increase recombination efficiency we have recently designed a CRISPR gDNA that will direct DNA double-strand breaks within our DNA cassettes. Once yeast with a circular chromosome XVI are confirmed, we will assess their relative fitness. This experimental approach may eventually shed light on the evolution of linear chromosomes in eukaryotes.


First Author
Marranne Conge
Berea College

Co-author
David Wilson
Johns Hopkins University School of Medicine

Co-author
Jordan Green
Johns Hopkins University School of Medicine

Gene therapy has the potential to effectively cure many diseases, however, there are certain challenges associated with delivering nucleic acids. Polymer poly(beta-amino ester)s (PBAEs) are a promising class of cationic polymers that are both effective for gene delivery and safe due to rapid degradation. By modulating the hydrophobicity of PBAEs, we aimed to increase nucleic acid encapsulation, and promote cellular endocytosis and endosomal escape. To achieve this, we synthesized PBAEs using amine monomers of differing alkyl side chain lengths in DMF using a Michael addition reaction followed by end-capping and ether precipitation. After synthesis of the PBAEs, the polymers and green fluorescent protein (GFP) mRNA/plasmid were mixed to form nanoparticles, which were then incubated with B16-F10 cells for 24 hours. We found that the incorporation of the hydrophobic amine groups in the polymer increased transfection efficacy (assessed a percentage of cells expressing GFP) for both mRNA and plasmid DNA compared to equivalent PBAEs with no hydrophobic amine groups. The degree of GFP expression in mRNA delivery was highest with the polymer incorporated with 1-dodecylamine. As for plasmid delivery, the more hydrophobic the polymer, the higher the degree of expression. Cell viability is not affected by the incorporation of the hydrophobic amine groups at the doses tested.

4. - Genetic interactions of tRNA anticodon loop modification genes TRM732 and TRM734 in yeast
Transfer RNA (tRNA) is a fundamental component for the production of proteins in the cell, and it requires chemical modification at many bases for proper functionality. In Saccharomyces cerevisiae, an important example of tRNA modification is 2'-O-methylation of the anticodon loop of tRNAPhe. This modification is catalyzed by the enzyme Trm7 methyltransferase, which works with accessory proteins Trm732 and Trm734 to methylate C32 and G34, respectively. In the absence of either single accessory protein, the cell is healthy. However, in the absence of either Trm7 alone or in the absence of both accessory proteins, the cell is sick. High throughput studies have identified genetic interactions of TRM7 with HDA1 and SRC1, as well as TRM732 with PUB1 and SPR2. To further study these interactions, HDA1, SRC1, and SPR2 have been knocked out in strains already lacking TRM732 or TRM734. To date, no sick phenotypes have been detected in hda1? or spr2? strains that lack TRM732 or TRM734. However, preliminary results suggest a sick phenotype for the trm734?src1? strain.

5. - Identifying JAK-Regulated Genes that Mediate Spermatid Individualization in Drosophila melanogaster

Spermatid individualization is the little-researched process by which spermatids become segregated from each other during spermatogenesis. This is performed by the formation of an actin meshwork called individualization complexes (ICs) around spermatid nuclei that will move down the spermatids and remove excess cytoplasm. Previous research has determined that JAK/STAT signaling in the somatic cyst cells is necessary for successful individualization to occur, so this project seeks to ascertain the specific genes which regulate spermatid individualization via affect of the JAK/STAT biochemical signaling pathway in Drosophila melanogaster. To accomplish this, RNA Interference knock-downs of candidate genes were performed to determine whether they have functions in individualization. Knockdowns of somatic cyst cell expression of scpr-A, scpr-B, and GP150 were each significantly higher in the number of ICs produced than their negative controls, with scpr-A also yielding an elevated ratio of ICs to nuclei clusters. The other two exhibiting proportional increases in nuclei clusters. These results indicate that the identified genotypes function in the regulation of D. melanogaster spermatid individualization but are not required for the process to occur. With continued research, such identifications will contribute to a more complete understanding of reproductive function by characterizing the little-documented biochemical mechanism for somatic-germline interaction, as well as lay the groundwork for future human-focused investigations based upon the similarities between Drosophila and mammalian spermatogenesis.

6. - Investigating the role of a V-ATPase in the Development of the Air Sac Primordia

Drosophila melanogaster is a commonly used organism in biological research. Their Air Sac Primordia (ASP) is analogous to human lungs but is studied for its behavioral similarities to tumors. This is due to the ASP metastasizing to the Wing Imaginal Disk (WID) in a manner like that of tumors. One gene found in Drosophila codes for a V-ATPase which was believed to influence the growth and development of the ASP. The V-ATPase is a vacuolar proton pump that plays a large array of roles from regulating the pH of cells internal space, to regulating endocytosis, to
processing proteins and degradation. In insects, the V-ATPase are important in establishing a membrane potential to drive K+ secretion. It has also been found to influence tracheal branching. Using RNA interference, the gene for the V-ATPase was knocked down. Data from these experiments will be presented and their significance will be discussed.

7. - Role of Apontic in ASP Development in Drosophila melanogaster

First Author: Camila Lozano
Co-author: Ajay Srivastava
Western Kentucky University

The air sac primordium (ASP), found in the Wing Imaginal Disc of Drosophila melanogaster, can be examined as a model for invasive behavior due to the properties it inhibits during development which imitate those necessary for tumor progression. The Janus kinase/signal transduction and activation (JAK-STAT) signaling pathway plays a considerable role during the development of the ASP and also has its own implications regarding tumor progression and metastasis. The gene apontic (apt), which codes for a protein expressed in the ASP, is known to be a negative regulator of JAK-STAT. In this study we investigated whether downregulation of the gene apontic had an effect on the invasive behavior of the ASP through the disruption of JAK-STAT. Using the GAL4/UAS system for targeted gene expression, we were able to knock down apontic and compare ASP development in affected lines vs. control lines. Through the downregulation of apontic, we observed an increased number of under-developed ASPs. The data presented is able to provide further understanding into the factors that could potentially play a role in the invasive behavior of tumors.

8. - A Protein Trap Screen for Genes Involved in ASP Development

First Author: Elisha VanZant
Co-author: Ajay Srivastava
The Carol Martin Gatton Academy of Mathematics and Science

A Protein Trap Screen for Genes Involved in ASP Development.
Elisha VanZant1,2, Dr. Ajay Srivastava2
1: Gatton Academy of Mathematics and Science
2: Western Kentucky University Department of Biology and Biotechnology Center

The Air Sac Primordia (ASP) in Drosophila melanogaster develops outside of the Drosophila's Wing Imaginal Disc (WID) and grows into and within it. This invasive behavior is similar to the behavior of developing metastatic tumors. Genes involved in Basement Membrane remodeling have been found to influence tumor metastasis and ASP invasion of the Wing Imaginal Disc. By utilizing protein traps and finding the genes responsible for Basement Membrane degradation in Drosophila, the genes responsible for tumor metastasis can be identified. In this study, thirty lines of Drosophila were dissected and screened for positive ASP expression in the Wing Imaginal Disc. Out of these, five lines appear to have positive expression in the Wing Imaginal Disc and one appears to have positive ASP expression. This will be followed up by knock down of the gene with positive ASP expression to note the effects on ASP invasion when the gene is not present as well as the screening of several more Drosophila stocks. The genes identified with positive ASP expression could possibly parallel genes found in tumor invasion in humans. This result will provide further reason for this gene to be studied and analyzed in the context of human cancer.

9. - Bioinformatic Analysis of an Apoptotic Gene, DAXX - An Insight Into its Molecular Evolution

First Author: Arivumani Srivastava
Co-author: Chandrakanth Emani
Western Kentucky University

The DAXX gene encodes for the DAXX protein that regulates apoptosis. The DAXX gene was shown to overexpress in patients with diverse diseases such as breast, lung, and skin cancer. A comprehensive bioinformatics based phylogenetic analysis would
better elucidate the role of this gene in humans and would help establish a molecular basis for cancer disease mechanisms. Phylogenetic analysis of the DAXX gene would help in discovering the evolutionary origins of this gene and help identify a model organism that can prove to be a valuable experimental tool to understand the function and impact of this gene on an organism. Using a variety of bioinformatics tools, we found that the closest related ancestral model organism to humans is the lab mouse, Mus musculus. Further, Danio rerio (zebrafish) and Drosophila melanogaster (fruit fly) were also found to contain this gene with 67% and 45% similarity to humans, respectively. This finding provides an opportunity to study this gene's function and biology in a tractable organism. Preliminary research in one of these model organisms could prove to be valuable and low-cost experimental tools in understanding the molecular basis of cancer and the related findings could be extrapolated to understand the functional aspects of DAXX in related diseases in humans.

10. - Cellular Targeting of Metastatic Ovarian Cancer

Emily McCord
Eastern Kentucky University

Hunter Hazelwood
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Margaret Ndinguri
Eastern Kentucky University

Lindsay Calderon
Eastern Kentucky University

Every year in the United States, an estimated 22,000 women will receive an ovarian cancer diagnosis and of those, an estimated 14,000 will fall fatal to the disease. Ovarian cancer accounts for more deaths than any other female reproductive cancer, ranking fifth in cancer deaths among women. Due to the nature of the disease, ovarian cancer is often difficult to detect in its early stages, limiting treatment options. Our recent work is focused on the development of a novel chemotherapeutic agent that will specifically target ovarian cancer cells while also exhibiting a reduction in deleterious side effects.

Previous studies have shown an overexpression of the luteinizing hormone-releasing hormone (LHRH) receptor on A2780 and A2780-cis cells. We have designed and synthesized a selective chemotherapeutic agent, Pt-Mal-LHRH, to target this receptor. Pt-Mal-LHRH attaches the LHRH peptide to cisplatin to selectively target and deliver cisplatin to the cancer cells. Platinum is used in common chemotherapeutic agents such as cisplatin and carboplatin, however, both compounds elicit detrimental side effects without targeting ovarian cancers. Further, cisplatin has high rate of resistance formation in patients.

To address whether Pt-Mal-LHRH is more selective agent than carboplatin and cisplatin, a drug uptake assay was conducted. The assay screened for platinum concentrations within the cells to show disruption and cessation of cancer growth. This assay was completed using both the A2780 and A2780-cis line of cells. The results of the assay suggest that there is a significant increase in uptake of Pt-Mal-LHRH in comparison to carboplatin in both the A2780 and A2780-cis cells. The assay further suggests that in the A2780-cis line there is a significant increase in uptake of Pt-Mal-LHRH in comparison to cisplatin.

11. - PD-1 Expression in Late Stage Breast Cancers and Their Metastases

JT Reagor
Wood Hudson Cancer Research Laboratory

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Translation initiation factor 4E (eIF4E) exhibits many characteristics of a tumor associated antigen (TAA). Since therapeutic efficacy is found in preclinical studies, the only TAA criterion not shown yet is immunogenicity. When T-cells are stimulated by the continued presence of an antigen, they become 'exhausted'. T-cell exhaustion is correlated with increased PD-1 expression. Our hypothesis is that eIF4E overexpression in human breast cancer tumor microenvironment leads to T-cell exhaustion through persistent antigen stimulation. We measured PD-1 and
eIF4E expression immunohistochemically in 78 formalin fixed paraffin embedded breast cancers. PD-1 expression was quantified by the number of positively stained lymphocytes per mm². To measure eIF4E expression, we calculated staining Histoscores (stain intensity X area stained). Not all the samples were satisfactory for analysis after staining for PD-1 due to necrosis or lack of tissue. The final sample size was 35 tissue samples with both stains. In primary tumors, there was an average of 56.2 + 7.50 PD-1 positive cells per mm²; in lymph node metastases, the average was 102.9 + 4.05 PD-1 positive cells per mm². The average eIF4E histoscore in lymph node metastases was 1.790 + 0.022, and the primary tumor average was 1.794 + 0.022. We saw a positive trend between phosphorylated eIF4E and PD-1 expression, but the R² value (0.0346) was not significant. Due to the small sample size, no conclusions can be made about the relationship between eIF4E and PD-1 yet. In order to either confirm or deny our hypotheses, more data are required.

12. - Transient Expression in Nicotiana benthamiana and Anticancer Activity of Mistletoe Lectin II

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**Introduction:** Mistletoe extracts are used as alternative medicines for cancer, mainly in Europe. These extracts comprise three major anticancer components, including ML-I, ML-II, and ML-III, all of which contain toxic (A) and a carbohydrate-binding (B) subunits connected by a disulfide bond. MLs exhibit anticancer properties by inducing apoptosis and autophagy.

**Objective:** To produce ML-II in Nicotiana benthamiana, extract and purify the protein, and test its anticancer activity in different malignant cell lines.

**Methods:** By using the GENEWARE technology, the ML-II protein was transiently expressed in Nicotiana benthamiana plants. Infectious tobacco mosaic virus (TMV) RNA transcripts were generated with the mMessage mMachine T7 kit and used to infect the plants. After plant infection, ML-II levels were assessed at different time points to determine the optimal time of protein expression. ML-II was detected and quantitated by SDS-PAGE, Western blot, and ELISA. To purify the protein from the plant extracts, fast protein liquid chromatography (FPLC) was performed on an affinity galactose agarose resin column. The MTS cell viability assay was performed to assess breast cancer MDA-MB-231 and lung cancer H460 and A549 cells after 72 hours of treatment with dilutions of ML-II starting at 10¹⁴g/mL. Microscopy was used to assess morphological changes.

**Results:** ML-II was successfully expressed in Nicotiana benthamiana, with the highest expression level obtained at 15 days post infection (30 mg/kg fresh tissue weight). In addition, ML-II bound to asialofetuin and showed anticancer activity against H460 cells with an EC50 of 1.8¹⁴g/mL. The other two cancer cell lines showed no susceptibility to ML-II in the MTS assay; however, cytotoxicity was observed by microscopy.

**Conclusion:** These findings confirm that ML-II can potentially be used for cancer treatment in the future and deserves further investigation.

13. - Computational Identification of Prenylated Proteins in Physcomitrella patens.

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Prenylation is the lipid modification of specific target proteins that have a consensus motif of CaaX at the C terminus, with the prenyl group being attached to the cysteine, representing aliphatic amino acids, and X generally being one of six specific amino acids. Prenylation plays major roles across eukaryotes, with implications in the progression of many cancers and other diseases in humans, and governing many aspects of development, differentiation, metabolism, and environmental responses in plants. Specifically, we have found that mutations in various prenylation processes in P. patens have potential biofuel and biotechnology applications. To understand those processes better, it is necessary to identify potential prenylation targets in the genome. Our work involves database searches of the annotated genome of the moss Physcomitrella patens for targets of protein prenylation. The general project first involves finding potential target proteins based on the presence of a C-terminal CaaX motif; running the protein sequences through a prenylation prediction program to determine how likely the protein is a bona fide target; then determining the potential function(s) of the target proteins based on sequence similarity to previously-characterized proteins from other organisms (using BLAST). After identification of promising putative target proteins with potentially interesting functions, these proteins will be characterized by knocking them out in moss to determine their biological functions in the moss.
Misexpression of Tau protein aggregates is a defining characteristic of a class of human neurodegenerative diseases called tauopathies. Orthologs of Tau also influence the neural health of aging over the lifespan of other animal model systems. For example, misexpression of the Caenorhabditis elegans Tau ortholog PTL-1 triggers age-dependent neurodegeneration. Genetic screens in Drosophila have also identified the ortholog of the puromycin-sensitive aminopeptidase (PSA) as a suppressor of Tau-induced neurodegeneration. As a result, we examined the role of the C. elegans PSA ortholog, pam-1, on the neurodegeneration of worms as they age. Hypomorph and loss of function pam-1 alleles were independently crossed with two transgenic strains that illuminated GFP-labelled touch receptor and GABAergic neurons, respectively, to generate reporter strains of pam-1-dependent neurodegeneration. The worms will be screened daily under a GFP microscope, with any phenotypes of neurodegeneration (blebbing, beading, and branching of either the cell body or axon) recorded. This study is ongoing, and our data will be presented.

Orthologs of the conserved puromycin-sensitive aminopeptidase (PSA) governs fertility in numerous model organisms. For example, adult Caenorhabditis elegans harboring a mutation in the PSA ortholog, pam-1, exhibit reductions in both brood size (65% compared to wild-type) and viability (14% compared to wild-type). A recent screen in our lab has identified a suppressor allele that mitigates the effects of the mutant pam-1. This suppressor allele of pam-1, called spam-1, is able to rescue the brood size and viability to near normal values. The goal of our research is two-fold: first, to map spam-1 in C. elegans using two-point mapping techniques, and second, to identify and clone spam-1.

C. elegans has six chromosomes, five autosomes, and an X chromosome. We crossed the suppressed pam-1; spam-1 double mutant into two different, marked strains, MT464 and MT3751. MT464 possesses marked, visible phenotypes associated with chromosomes IV, V and X. MT3751 possesses marked, visible phenotypes associated with chromosomes I, II, and III. By observing the ratios of suppressed vs. non-suppressed F2 animals segregating with each visible marker, we will be able to map the spam-1 locus to a specific chromosome. Our goal is to reduce the location of spam-1 to a tightly defined region as to enable the sequencing of candidate genes.

Diabetes mellitus is a world epidemic, currently affecting 10% of Americans. This number is expected to rise in the coming years. Although diabetes is well-studied, there are many aspects concerning the role of various genes throughout pancreas development and how mutations can lead to diabetes that are not understood. Sox4, a transcription factor from the SoxC family of proteins, may play an important role in pancreatic development. In zebrafish, sox4b, an ortholog to human Sox4, is expressed in endocrine pancreatic cells and thought to play a role in islet cell determination. Knockdown of sox4b in zebrafish by morpholinos resulted in decreased pancreas size, suggesting a delayed development or impaired function. These sox4b morphants also displayed previously documented phenotypes, including coloboma and heart edema. In addition to studying sox4b morphants, we have a line of sox4b mutant zebrafish that were generated by CRISPR/Cas9. In sox4b maternal zygotic mutants, there was
increased variability in whole body glucose concentrations. This may be due to an inability to regulate glucose properly. Overall, our data demonstrates that Sox4b has a role in pancreatic development. Further study of Sox4b will continue to better our understanding of zebrafish pancreatic development and glucose regulation.

17. - Characterization of insulin regulation in zebrafish

Gabrielle Kennedy
Murray State University

According to the American Diabetes Association and the CDC, roughly 29 million Americans have diabetes. The pancreatic hormone, insulin is critical for maintaining normal blood glucose levels by signaling cells to take up glucose. Defects in insulin production or secretion are associated with the development of metabolic diseases such as diabetes. Expression of insulin, which is produced and secreted exclusively by the ß-cells of the pancreas, is mediated by a number of transcription factors that associate with the proximal promoter of the insulin gene. The zebrafish has emerged as a powerful model for the study of pancreas development for several reasons including short generation time, rapid development, and amenability to genetic techniques. Despite its widespread use as a model organism, little is currently known about the transcriptional regulation of insulin in the zebrafish. We have isolated and characterized the zebrafish insulin promoter. We demonstrated that the proximal insulin promoter in zebrafish shows little similarity to mammalian insulin promoters and is regulated by only a small subset of mammalian insulin regulatory proteins. Nonetheless, zebrafish maintained on a high-glucose, high-fat diet exhibited defects in blood glucose homeostasis resembling a pre-diabetic state observed in mammals prior to diagnosis of type-2 diabetes. Collectively, these data indicate that although there exist important differences in insulin regulation between mammals and fishes, the zebrafish may serve as an important model for understanding the development of diabetes.

18. - Spatiotemporal Expression of GLIS3 in Developing Zebrafish

Tasha Swenney
Murray State University

The transcription factor Gli-similar 3 (Glis3) has been shown to play critical roles in the development and maintenance of insulin producing ß-cells in the pancreas and mutations within the human GLIS3 locus are associated with several pathologies including diabetes mellitus. In mice, Glis3 is expressed in the endocrine progenitor cells of the pancreas, but its roles in endocrine cell specification, beta cell maturation, and postnatal expansion are unclear. The zebrafish is a rapidly emerging model of pancreas development but little is known about glis3 expression in this model organism. We have characterized the spatio-temporal expression of glis3 in the zebrafish during early pancreatic development.

We found that glis3 is expressed in embryos between 12-24 hpf when the expression was mostly limited to the brain and pronephros. By 72 hpf, expression was evident within the pancreas suggesting a possible role in secondary islet generation or beta cell mass expansion. Morpholino knockdown of glis3 in zebrafish resulted fish that had a more restricted area of insulin expression and a disruption of the normal islet architecture suggesting that glis3 is not required for ß cell specification in zebrafish, per se, but may have roles in subsequent ß cell expansion and distribution. Collectively, these results indicate that glis3 is important in pancreatic development in zebrafish and may provide valuable insight into human pancreas development and the etiology of diabetes.

Saturday, November 2, 2019 8:30am - 11:00am

Ecology - Poster Presentations

Baird Lounge, Alumni Building

20. - Moss Diversity Between Mesic and Xeric Cliff Talus

First Author
We collected and identified different moss species growing in the unique microhabitat created on cliff taluses, located at the Breaks Interstate Park in eastern Kentucky and southwest Virginia. We determined what variables along the cliff taluses affect moss species richness between mesic and xeric cliff taluses. We also documented the different mosses found at the Breaks Interstate Park. We collected and identified over 300 specimens, 49 different species with 18 common to both habitats, and 16 found only in xeric and 15 found only in mesic environments. The results showed that between the different taluses there is not much difference in species richness, but there is a major difference in the types of species growing on the xeric vs. the mesic taluses.

21. - Assessing the Influence of Greening in Urban Residential Neighborhoods on Biodiversity and Human Health

Globally, the functioning of ecosystems and the services they provide are declining due to human-driven landscape conversion, fragmentation, and degradation. In response, there has been increased efforts to restore ecosystem functions in degraded landscapes, including greening in urban environments. This degradation, specifically the ecological systems that support green vegetation, have to be associated with poor human health outcomes. Our objective is to assess the broader biodiversity associated with urban greening and relate that to human health outcomes. Specifically, we are monitoring birds, bats, and arthropods within greening (n=34) and control areas (n=106) in residential neighborhoods in Louisville, Kentucky. Our sites are a part of the Greenheart Project, a five-year prospective interventional clinical trial. We collected pre-greening data from urban sites in July/August 2019 and will collect post-greening data next summer. We use point counts to document birds, Pollard walks for butterflies, vacuum sampling for non-butterfly arthropods, and bioacoustics for bats. We observed 54 bird and 11 butterfly species combined across urban sites. We are currently processing arthropod and bat samples and plan to quantify species richness and overall diversity, across all taxonomic group studied and by guilds and will compare these metrics between greened and non-greened sites. While there is little insight of the effects urban greening has biodiversity, a previous study found greater bird species richness within greened areas compared to random urban areas without greening in Boston, Massachusetts (Strohbach et al. 2013). Similarly, we expect increases in richness/diversity among surveyed taxa in pre-greening versus post-greening assessments.

22. - Use of eDNA in detection of northern dusky (Desmognathus fuscus) and southern two lined salamanders (Eurycea cirrigera)

Environmental DNA (eDNA) utilizes DNA released from aquatic organisms into the environment to detect their presence and provides an effective, non-invasive method to determine organism presence or absence in an efficient manner. We developed species specific eDNA primers for southern two-lined (Eurycea cirrigera) and northern dusky (Desmognathus fuscus) salamanders. Primers and probes were designed based on cytochrome b sequences
amplified from specimens collected from the study site using published primers. The developed eDNA primers proved specific to the appropriate target species in tissue tests with all sympatric salamander species. Three amplicons from field collected samples were cloned and sequenced for each species to verify species identity. The data obtained should add to the growing pool of knowledge concerning eDNA monitoring of salamander species and should provide useful reference data and molecular tools for future monitoring or range delineation studies.

23. - ORIGINAL AND DAUGHTER PLANT ARBUSCULAR MYCORRHIZAL FUNGI COLONIZATION IN TRIFOLIUM STOLONIFERUM

First Author  Co-author
Kaitlyn Brewer  Jennifer Koslow
Georgetown College  Eastern Kentucky University

ORIGINAL AND DAUGHTER PLANT ARBUSCULAR MYCORRHIZAL FUNGI COLONIZATION IN TRIFOLIUM STOLONIFERUM

Running Buffalo Clover, Trifolium stoloniferum, is a perennial plant native to Eastern and Midwestern states that reproduces asexually by rooting new ramets from extended stolons, as well as through fruit production. Trifolium stoloniferum is most common in disturbed forests with partial shade. It is known for its association with buffalo once native to the same areas, but now extinct. It is hypothesized that the clover lived in areas associated with buffalo because buffalo provided intermediate disturbance that suppressed competitors and nitrogen and added phosphorus via feces. It is likely that the association with buffalo is why that T. stoloniferum lacks rhizobia in its roots. Specifically, associations with arbuscular mycorrhizal fungi (AMF) may take on a larger role in nutrient acquisition for T. stoloniferum due to the loss of nitrogen fixing associations. These fungal symbionts penetrate the roots of T. stoloniferum and form arbuscules, which house haustorial organs for nutrient exchange. We collected and stained root samples from plants in three restoration populations of T. stoloniferum at Taylor Fork Ecological Area on the campus of Eastern Kentucky University in Richmond, KY in July 2019. Root sampling and staining were performed in order to determine if there would be a difference of AMF colonization in original and daughter plants, as well as plants known to be from the same genet. There was no significant relationship between original plant and daughter plant colonization or when comparing plots, but preliminary data suggests daughter plants had more AMF abundance than original plants.

24. - Analysis of social interactions in groups of zebra fish (Danio rerio).

First Author  Co-author
Miriam Obley  Victoria Braithwaite
Asbury University  Pennsylvania State University

Fish are widely used in academic research. However, not much is known about how they react to various stimuli commonly used in animal studies. By analyzing the social interactions between fish and comparing them to other animals, a better understanding of the cognitive and collective aspects of fish can be gained. A total of 36 zebra fish (Danio rerio) were separated into groups of three and tested as a group to see how long it took for the group to discover which of three compartments contained a food source. Each fish was then tested individually in a tank containing a novel object. The data collected was used to determine the type, leader or follower, present in each group. This information was used to indicate whether type had an influence over group cooperation. This data adds to how we understand fish in a research setting and their social interactions in groups.

25. - Fish-host identification of Louisiana Fatmucket, Lampsilis hydiana

First Author  Co-author
Jonathan Frommeyer  Chris Lorentz
Thomas More  Thomas More
University  University

Freshwater mussels have a unique life cycle in that they require a fish hosts to receive their nutrients during their larval stage. The larval form, called glochidia, are released into the water by processes such as dispersal or the use of a lure to attract fish for direct contact onto fish gills. This study attempts to determine fish hosts for Louisiana Fatmucket (Lampsilis hydiana), of which only Green Sunfish (Lepomis cyanellus) was known, using nine different
species and eleven individuals. The glochidia were extracted from the mussel using a hypodermic needle and the gills were directly infected. The fish were left in tanks for three to four weeks with water changes every other day. The tanks were siphoned through a 100-micrometer sieve and all contents were examined under a microscope to locate juveniles. Results concluded that Spotted Bass (Micropterus punctulatus) are a confirmed host for Louisiana Fatmucket. Further experiments should be conducted to further confirm the observed fish host as well as investigate any potential new hosts.

**26. - Marine Animal Husbandry**

*First Author*
Rachael Foster  
*Thomas More University*

The Biology Department saltwater aquarium faced issues including nuisance hair algae, cyanobacteria infestations, and uncontrolled predation as a result of poor tank care, improper feeding, inadequate lighting, and an inefficient filtration system. The goal of this project was to develop a filtration and water quality system and protocol to improve tank health. Logs were created to track maintenance, water quality, and feeding. Weekly water chemistry tests and daily organism checks monitored tank health. A refugium containing an assortment of macroalgae species was constructed to remove excess nutrients from the tank. To eliminate cyanobacteria and algae, a sump filter with a phosban reactor and protein skimmer replaced the old canister filter. LED reef lights with an appropriate spectrum were implemented to promote coral growth. Improving the quality of tank maintenance and incorporating better filtration and lighting improved water quality and organism health and reduced predation.

**27. - Twenty Years of Change (1997-2017) in an Old-growth Forest Community at Boone Cliffs Nature Preserve (Burlington, KY)**

*First Author*
Shannon Galbraith-Kent  
*Thomas More University*

Many eastern deciduous forests are changing in species composition and diversity due to a variety of conditions. In this study, using three sample years (1997, 2009 and 2017), we compared the tree community on the south-facing ridge of the mixed mesophytic, old-growth forest at Boone Cliffs Nature Preserve (Burlington, KY), with particular attention to the effects of the emerald ash borer (EAB) (Agrilus planipennis). In each sample year, six established circular plots (0.04 ha/plot) at 30-meters apart were used to measure trees [> 3.5 in diameter breast height (DBH)]. Overall, we found a minimal decline in tree species diversity, based upon the Index of Species Evenness (J') (1997=1.7, 2017=1.5), the Shannon-Wiener index of species diversity (H') (1997=0.68, 2017=0.64), and total richness (1997=12 species, 2017=10 species). Both tree community density (416 to 450 trees/ha) and basal area (25.8 to 31.4 m2/ha) had increased over 20 years, suggesting both recruitment into the tree class size (>3.5 in DBH) and growth of established trees. However, the community of this south-facing ridge is changing, as the species with the second-highest IV in 1997, the American white ash (Fraxinus americana), has been eliminated by EAB [IV: 46.58 (1997), 0.00 (2017)]. In 2017, this community is more dominated by sugar maple (Acer saccharum) [IV: 106.84 (1997), IV=127.91 (2017)], while light gaps resulting from ash dieback appear to be allowing shade-intolerant species (e.g., Quercus spp., Carya spp., Robina pseudoacacia) a greater importance in the community. We hope our study can serve as an example of dynamic trends in similar eastern forests.

**28. - A Natural History of Plants in Uplands of the Blood River Watershed, KY**

*First Author*
Talon Gower  
*Murray State University*

Long-term studies show connections between plant biodiversity and ecosystem functioning (e.g., soil fertility, aboveground and belowground biomass) and stability. There is concern that this biodiversity is being lost in regions of the U.S. where lands are harvested for timber or converted to agricultural practices. My objective is to conduct an
inventory of plant biodiversity in a 1 km²-plot of land in the Blood River watershed, KY. I am specifically interested in identifying regionally undocumented, rare and/or endangered herbaceous plant species, and identifying the habitats in which they occur. The Blood River watershed (~ 334.7 km²) is composed predominantly of forest (56%) and agricultural lands (26%), and portions have been subjected to logging in recent history. I conducted the inventory across lowland forest, highland forest, and grassland habitats within the study area. The forest understory and overstory have been left undisturbed for over 40 years, while the grassland is mowed on a bi-annual schedule. During surveys in spring and fall of this year, I obtained approximately 200 plant specimens. Some notable herbaceous species include Lilyleaf Twayblade, Green Adder's Mouth, Culver's Root, Slender Whiteflower Beardtongue and Yellow Lady Slippers. Initial findings suggest that this site has the potential to possess habitats required for a multitude of rare and endangered species. Being in possession of such land is a valuable resource that can be used for further research projects.

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Amur honeysuckle (Lonicera maackii) is a woody invasive shrub introduced from Asia that grows aggressively and has a negative impact on local fauna. Within the past decade, a native fungal pathogen, honeysuckle leaf blight (Insolobasidium deformans (C. J. Gould) Oberw. & Bandoni), has emerged and has been shown to reduce honeysuckle growth by causing significant leaf loss. The purpose of our study was to find the correlation between leaf blight and growth in honeysuckle shrubs. Ten shrubs at NKU REFS (Field Station) were selected, and both diameter and length of stem sections were measured using a micrometer and meter tape. Volume was calculated for current and old growth separately, and leaf blight on each shrub was estimated using a six-point scale. We developed allometric equations that use diameter at 10 cm to predict both old and new stem growth. There was also an excellent correlation between our volume equations and biomass equations previously developed for this species. Our results indicated strong a positive correlation between total stem volume and leaf blight extent. This suggests that larger shrubs are more susceptible to leaf blight than smaller shrubs and can be slowed by the pathogen.

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Invasive species are a threat to native plant diversity. Microstegium vimineum (Japanese stiltgrass) is a shade tolerant grass native to South and East Asia that has invaded much of the eastern United States. Although some researchers expect that intact biological systems will resist invasions by novel species, natural disturbances such as treefall gaps still provide openings in these communities. We observed that M. vimineum appeared to be more abundant in light gaps in Lilley Cornett Woods, an old-growth forest in southeastern Kentucky. We visited 41 patches of M. vimineum and estimated its percent coverage in 4m x 4m plots. We also used hemispherical photography to determine the percent canopy openness in these locations. Finally, in 14 plots, we also removed M. vimineum to determine the plot-level biomass as a check on our coverage estimates and to help manage this invasive species. We ran three linear regression to assess relationships among the three variables. There was no relationship between canopy openness and either percent coverage or biomass. Percent coverage and biomass had a strong positive relationship. From this, the data supports the statement that M. vimineum is a shade tolerant species when growing in an old-growth forest, which intensifies the need for removal. We also used the program MaxEnt, a niche modeling service, to model the distribution of M. vimineum in the northeastern United States. These models give insight for management practices, probability distribution maps, and predicted density of growth for M. vimineum.

32. - Macroinvertebrate diversity in urban vs rural streams after storm events

First Author | Co-author | Co-author | Co-author
--- | --- | --- | ---
Jessi Urichich | Abby Hutcheson | Olivia Blasdel | Chris Lorentz
Thomas More | Thomas More | University of Evansville | Thomas More
University | University | University | University

Increased flooding from frequent storm systems threatens infrastructure as well as stream ecology. The importance of stormwater management will escalate in order to control the influence of increased runoff on stream stability and biological communities. After a series of storm events, macroinvertebrate diversity shifts as substrate and streambed morphology changes. Twelvemile Creek, a stream with a predominantly agricultural watershed, and Taylor Creek, a stream with an urban watershed, were sampled during a chain of rain events and the diversity of macroinvertebrates over time was studied. Twelvemile Creek had a smaller Shannon-Weiner Index value (1.17) than that of Taylor Creek (1.55) 48 hours after the first storm. However, Twelvemile Creek yielded a larger diversity index value (1.10) than that for Taylor Creek (0.14) 48 hours after the second storm. The diversity index values for Twelvemile Creek were more consistent than those of Taylor Creek, however the data implicates that successive storm events may decrease macroinvertebrate diversity and overall recovery in urban streams.

33. - Summer Insect Emergence from Beaver Ponds of a Restored Headwater Valley in the Daniel Boone National Forest

First Author | Co-author | Co-author | Co-author | Co-author
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Dakota Mullannix | Amy Braccia | Jesse Robinson | Michael Croasdaile | Arthur Parola
Eastern Kentucky University | Eastern Kentucky University | The Stream Institute, University of Louisville | The Stream Institute, University of Louisville | The Stream Institute, University of Louisville

Emergence of aquatic insects provides a transfer of energy from aquatic habitats to surrounding riparian areas, which maintains ecosystem productivity and diversity. Studies have shown that emergence is influenced by factors such as habitat complexity, thermal heterogeneity, and availability of oviposition substrates. But little is known about the influence of depth on emergence in beaver ponds. The objective of our study was to measure the abundance and richness of emergent aquatic insects from recently established beaver ponds of a restored headwater valley during early summer. More specifically, we investigated emergence patterns between deep, open water and shallow, marginal microhabitats. We randomly placed four floating emergence traps in deep-water microhabitats and four traps in shallow-water microhabitats on three separate occasions during early summer 2019. The traps were deployed on Tuesdays and retrieved approximately 48 hours later. Insects from the emergence traps were preserved in ethanol, identified to morphospecies, and counted. We collected 428 individuals and 17 taxa from deep depths and 1,099 individuals and 22 taxa from shallow depths. Collections from both habitats were numerically dominated by midges. Results from a two-sample t-test indicated significantly greater abundance from shallow depths than from deep depths.
deeper depths, yet no significant difference in richness. These findings provide an estimate of emergence from beaver ponds during early summer, but similar studies should be conducted during other seasons. The findings also have implications for future studies that aim to compare emergence between restored and unrestored headwater valleys, and indicate that shallow, marginal habitats should not be overlooked.

34. - Assessing the Influence of Stress and Behavior on Susceptibility to and Recovery from Snake Fungal Disease in the Timber

First Author: John Hewlett  
Murray State University

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Since 2006 Snake Fungal Disease (SFD; caused by the fungus Ophidiomyces ophiodiicola [Oo]) has been documented as causing mortality in some wild snake populations but causes of the disease are still unclear. We are investigating the effects of baseline and elevated corticosterone and corticosterone reactivity on snake fungal disease dynamics and 2nd and 3rd order habitat selection in a population of Timber Rattlesnakes (Crotalus horridus). In 2018, we captured and transmittered 10 C. horridus in the Land Between the Lakes National Recreation Area and aim to capture an additional 10 in 2019. From the point of capture through late October, we tracked each individual every 72 hours and will continue tracking them during summer and spring 2019. Blood and swab samples were collected once per month from each individual to quantify baseline and elevated corticosterone and Oo presence, respectively. We analyzed corticosterone using an enzyme-linked immunosorbent assay and determined the presence of Oo using quantitative polymerase chain reaction. Additionally, we measured habitat attributes at used and random locations once per month to quantify habitat selection. We will present preliminary data on Oo detection, corticosterone, and habitat selection.

35. - Use of eDNA in the detection of northern water (Nerodia sipedon) and queen snakes (Regina septemvittata).

First Author: Elle Beery  
Asbury University

Environmental DNA (eDNA) utilizes DNA released from aquatic organisms to detect their presence in the environmental and provides an effective, non-invasive method to determine organism presence in an efficient manner. The majority of eDNA studies to date have focused on aquatic species such as fish and amphibians although the number of studies targeting reptile species that live in close association with aquatic systems is expanding. Initial reptile studies targeting turtle and snake eDNA report success in detecting these species, although low detection and some instances of non-detection, particularly for squamates, have been reported. Northern water (Nerodia sipedon) and queen snakes (Regina septemvittata) live in aquatic habitats and are common throughout much of the U.S. We developed and tested tools to detect these snakes using eDNA. Cytochrome b was amplified and sequenced for each species using published primers. Species specific primers targeting a short (approximately 105 BP) region of cytochrome b in each species were then developed and these primers tested against target and non-target snake tissue extracted DNA. These data provide molecular tools enabling use of eDNA to detect these widespread organisms in future studies.

36. - Do amphibian populations at geographic range margins exhibit reduced capacities for phenotypic plasticity?

First Author: Abigail Odegard  
Eastern Kentucky University

Rapid global climate is predicted to eliminate 11 – 17% of species by the end of the century, yet phenotypic plasticity may reduce extinction risk by buffering species from climate change. Such assumptions, however, contradict relationships between genetic diversity and range position, as geographically peripheral populations often exhibit reduced genetic diversity, resulting in populations that may be ill-prepared to withstand climate change. We assessed
phenotypic plasticity in tadpoles (Cope’s Gray Treefrog, Hyla chrysoscelis) from geographically central and peripheral populations in response to two ecological stressors: reduced hydroperiod and predation risk. Tadpoles from peripheral populations exhibited increased growth rates under predation risk and increased tail length: depth ratios, which indicate development towards greater thrust for escape from predators. Data from hydroperiod experiments are still being analyzed, but results to date indicate that peripheral populations may be just as capable, or even more capable, of phenotypically plastic responses to stress. While our findings are limited to small sample sizes from this pilot study, if such patterns are reinforced in more comprehensive future studies, a reconsideration of the hypothesized pattern of central-peripheral variation in phenotypic plasticity, and its roles in response to global climate change, may be necessary.

37. - State Conservation of North American Amphibians: Effects of Range Fraction and Biodiversity Hotspots

First Author  Co-author  Co-author
Evan Moser  Kelly Watson  Cy Mott
Eastern Kentucky  Eastern Kentucky  Eastern Kentucky
University  University  University

The abundant center distribution hypothesis (ACH) predicts decreasing population densities as range margins are approached, but tests of the ACH are hindered by the logistical difficulties of range-wide sampling. Assessing species’ state-level conservation statuses could represent a viable alternative to range-wide sampling in tests of the ACH, given that sparser populations at range margins are more likely to elicit elevated conservation statuses. We hypothesized that states exhibiting small range fractions (i.e., marginal populations) of a species would exhibit elevated state-level conservation statuses. Using state-level conservation statuses for thirty North American amphibian species, we used linear regression to examine relationships between conservation status and the fraction of a species' range located within that state. State, species range size, and range fraction within a state significantly affected state-level conservation status. Generally, smaller range fractions within states were associated with peripheral populations exhibited higher state-level conservation statuses, and a) smaller states and b) species with larger range sizes tended to exhibit higher state-level conservation statuses. State-level conservation statuses appear to reflect the patterns predicted by the ACH, and for anurans specifically, these results are in agreement with results from in situ population density estimates. Therefore, these results promote the use of conservation status across species ranges’ as a viable test of the ACH.

38. - Lightning damage facilitates beetle colonization of tropical trees

First Author  Co-author  Co-author
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Georgetown College  University of Louisville  University of Louisville

Lightning is an important source of natural disturbance in many forests. Lightning damage to trees facilitates beetle infestations in some temperate forests, but lightning-beetle associations remain unexplored in the tropics. The goal of this study was to estimate the abundance of beetles infesting lightning-damaged trees in a Panamanian forest. I compared the number of beetle holes on tree trunks between tropical trees in ten lightning strike sites and ten control sites. Lightning-struck trees had significantly more beetle holes than control trees. The abundance of beetle holes increased with increasing crown dieback in both struck and control trees. Beetle holes in struck trees increased with diameter but did not change with distance from the central tree in a site, whereas beetle holes in control trees decreased with distance but did not change with diameter. Trunk sections of trees in strike sites with a damaged crown section above also had higher beetle hole abundance. These results suggest that lightning damage increases beetle colonization in tropical forest trees. Future research will include measurements of beetle damage in trees that died from causes other than lightning, and determination of the species composition of beetles attacking lightning-damaged trees.

39. - Bat species richness and activity in wetland and riparian habitats in Appalachia.

First Author  Co-author  Co-author  Co-author  Co-author
Elizabeth Pottinger  Victoria Long  Philip Allagas  Richard Carter
Asbury University  East Tennessee State University  East Tennessee State University  East Tennessee State University
Riparian and wetland habitats are attractive to foraging bats due to both the presence of abundant water and insect populations. However, variation in factors such as insect composition, vegetation, and water chemistry may result in species-specific foraging preferences. Surveys of bat species richness and activity were conducted in wetlands in east Tennessee as well as riparian habitats over a ten-week period in the summer of 2019. Bat activity was sampled through acoustic monitoring using SM4 BAT FS detectors by Wildlife Acoustics. Calls were analyzed using SonoBat 4 to quantify bat passes and identify species. Overall bat activity was measured at each location by quantifying bat passes recorded. These data will further clarify the foraging preference of bats with regard to habitat type, known to be related to species morphology and echolocation calls. The results of this study will also further the understanding of bat activity in wetlands, furthering the potential use of bats as bioindicators in these threatened systems.

40. WITHDRAWN - Bee Abundance in Three Managed Grassland Types on the WKU Green River Preserve

First Author
Emily Russ
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Co-author
Albert Meier
Western Kentucky University

Bees provide pollinator services to wild plants and important crops. There is now evidence of bee declines due to numerous factors including habitat loss, pathogens, pesticides, and climate change. In my study, we used bee bowls and sweep nets to sample bee species populations and densities in three replicated, human-managed, grass-dominated habitats on the WKU Green River Preserve. Preliminary results show that fields dominated by pollinator plantings had the highest abundance and diversity of bees. Mowed fescue fields contained the second highest abundance of bees. Surprisingly, we found the fewest bees in the tall grass fields which were planted to meet the requirements of the Conservation Reserve Enhancement Program. Future conservation plantings in the karst plain should consider these findings where pollination is an important goal.

41. - Estimating bird productivity and survivorship following native grassland restoration

First Author
Natalie Sweeting
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Co-author
David Brown
University

Co-author
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KY Department of Fish and Wildlife Resources

Songbirds that use early successional habitat are in decline. In 2012, the area around a bird banding station, located in Shaker Village, Kentucky, was restored from an old field by removal of nonnatives and planting of native warm season grasses. To measure the success of the restoration, data from the bird banding station that followed protocols of the Monitoring Avian Productivity and Survivorship Program were used to test for population trends of songbirds before and after restoration. Eight species that had n>100 captures were included in analysis. We addressed how the restoration affected apparent survival, probability of capture, and changes in productivity and population trends. Because many individual birds were only captured once, we used transient models to estimate apparent survival of non-transients before and after restoration. Apparent survival increased for Field Sparrows, Song Sparrows, and Common Yellowthroats following the restoration and decreased for Indigo Buntings, American Goldfinch, Gray Catbird, Yellow Breasted Chat, and Northern Cardinals. Productivity, the proportion of juveniles, was not influenced by the restoration. Population trend and capture probability were estimated with temporal symmetry models. Capture probability decreased following restoration in American Goldfinches, Gray Catbirds, and Northern Cardinals. The warm season grass restoration had a positive effect on population trends of Gray Catbirds and Yellow-breasted Chats and a negative effect on population trends of Song Sparrows. It appears that the restoration has benefited some early successional species but further monitoring is recommended.

42. - Is Fragment Size or Fragment Number More Important to Moth Biodiversity in Iowa Prairie Fragments?

First Author
Andrew Seiler
Thomas More College

Co-author
Andrew Forbes
University of Iowa

The state of Iowa has historically been covered in woodlands, wetlands, and tallgrass prairies. Of the 30 million
original acres of Iowa prairie, less than one-tenth of one percent still exists as remnants or as a result of recent restoration projects. Vegetation-driven restoration is popular in the United States, but most organisms in an ecosystem are animals. One of the most specious taxa is Insecta, and of this group, Lepidoptera are highly charismatic and conspicuous along with both host-specific and generalist feeding habits, offering unique insight into prairie systems. This study to identified and quantified moth individuals captured in prairie fragments around Iowa City, using this data to calculate indices investigating these sites. All sites were found to experience similar values for both the Shannon and Simpson Biodiversity Indices; however, the Jaccard Similarity Index indicates high percentages of species difference between one site. This expresses the regional biodiversity may increase with the number of fragments, calling for the need to establish more prairie restorations.

43. - The effects of glutamate exposure on roots growth and physiology of Arabidopsis thaliana: Pharmacological and electrophy

First Author
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Robin Cooper
Univ of KY

The ability to understand the regulator factors in the growth of plants has far reaching applications from developing cost efficient means of growing plants to being able to control growth for such conditions as altered environments on earth as well as inhabiting space with reduced gravity. Our study uses the model plant Arabidopsis thaliana. The culturing of the plant in agar, with physiological salts, allows the roots to be visualize for changes in morphology and to measure electrical potentials associated with exposures to compounds such as glutamate. Constant glutamate exposure to the roots decreases length of the primary root and promotes secondary root growth. We are addressing how agonists and antagonist to glutamate receptors impacts the root growth to help in pharmacologically identifying the receptor subtype. We are also addressing what are the effects of periodic exposure of glutamate on the branching and growth rate of primary and secondary roots since glutamate receptors in animals show a desensitization to glutamate. In addition, since CO2 exposure is known to block the response of glutamate receptors to glutamate in Drosophila and crayfish neuromuscular junctions, we are testing if CO2 exposure to the root tips also block the roots response to glutamate. Robin Cooper is the KAS sponsor member.

44. - The studies of mutually symbiotic electrophysiology between Arabidopsis thaliana and mycelial networks.

First Author
Matthew Thomas
University of Kentucky

The behavior of nodal networks and feedback loops are often nonlinear and become more difficult to model as complexity increases. The number of interconnections in an ecosystem produces a higher level of stability by decreasing the response time to given threats at the nodal level, and thus increases the adaptability of the ecosystem as a whole with the aid of 'genetic learning'. This increase in adaptability makes networking evolutionarily favorable. In this study I propose to implement the model plant Arabidopsis thaliana, in symbiosis with a mycorrhizal fungi, to see if Action Potentials (APs) are solely individualistic, or if they are also used by the network for holistic goals. A. thaliana will be grown in agar which will make root visibility possible and will help visually confirm mycorrhizal connections. A mycelial ‘bridge’ will be placed in between the root systems of the two A. thaliana and allowed to grow onto the roots. An AP will then be generated by subjecting A. thaliana 1 to a stimulus. The goal is to see if this AP travels down through the roots and triggers an AP in the mycelium, thus triggering an AP in A. thaliana 2. We will also observe if the triggered response in A. thaliana 2 then causes a chain reaction AP to occur in the mycelial ‘bridge’ and finally, in the originally stimulated A. thaliana 1 as well.

Saturday, November 2, 2019  8:30am - 10:45am

Geology - Poster Presentations
Baird Lounge, Alumni Building

45. - High Resolution Stratigraphy of the Lexington Limestone (Ordovician) within Cores and Outcrop
The Lexington Limestone (Ordovician) crops out in central Kentucky and was deposited in shallow marine environments on a carbonate platform. It is chiefly limestone but contains a significant amount of shale interbeds. Distinguishing between limestones and shale lithology is important for interpreting depositional environments, correlation of strata, and recognizing hydrologic properties. One objective of this study is to provide lithologic information that may be useful when constructing a water budget for the city of Lexington, Kentucky. The Lexington Limestone had been extensively studied and mapped, particularly by the USGS, however it has not been examined on the centimeter scale. Several members of the Lexington Limestone are defined by their bedding, which is likely controlled by stratigraphic shale occurrence. We seek to tie subsurface shale content to surface bedding patterns to correlate formal units into the subsurface. We use pre-existing core, housed at the Earth Analysis Research Library (EARL) operated by the Kentucky Geological Survey (KGS). The drill sites lie along a 14-km transect from northwest to east Lexington, where our outcrop is located. Geologic quadrangle maps were used to estimate the thickness of each member at every location. We have determined the shale content of five cores and produced graphic logs showing shale content with stratigraphic position. The outcrop is mapped as the Millersburg Member and contains grainstones interbedded with shaly sequences. The grainstones were likely deposited in shoal environments as evidenced by occurrence of diverse marine fauna, fragmented fossils, and cross bedding.

46. - Application of Machine Learning to Predict Lithofacies from Wireline Log Data

First Author  Co-author
Kimberly Kusler  Nilesh Dixit
Northern Kentucky University  Northern Kentucky University

A good understanding of different rock types and their distribution is critical to locate oil and gas accumulations in the subsurface. Traditionally, rock core samples are used to directly determine the exact rock facies and what geological environments might be present. Core samples are often expensive to recover and therefore, not always available for each well. Wireline logs provide a cheaper alternative to core samples, but they do not distinguish between various rock facies alone. This problem can be overcome by integrating limited core data with largely available wireline log data with machine learning. It involves using core data from one well (labeled data) to train and interpret wireline log data (unlabeled data) from nearby wells to predict facies without the need to acquire new core samples. Here, we present an application of machine learning in rock facies prediction based on limited core data from the Umiat Oil Field of Alaska. First, we identified five rock facies within the Lower Grandstand Formation using core samples and mineralogical data from the Umiat 18 well. Next we applied machine learning algorithms (ascendant hierarchical clustering, self-organizing maps, artificial neural network and multi-resolution graph based clustering) to available wireline log data to build our models trained with core-driven information. These models were then individually applied to nearby wells, Umiat 23H and SeaBee-1 for predicting similar rock facies at different depths.

47. - Creation of Digital Elevation Models Using Scanning Airborne Laser Altimetry (LiDAR)

First Author
Cameron Peterson
Northern Kentucky University

Floods cause changes to river valley topography over time. Subsequently topography changes control the movement of flood water and are, therefore critical for producing local flood hazards maps. Currently, field-based surveying and aerial photogrammetric methods are often used by government agencies to obtain terrain information. However, both methods are time and resource intensive. Airborne LiDAR technology has become the preferred choice for digital surface elevation data acquisition as it can collect data more rapidly and with more accuracy. Here, we demonstrate how LiDAR is used to create 3D high-resolution digital elevation maps for flood-prone areas along the Ohio River valley. A time-series of elevation maps can then be used to understand the influence of topography changes on the flooding of the Ohio River.
48. - Analysis and interpretation of the Depositional Environment of a Glen Dean Limestone Outcrop
Grayson County, Kentucky

This investigation conducted a detailed stratigraphic analysis of the Glen Dean Limestone and associated sandstones at a relatively new road outcrop in Grayson County, Kentucky. The purpose of the investigation was to determine the depositional environment that formed the outcrop and to construct a depositional model of the outcrop. The Glen Dean Limestone is an upper Mississippian aged unit consisting of limestone and shale sequences that are bounded below by the Hardinsburg Sandstone and above by the Tar Springs Sandstone. A total of twelve cross sections were made along the outcrop and rock samples were collected in vertical sequence at each section. Rock samples were classified using the Dunham classification method. Thin sections were made from some of the rock samples and described using a petrographic microscope. Index fossils were also identified. A microfacies approach was used to identify sedimentological patterns that could provide insight into the depositional history of the strata. Preliminary data indicate that the rock sequences appear to represent both tidal and deltaic influence on a carbonate platform.

49. - Using titanite to determine magmatic thermal histories of granites

Granite, the most abundant rock in the continental crust, is primarily comprised of the minerals quartz, potassium feldspar, and plagioclase feldspar, but also contains minor abundances of zircon, titanite, amphibole, and biotite. The crystallization temperatures and cooling rates of granites are critical factors for understanding the formation and evolution of magmas in the crust, yet both (particularly cooling rates) are poorly constrained. Titanite, also known as sphene, can be an important tool for analyzing the cooling histories of granites. The diffusion of elements can be observed in titanite zoning patterns, which can be analyzed to determine the cooling rate of their host granite. Additionally, thermobarometry that utilizes the substitution of Zr4+ for Ti4+ in titanites can be used to calculate the temperature at which the granite crystallized. The goal of this study is to better understand the thermal histories of granites, and in doing so gain knowledge of the process of continental crust formation.

50. - Placing Devonian ctenophore Archeocydippida hunsrueckiana in evolutionary and ecological context

Archeocydippida hunsrueckiana (Stanley and Stäármer) is a ctenophore from Germany’s Devonian HunsrÄ¼ck Slate formation. It represents only the second Devonian ctenophore fossil ever found, and the most recent ctenophore fossil. The evolutionary relationship between ctenophores and other early animals, especially sponges and cnidarians, has relevance for the evolution of bilaterians, including humans. Ctenophores share some unique features with humans, such as the structure of their muscles and nerves, and specific neurotransmitters, which is of interest to medical researchers, for example. A. hunsrueckiana has been exceptionally well preserved through pyritization, within a slate matrix, due to the ecological conditions of the shallow Devonian HunsrÄ¼ck Sea with brackish intrusions. The fossil was discovered by accident in the 1980s through X-ray analysis of another feature in the rock. The 2019 research project described here used new techniques in X-ray computed tomography to create a 3-D model of A. hunsrueckiana in order to describe the fossil's morphological characters in detail. The 278
morphological characters coded were then used in a morphomolecular study in order to generate phylogenetic trees that suggest the fossil’s evolutionary placement as a crown group ctenophore, or the oldest known member of the group containing living ctenophores. A. hunsrueckiana likely had ecological significance as both predator and prey, like modern ctenophores, which this research shows had a slow rate of evolution.

Saturday, November 2, 2019  8:30am - 11:00am

Physics & Astronomy - Poster Presentations
  Baird Lounge, Alumni Building

52. - Modeling Keplerian Orbits using ExoFastV2 and Twobody

First Author  Co-author
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Northern Kentucky  Northern Kentucky
University  University

ExoFastV2 is an exoplanet transit, radial velocity (RV), astrometry, and stellar fitting software package in IDL. This package is designed to fit high quality Keplerian Orbits to these astronomical data. We tested this software on simulated RV curves using a mock catalog with RV curves similar to SDSS APOGEE survey. We discuss our initial results with a particular focus on how well we recovered orbital periods as a function of parameter space. In addition, we will discuss using twobody, a Python package that computes orbits and astronomical data for two-body systems. We are currently using this package to test how well the calculated RV curves from twobody compare with the simulated RV curves from the mock catalog.

53. - Why are the Orbits of Uranian Trojans so Unstable?

First Author
Jeremy Wood
Kentucky Community and Technical College System

Trojans asteroids of a planet are those asteroids which librate about the planet’s L4 or L5 Lagrange point. Though the planet Jupiter has over 6,700 known trojans, Saturn has zero, Uranus has 1 and Neptune 17. It is known from numerical simulations that the orbits of hypothetical trojan asteroids of Saturn and Uranus are more unstable than those of Jupiter and Neptune (Nesvorny & Dones 2002, Dvorak et al. 2010).

In this work, I prove that Neptune is responsible for the instability of Uranian trojan orbits by causing the Uranian trojans to leak out of tadpole orbits into more unstable horseshoe orbits.

54. - Neutron Detector Geometry

First Author  Co-author  Co-author  Co-author
Sarah Vickers  Emily Ballantyne  Rebecca Calvert  Christopher Crawford
University of Kentucky  University of Kentucky  University of Kentucky  University of Kentucky

The current accepted value of the mean lifetime of the neutron is 880.2±1.0 s [1] before decaying into a proton, electron, and an antineutrino, measured in ultracold neutron storage (bottle method) experiments. The same value is measured to a precision of 0.06% in previous in-flight (beam method) experiments. However, the source of discrepancy of 6 standard deviations between these two methods is not understood at all. The Beam Lifetime 3 experiment has been proposed to the National Science Foundation (NSF) to be executed at the National Institute of Standards and Technology (NIST), to reduce the error in precision to 0.01%. To achieve such low systematic uncertainty, it is essential to have well characterized, uniform acceptance everywhere in the neutron beam. This summer I used geometry, calculus, and simulations in Python and Mathematica to determine the angle and tilt of the neutron detectors with respect to the deposit which the neutrons impact to optimize the uniformity. The ideal angle for 2 detectors using analytical geometry and solid angle was found to be \( \theta = 35.26^\circ \), opposed to the previous accepted value of 30\(^\circ\). \( \beta \) is added to represent the tilt of the detector from the angle perpendicular to \( \theta \). Optimizing both values resulted in a \( \theta = 43.44^\circ \) and \( \beta = 30.22^\circ \). The equations were further modified to compensate for the varying \( ?Li \).
Stolen or lost radioactive sources could cause contamination of environment and lead to an increase in individual and population radiation doses. Various methods to locate radioactive sources were previously discussed in literature. The goal of the project is to develop a probabilistic method to locate 'lost source' of radiation in 2 and 3-dimensions. In this method, to predict the position of the source, we use counts detected by a number of radiation detectors at specified locations. To predict the position of the source a maximum likelihood method was utilized. The most probable position of the source is where the Likelihood function is maximal. Probability density function (PDF) of the source located at a given position was calculated under the assumption that there is only one point-like source. The PDF was calculated in 'empty' space and in a 'city-like' landscape. Detected counts in a 'city-like' landscape were obtained using a MCNP simulation provided by the UNLV research team. The volume under the probability distribution was calculated to show contour lines at 68% and 95% probability, one and two standard deviations from the mean. As more detectors are used, the peak of the contour plot becomes 'sharper' and more defined, and the area of the contour lines becoming smaller as a function of increasing number of detectors.

Support for the project was provided by the Department of Physics and Astronomy and the Ogden College, WKU.
definitive conclusion until the molecular dynamics calculations have finished. This work is funded in part by NSF grant DMR 15-08189.

58. - Second Nearest Neighbor Modified-Embedded Atom Method for Ruthenium

First Author  Co-author  Co-author
David Maess  Daniel Franklin  Matthew Zacate
Northern Kentucky  Northern Kentucky  Northern Kentucky
University  University  University

Ruthenium is a rare earth metal highly sought for its uses in high-tech, industrial alloys. It is used in electrical contacts with platinum and palladium to harden them as a thin film. Ruthenium also adds corrosion resistance to titanium and it is used in high-temperature single-crystal superalloys which are used in components of jet engines. The purpose of this work is to develop an empirical potential for ruthenium within the framework of the second nearest neighbor modified-embedded atom method, which is a standard computer simulation method used to calculate metal properties. Optimal parameters were determined by matching simulated values to those determined experimentally. The resulting parameter set satisfactorily reproduces important known materials properties including lattice parameters, elastic constants, structural enthalpy differences, vacancy formation energy, thermal expansion, specific heat, and melting temperature. This is an improvement to an earlier parameter set, which was unable to reproduce the correct phase stability at elevated temperatures. In future work, this potential will be used with potentials for other elements to calculate properties of ruthenium alloys. This research is funded in part by NSF grant DMR 15-08189.

59. - Experimental Measurement of the Bifurcation Diagram of the Chaotic Pendulum

First Author  Co-author  Co-author
William Poteet  Ivan Novikov  Doug Harper
Western Kentucky  Western Kentucky  Western Kentucky
University  University  University

The damped driven pendulum exhibits chaotic behavior at specific conditions. This system has been extensively studied by scientists, including DeSerio (2003) and Kulkarni and Borkar (2015) using various programs from MATLAB to Phaser Scientific Software. An uncommon way to analyze the system is the bifurcation diagram, which shows the period doubling of a chaotic system. Bifurcation diagrams have been utilized, but the quality of the diagram could potentially be improved using other methods and better equipment, which is the goal of the project. The system is a commercial PASCO Chaos Experiment device modified with more modern hardware and software to make accurate data acquisition possible. The main upgrades used are LabVIEW, an encoder, and an Inductive Angle Encoder from Zettlex, which provides very accurate angular resolution. As the first step for the project, the ODEs of this system were studied. Along with the well-known Runge-Kutta method, these ODEs were solved using a LabVIEW program. A data acquisition system in LabVIEW obtains the angular position and angular velocity of the system, and then Project Jupyter's program Jupyter Notebook is being used to run a Python code to create the phase portraits, Poincaré sections (also commonly referred to as Poincaré maps), and bifurcation diagram.

Special thanks to Western Kentucky University for providing funds through the FUSE Award #19-FA253.

60. - Modeling Stochastic Resonance in the Duffing Oscillator

First Author  Co-author
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Gatton Academy  Western Kentucky
University

Stochastic Resonance (SR) is a phenomenon that has been observed in various disciplines including climate science, mechanical and electrical engineering, optics, and various chemical and sociological models. SR occurs when the optimal amount of white noise is added to a bistable or nonlinear system such that the signal to noise ratio is maximized. This effect was observed in the Damped Driven Duffing Oscillator (DDDO) (Gammaitoni et al., 1989). The DDDO is a bistable system with a damping force, which exhibits chaotic behavior when a periodic external force is applied. To observe SR in the DDDO an external random force or white noise is introduced into the system. The goals of this project are to build a DDDO system experimental setup controlled by LabVIEW modules and to
experimentally study SR. As the first step, numerical methods have been used to calculate analytical solutions of the DDDO. These solutions were visualized as phase portraits and Poincaré maps were plotted. The phase portrait shows both the position and velocity in an intuitive way; the Poincaré map of the DDDO shows the periodic recurrence of the oscillator, a result that cannot be observed in the phase portrait due to the chaotic nature of the oscillator. These calculations were done in the Jupyter Notebook environment, which allows the results to be easily shared with a community of learners. The project is supported by The Gatton Academy at Western Kentucky University.

61. - Cosmological Model with Acceleration

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In this research we studied cosmological models to describe the large scale structure of the universe. We studied two models as case studies which describe acceleration. Here we studied various properties of the model such as the Hubble constant $H(t)$ and the scale factor $a(t)$. Hubble constant is related to the velocity of galaxies $v$ and the distance to them $d$ as $v = H_0(t) \cdot d$. The scale factor describes the expansion of the universe. In this poster, we will present various properties of the universe such as $a(t)$, pressure, and density of the Universe.

62. - Building an Electromyogram Circuit

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Building an Electromyogram Circuit DANIELA OLIVERA VELARDE* and DR. TROY MESSINA, Department of Physics, Berea College, Berea, KY 40404. An electromyogram is a record of the electric activity generated by the neuronal activity in skeletal muscles. An electromyogram is used in medicine to rule out muscular and neurological diseases. In addition, electromyography has important applications in the development of prosthetics. I will discuss the building of a circuit consisting of electrodes, pre-amplifiers, and a differential amplifier. Using this circuit, the resulting electromyograms displayed on an oscilloscope will be used to compare the activity of nerves and muscles when doing multiple tasks.

63. - Advanced Bioinspired and Biomimetic Membranes for Enhanced Filtration

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<td>Taylor Robinson</td>
<td>Sanju Gupta</td>
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Recent advances in synthetic membranes allow their use in fields as diverse as food and agriculture, industrial water treatment, potable water production and biotechnology. Among the newly developed technologies, nanofiltration for liquids and more particularly for desalination of seawater or saline aquifers is the most recent one. However, current solid-state membranes are limited, which calls for the development of novel formulations for new membranes offering both high permeability (ion and water flux) and ion differentiation (selectivity) that are usually considered antagonist features. We report on the strategic development of hybrid nanoporous membranes made of a solid-state track-etched polymeric thin film and graphene oxide as supports in which biological ion channel such as Gramicidin A, alpha-hemolysin and ion selective binding peptide motifs are confined, respectively. These bioinspired and biomimetic solid-state membranes are attracting widespread attention since they offer several advantages including mechanical robustness, scalable, controlled pore dimension and shape, modifiable surfaces for desired function and energy-efficiency, for water sustainability. The permeability and selective ion transport will be evaluated via ion diffusion kinetics, UV-Vis absorption spectroscopy and nanofiltration while gaining insights into the role of key performance parameters including track-etch pore size, surface chemistry, and ion binding through nanochannels for water purification. The proposed activity positively impacts the environment by integrating ecofriendly materials design, development and deployment.
64. Transparent, Transferrable and Flexible Pseudocapacitors from PEDOT/V2O5/Graphene with Record Durability in Solid Electr

First Author
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Sanju Gupta

Western Kentucky

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Transparent conductive electrodes (TCEs) are of enormous significance to the continued growth of optoelectronic devices and the emergence of flexible and wearable electronics in the foreseeable future. Versatile and tunable TCEs, featuring with not only high optical transmittance but also intriguing features of electrochemical energy-storage capability, flexibility and transferability, remain a significant challenge. Here we strategically develop a graphene-conjugated V2O5@poly(3,4-ethylene dioxythiophene (from hereon, V2O5@PEDOT) hybrid, serving as an easily transferable, transparent, capacitive active electrode films. The constructed electrodes exhibit a high areal capacitance of 50-60 mF cm\(^{-2}\) at an optical transparency of > 60% with a record durability over thousands of cycles. As demonstrated by experimental results, both the kinetic blocking of the PEDOT layer and the anchoring capability of graphene upon soluble vanadium ions from V2O5 nanoribbons/nanotubes contribute synergistically to the unusual electrochemical stability and electroactivity shown using scanning electrochemical microscopy (SECM). Transparent symmetric and asymmetric solid-state supercapacitors made of the as-fabricated pseudocapacitive TCEs deliver a broad voltage window of 1.4 V or higher under two different electrolyte environment (aqueous LiCl and organic gel made from LiCl and polyvinyl alcohol) demonstrate the highest power and energy density that outperforms all the previously reported transparent devices.

65. Systematic Study of the Effect of Incorporation of Carbon Nanotubes into GexSe1-x Glass System

First Author
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We successfully synthesized GexSe1-x (x = 0.225) glass samples and doped the samples with commercially produced (Protein Mods) carbon nanotubes (CNTs). We investigated the glass transition temperature (Tg) using Modulated Differential Scanning Calorimetry (MDSC). The glass samples without the CNTs have a Tg of ~220°C and the Tg was found to be independent of starting materials from different suppliers as well as water-bath temperature. CNTs, being a very hygroscopic material as well as oxygen absorbing material, needed to be cleaned under vacuum with the hot water-bath. We found that the Tg decreases when 5% and 10 % CNTs by mass is added to the glass samples as compared to the base GexSe1-x glass. The decrease in Tg indicates the occurrence of an intermediate phase (reduced-stress glass phase) at lower temperature, which could be potentially useful in material science applications.

66. Directed Assembly Strategies to Construct 3D Boron Nitride and Graphene Oxide Nanosheet Topological Networks

First Author
Alex Henson

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Sanju Gupta

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Inspired by the nano/microscale hierarchical structure, topological network and precise inorganic/organic interfaces, we fabricated artificial ‘nacre-like’ papers and aerogels based on noncovalent functionalized boron nitride nanosheets (NF-BNNSs) and varying poly(vinyl alcohol) (PVA) concentration via vacuum-assisted self-assembly and freeze-drying techniques. The electron microscopy showed an ordered ‘brick-and-mortar’ arrangement of NF-BNNSs and PVA paper and aerogels, in which the long-chain PVA molecules act as the bridge to link NF-BNNSs via hydrogen bonds. Likewise, due to the need for heat removal in modern electronic devices, polymer composites with high thermal conductivity have drawn much attention. However, traditional method to enhance polymers thermal conductivity by random addition of nanofillers usually creates composites with not only limited thermal conductivity but also other detrimental effects due to large amount of fillers required. Here, novel polymer composites are...
prepared by first constructing 3D boron nitride nanosheets (3D-BNNS) network using ice-templated approach with varying BNNS sheets concentration and then infiltrating them with epoxy matrix. The thermal and mechanical properties of resulting free standing nacre-like papers, aerogels and composites are investigated. They elucidated high glass transition temperature, low interfacial thermal resistance or high thermal conductivity with relatively low BNNS loading thus revealing their superiority as flexible substrates. These results demonstrate that this approach opens a new avenue for design and preparation of polymer composites with high thermal conductivity useful in advanced electronic packaging techniques, namely, thermal interface materials, underfill materials, and molding compounds.

67. - An Investigation of Quark Star Dynamics and the Equation of State

First Author
David Suarez
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Co-author
Keith Andrew
Western Kentucky University

We investigate properties of quark stars under the Tolman-Oppenheimer-Volkoff (TOV) equation. Intense pressures and low temperatures in the quark star's core forms a state of matter in which quarks become deconfined, but also form crystalline lattices. These lattices consist of quark clusters: under interaction potentials motivated by the QCD Dirac Equation, color-neutral bound clusters of quarks form the framework for the lattice. Structure equations dictating the star's size are numerically solved in Mathematica using the MIT Bag Model $\bar{\chi}$, a relativistic potential with a vacuum barrier arising from gluon fields $\bar{\chi}$ and the assumption that quarks cluster in a simple cubic crystalline configuration under a Lennard-Jones potential. Our results show that a stable configuration (with the mass and radius of the quark star ranging from 1 to 2 solar masses and 5-8 km, respectively) results from this clustering, and we use them to predict future results concerning different lattice configurations' effects on the final state parameters of the quark star.

68. - Deriving Equations to Calculate the Properties of Pulsars with the P vs. P-dot Diagram

First Author
Colby Winters
Morehead State University - Craft Academy

Pulsars are the stellar remnants of supernovae explosions, caused by the death of a massive star. Pulsars are specific neutron stars that emit a beacon of radiation from their magnetic dipoles and can be observed in radio wavelengths. By studying these stars, conditions that are unable to recreate on Earth, such as extremely dense matter and magnetic fields so strong they distort electron clouds, provide insight into the physical properties and the evolution of neutron stars. This research explores how equations that describe pulsars have been acquired from an ideal model of neutron stars. Those calculations are applied to the period versus period derivative plot to qualitatively examine the population of neutron stars. Data collected by the Pulsar Search Collaboratory; a public outreach research organization committed to involving high school students in radio astronomy was involved. Several candidate pulsars from Green Bank Drift Scan Surveys were examined for similar characteristics from previously derived parameters including diameter, rotational inertia, and characteristic age. The results of this were that most of the calculated values did not align with published results from the ATNF Pulsar Catalog and showed significant error. Although this error is due to basic assumptions, the process allowed meaningful relationships of properties to be examined. The application of this process allowed a further understanding of the evolution of pulsars and checked a fundamental derivation used in radio pulsar astronomy.
A goal of environmental education (EE) is to help instill environmental stewardship into the students for the future. Hungerfold and Volk (1990) believe environmental stewardship is changing behaviors, values, or beliefs related to human-environment interaction. It is important for people to learn at a young age about environmental concepts, so they will care about them in the future. Eastern Kentucky University’s (EKU) Division of Natural Areas has been conducting EE programming for students K-12 for the past 13 years. Over the years, the curriculum has been updated to improve student engagement and meet the Next Generation Science Standards. The current facilitation of EE programs does not include an assessment of teachers' perceptions. The purpose of this project is to assess the teachers whose classes participate in the EE programs at EKU's Natural Areas. These areas include Maywoods Environmental and Educational Laboratory in Garrard County, KY or Lilley Cornett Woods Appalachian Ecological Research Station in Letcher County, KY. After the students visited and participated in EE programs, the teachers were emailed a survey and asked to respond. The researchers assessed teachers' perceptions of the EE programs. For instance, if the teachers believe the programs fit into school curriculum, if the teachers feel as if the station leaders were prepared and knowledgeable of the material taught, and if the teachers have any suggestions on changes or improvements to the programs. The results from the survey were overall very good. The potential barriers teachers might have and their comments suggest the EE programming could be improved in some areas; for instance, providing interdisciplinary EE lessons or having more dates for teachers to choose from. The next steps in this research project could be to continue surveying teachers over several semesters and years, and to evaluate the impact the programming has on the students.

70. - Summer Internship Experience at the Kentucky Science Center for STEM Students

In order to address the critical shortage of certified STEM teachers in Kentucky, at Bellarmine University, we are building community partnership with the Kentucky Science Center (KSC) to inspire the next generation of STEM students to pursue a career in STEM teaching. Funded by the NSF's Noyce Capacity Building grant, ten STEM students from Bellarmine University did an internship at the Summer Camps in 2019 ranging from Pre-K to Grades 7-8 at the KSC that were meant to develop their skills in STEM education. Under the guidance and supervision by a KSC staff, these interns facilitated all lesson plans provided by KSC for up to 25 students in each summer camp class. The Interns used the engineering design processes, inquiry-based learning, Next Generation Science Standards (NGSS) to conduct these summer camps. Additionally, these interns provided guidance to camp counselors and volunteers in the classroom. The ten Noyce Summer Interns took part in distinct types of surveys conducted by both the project PI/Co-PIs and independently by the KSC that were collectively used to determine their interest in pursuing a career in STEM teaching. We will present the results of the survey data and show the relationships between the various forms of data collected, including videos, observations and the student focus group data.

71. - Undergraduates Have Varying Expectations for Written Feedback on Scientific Writing Assignments in Biology

Written feedback on scientific writing assignments can be a valuable learning tool for undergraduates in biology. However, undergraduates sometimes ignore or under-utilize the feedback provided. It is not known if the unused, or underutilized, feedback is due to the undergraduates' expectations not being met. Therefore, the purpose of this project was to determine the expectations and experiences of undergraduates receiving written feedback on scientific writing assignments. A total of 283 undergraduates from among four different biology courses were surveyed prior to receiving any written feedback on the scientific writing assignments during Spring 2019. Analyses via multivariate,
generalized linear models indicated that the undergraduates tended to score feedback that focused on surface-level errors (e.g. spelling and punctuation errors) as less important compared to discipline-specific errors (e.g. development of scientific arguments and interpretation of statistical analyses). Undergraduates reporting prior publication experience scored feedback on 'use of scientific terms' as significantly less important, and feedback on the 'development of scientific arguments to explain the results' as significantly more important, compared to undergraduates with no prior scientific publication experience. Feedback expectations also varied significantly based on the primary written language of the undergraduates. It is clear from our findings that our undergraduate students have varying expectations for the types of written feedback they find important.

### 72. - Calling all scientists: Promote your discipline through the airwaves!

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Have you ever wanted to dabble in science communication? Now's your chance. 90% of all the scientists that have ever lived are alive and working today, so a tremendous amount of scientific research gets published daily, much of it of interest to the general populace. For the past year we have been broadcasting 'Bench Talk: The Week in Science' a weekly radio show that communicates scientific advances, science history, and policy to the general public. This 30-minute show, broadcast in Louisville, KY on WFMP, 106.5 FM reaches a potential radio audience of 300,000 people, is livestreamed on the web, plus podcasted to those living outside the listening area. To hear previous episodes of Bench Talk, go to https://www.forwardradio.org/bench-talk. We are looking for other trained scientists to contribute stories to Bench Talk, either about their own research or on scientific advances in other disciplines. You can work at your own pace, as the show is taped ahead of time. Simply record your story on a personal computer, microphone recorder, or Smartphone and send it to us for editing and broadcasting. Stories can vary from 3-25 minutes. Social scientists, engineers, mathematicians, and physical/natural scientists are encouraged to contribute stories. Graduate students are also welcome. Help us show the world that science can be understandable, pertinent and fascinating!

### 73. - Neuro-NORSE (Neuroscience Outreach Resources for Secondary Education): Low-cost lessons for high school science labs

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<td>Melissa Garcia-Retama</td>
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Budgetary and time constraints make it difficult for high school teachers to implement inquiry-based lab activities into their science courses. Neuroscience incorporates multiple disciplines including biology, chemistry, psychology, anatomy and physiology, and math/statistics. Therefore, the development of low-cost, neuroscience-based lab activities will greatly enhance opportunities to expand the use of evidence-based practices in Kentucky high school science and mathematics classrooms. We developed a package of materials that can be used to introduce neuroscience concepts in high school classrooms, keeping the total cost for all materials to $90 per teacher. Each set of materials is linked with activities that can be completed during a 50-minute class. In this way, teachers have the flexibility to use several activities in one longer lab period or to use one activity to prompt a deeper discussion on a...
Activities were field tested during a Northern Kentucky University BRAIN (Best Research Academy In Neuroscience) high school science camp in June and shared with teachers at the CINSAM STEM Conference this fall. Supported by a 2019 KAS Athey Science Education & Outreach grant.

**Saturday, November 2, 2019 8:30am - 11:00am**

**Social Sciences: Anthropology, Psychology, and Sociology - Poster Presentations**

**Baird Lounge, Alumni Building**

**74. - Seasonal Harvesting of Donax variabilis and Site Occupation at the Tomoka Mound and Midden Complex**

**First Author**  
Kelsey Tuggle  
Eastern Kentucky University

**Co-author**  
Jon Endonino  
Eastern Kentucky University

Analysis of faunal remains in archaeology is used to determine dietary and cultural practices and human-environment relations through time. At the Tomoka Mound and Midden complex in Northeast Florida, several mounds and ridges dating from approximately 500-4400 cal BP are composed of shells from aquatic invertebrates. Many different species of mollusks have been identified in shell mounds and general midden with the most common being coquina clams. Donax variabilis, which inhabit the high energy environment of the intertidal zone and have an annual life cycle. During recent archaeological investigations led by Eastern Kentucky University professor Dr. Jon Endonino, two refuse pit features and one hearth containing Donax shell were identified and excavated. For this study, the annual growth rates of Donax were determined to identify the season of harvest and, by extension, when the pit features and hearth were created and used. Season of harvest is determined by measuring whole shells from the anterior to posterior with digital calipers, yielding the total shell length, and comparing the shell length data to growth-rate curves derived from modern datasets. Together, an estimation of the season(s) of harvest and, by extension, the time of year the site was occupied and the features were created, are obtained.

**75. - The Correlation Between Borderline Personality Disorder and Suicidality**

**First Author**  
Shannon Ackerman  
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**Co-author**  
Russell Smith  
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It is commonly believed that people with borderline personality disorder (BPD) have the highest suicide rate. We sought to answer the question ‘What impact does BPD have on suicide rates?’ by computing an overall weighted average effect size. In our meta-analysis, we located five studies from PsychINFO by using the key terms of ‘BPD’ and ‘Suicidality.’ Overall, the effect of BPD on suicidality was OR = 2.59, which means that people with BPD are 2.59 times more likely to die by suicide than comparative populations. We conclude that BPD does have a substantial effect on suicide rates, making this diagnosis a contributor to the suicide epidemic.

**76. - Sterile Inflammation In Olfactory Neuroepithelial Cells Derived From Bipolar Subjects And Non-Bipolar Controls**

**First Author**  
Karson Evans  
University of Louisville

There is growing evidence of increased inflammatory markers during periods of mood disturbance in mental and behavioral disorders, like bipolar disorder (BD). There have been inconsistent reports of the effects of lithium on inflammation in BD, demonstrating the need to study sterile neuroinflammation associated with BD. Studies indicate that apoptosis plays a role in the pathophysiology of BD and can be associated with sterile inflammation and necrosis. In this study, Olfactory Neuroepithelial Progenitors (ONPs) were obtained from type I bipolar patients and non-bipolar controls of matching age and gender, which are novel cellular models of BD. Monosodium glutamate salt
(MSG) was used as the apoptotic stimulus. ONPs were exposed to MSG alone for 24 and 48 hours, pretreated with 0.1 M MSG for one hour then treated with 0.1 M MSG+Lithium (1mM) for 24 and 48 hours, or pretreated with Lithium for 3 days then treated with 0.1 M MSG+Lithium (1mM) for 24 or 48 hours. Apoptosis was measured by MTT assay. The mRNA levels of inflammasome related genes, caspase-1 (CASP1) and NLRP3, were measured by qRT-PCR. Cell growth inhibition rate is significantly higher in BD-ONPs compared to non-BD-ONPs with 0.1 M MSG treated for 48 hours. The mRNA expressions of CASP1 and NLRP3 didn’t alter under toxic glutamate treatment. ONPs are heterogeneous populations including neurons, astrocytes, and oligodendrocytes, but not microglial cells. Microglial cells play a major role in response to inflammation. Thus, ONPs may not be useful in studying inflammation in vitro.

77. - Affects of Left Temporal Gyrus on the Development of Autism

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Autism spectrum disorder is a disability that has been on a steady incline for years. In 2018, it was reported that 1 in 59 children have autism spectrum disorder. The rise in autism led us to the research question "Does the left superior temporal gyrus affect the development of autism?" The left superior temporal gyrus houses the auditory cortex, which handles sound and language, which is a large problem for those with autism. Through PsycINFO, we located 5 studies that compared samples with autism to healthy controls on several brain properties and functions. From each study, we computed the effect size of the difference between the autistic samples and healthy controls. We found that the weighted average effect size was $d = 0.32$. Although this is considered a weak effect, it still indicates an important difference between children with autism and typically developing children in the left superior temporal gyrus. This research helps explain why children with autism have problems with language and sounds.

78. - Audio Learning in Autonomous Driving Situations

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Abstract

Semi-autonomous driving refers to a driving condition where the computer controls the car, but a human driver is still required to be attentive to the road ahead (SAE International, 2018). The current study investigated the effects of computer generated audio learning in a semi-autonomous driving situation.

Description

Vehicle automation can be classified into different levels, from Level 0 with no automation, to Level 5 with full automation (SAE International, 2018). At Level 0, the human driver is fully responsible for steering, acceleration, deceleration, and braking. Level 1 is similar to the cruise control system in most modern cars, with computer assisted acceleration, deceleration, and even braking. Levels 2 and 3 currently exist in certain high-end vehicles, with computer steering assistance added to the traditional cruise control. Drivers, especially commuter students, might start to take advantage of Levels 2 and 3 vehicle automation as they become more prevalent. The current study investigated attention and learning outcome in a simulated driving situation, where the driver had to learn from a computer generated audio text but also monitor and respond to warning messages in a simulated Level 2 autonomous driving situation. Results indicated that drivers would experience higher levels of mental workload and have impaired learning performance in a Level 2 autonomous driving situation. Findings from the current study could provide important safety and learning recommendations as autonomous driving becomes more prevalent.

79. - Distracted Driving
Most people get distracted while driving and there are many possible distractions, but what impairs our driving the most? The purpose of this research was to analyze the effects of alcohol, marijuana, and texting while driving. For this meta-analysis, we located 5 studies that measured the effects of all of these distractions. The overall effect size is $d = 0.52$, so there is a moderate effect when all the distractions are combined. When we calculated the effect sizes of the individual distractions, we saw different results. The texting effect size was $d = 0.71$, the strongest effect size we saw. Second was drinking, which was $d = 0.35$. The weakest was marijuana, which had an effect size of $d = -0.19$. Comparing these weighted average effect sizes allowed us to determine that texting is the most distracting thing you can do while driving.

80. - Assessing Cognitive and Motor Function in Adult Mice Exposed to Benzo[a]Pyrene During Early Brain Development

Benzo[a]pyrene (BaP) is a carcinogenic polycyclic aromatic hydrocarbon commonly found in traffic-related air pollution, tobacco smoke, and grilled foods. BaP is linked to learning deficits and to neurodevelopmental delays in human and animal studies. We are using a mouse model to determine if genetic differences increase susceptibility to BaP exposure during early brain development. Mice lacking the CYP1A2 metabolic enzyme and wild type control mice were exposed to BaP from gestational day 10 (GD10) through weaning at postnatal day 25 (P25). A battery of cognitive and motor function tests were performed when the mice reached young adulthood (P60). We used rotarod and a pole climb test to assess motor function, open field locomotor to assess activity levels, and novel object recognition to assess non-spatial visual learning and memory. Preliminary results from the first two behavioral cohorts will be presented.

81. - Assessing Neonatal Motor Function in Three Genotypes of Mice Exposed to Benzo[a]Pyrene During Early Brain Development

Benzo[a]pyrene (BaP) is a pollutant produced through the incomplete combustion of organic molecules. Exposure can come from cigarettes, vehicle emissions, wood smoke and grilled food. BaP is a known carcinogen, but has recently been associated with lower IQs in children exposed during pregnancy and early life. Negative geotaxis and righting reflex are innate behavioral responses in mice that require normal vestibular sensory abilities and neuromuscular control. In this study, we compared three genotypes of mice, AhrdCyp1a2(-/-), AhrbCyp1a2(+/+) and wild type AhrbCyp1a2(+/+) mice. Pregnant and lactating mice were given daily treatments of BaP or the corn oil
vehicle on small pieces of cereal. Offspring were tested at postnatal days 5, 7, 10 and 14 to determine whether indirect exposure to BaP affected the pups’ behavioral response. We hypothesized that pups from knockout dams would experience greater impairments to BaP exposure compared with pups from wild type dams, because metabolism and excretion would be higher in the wild type mice. Comparing high-affinity Ahrb and poor affinity Ahrd mice allows us to determine the importance of aryl hydrocarbon receptor activation in developmental BaP neurotoxicity.

**82. - Driving distracted and the effects: A meta-analysis**

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In recent years, with the rise of technology and smartphones, the rise in marijuana popularity, and the growing prevalence of alcohol in younger ages, the number of people participating in distracted driving has increased. We know these distractions affect driving, but how strong are the effects of them on driving performance? We sought an answer to the question through meta-analysis. To answer this question, we analyzed 6 studies that showed associations between distractions and driving performance. The distractions that were focused on within our research were: alcohol, marijuana, and texting. These were used to conclude the effects on driving performance. The research concludes that texting and alcohol have equally strong effects on driving performance (d = 0.57, 0.58), but the effects of marijuana are trivial (d = -0.12). These results are surprising for marijuana, and more needs to be done on this drug and its effects.

**83. - Empathetic Understanding: A Quantitative Systematic Review Comparing Delinquent and Non-delinquent Juvenile Populations**

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Past research has demonstrated the importance of empathy for engaging in prosocial behaviors. But is there empirical evidence for the opposite effect that those who engage in anti-social behaviors are less empathic? Our goal was to evaluate differences in empathic understanding in juvenile delinquents and non-delinquents. We used PsycINFO and EBSCOhost with the search terms 'juvenile delinquen*,' 'youth offenders,' and ‘empath*.’ From these sources, we found eight articles that met our inclusion criteria of evaluating empathy in both delinquent and non-delinquent youth samples. Using Excel, we calculated the weighted average effect size (d = -0.29). Although the effect size is small, it suggests that delinquent juvenile populations are less likely than non-delinquent juvenile populations to express empathic concern. We believe that more specific contexts of empathy, such as cognitive or affective empathy may produce larger effect sizes within this sample.

**84. - Does prenatal stress cause difficult temperament in children?**

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<td>Ellen Jennings</td>
<td>Alison Galbraith</td>
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Nature vs. nurture creates a simple dichotomy about the forces that act on each person, but for our study, we chose to look at a topic that falls in the grey area between nature and nurture: How does maternal prenatal anxiety affect child temperament? This meta-analysis used 7 studies (total sample size N = 11,363) that reported the relationship between prenatal stress and temperament in children. The regression coefficient, r, was determined from data provided in each study. This meta-analysis includes a study conducted by Laceulle and O'Donnell (N = 10,417). With the exclusion of this study, the overall weighted average effect size is negative (r = -0.12) showing a weak negative effect between prenatal stress and child temperament (more prenatal stress corresponds to better infant temperament). With the Laceulle and O'Donnell study included, due to the large sample size, the overall weighted average effect size is positive, (r = 0.51), suggesting that more prenatal stress corresponds to a worse infant temperament.
85. - Bingocize: A Novel Mobile Application to Help Improve Older Adult Health in Underserved Areas

First Author: Andrea Anderson
Western Kentucky University

Co-author: Matthew Shake
Western Kentucky University

The older adult population in the United States is growing rapidly, and the majority suffer from chronic disease conditions (Centers for Disease Control, 2011). Exercise interventions and other health-promotion programs have the potential to improve older adults' cognitive and physical functioning, but getting older adults to adopt these health-changing behaviors is challenging. We developed Bingocize®, a 12-week long health intervention program combining bingo, health education, and exercise using a novel app for tablets and phones. Participants were recruited at senior centers in Kentucky and Tennessee (n=107 enrolled and 85 completed thus far). Participants' mean age was 73.45, 86% were female, 80% were white, 81% had a high school diploma or less, and 85% had an income below the poverty line. Participants were randomly assigned to one of four conditions that vary with regard to exercise and health education. Health knowledge, fluid cognitive abilities, and physical abilities were assessed before and after the 12-week long intervention. Health knowledge improved in all participants, with a trend for greater improvement in the health education conditions, F(1,83)=3.58, p=.06. With regard to cognition, participants in exercise conditions reduced their phonemic rule violations F(1, 82)=4.01, p=.05. Physically, exercise participants improved in chair rise score, F(1, 80)=3.70, p=.058. Results indicate that Bingocize® can be used to provide a health promotion program to underserved older adult populations. Further health promotion research is needed in high risk, vulnerable older adults, especially in poor health states such as Kentucky.

86. - How Need for Power Explains Why Narcissists are Antisocial

First Author: MeganBrooke Alexander
Eastern Kentucky University

Co-author: Caitlin Hacker
Eastern Kentucky University

Co-author: Jonathan Gore
Eastern Kentucky University

Past research has found that narcissists engage in antisocial behavior. Some past research has even looked at reasons why narcissists engage in antisocial behavior. However, no research has looked at Need for Power as a factor to why narcissists engage in antisocial behavior. The purpose of the current research is to examine Need for Power as a potential mediating factor between narcissism and antisocial behavior. The current research was conducted in two studies. Participants (n = 408) of study one consisted of undergraduate students who completed an online survey focusing on Narcissism, Need for Power, and Aggression. The results of study one found that Need for Power fully mediated the association between narcissism and aggression. Participants (n = 323) of study two consisted of adults who completed an online survey through Mechanical Turk. Study two focused on 7 types of Narcissism, 4 types of Need for Power, Need for Influence, and Lifetime Criminal Behavior. The results of study two found that most forms of narcissism positively associated with criminal behavior, but only the desire to resist subordination mediated the link between narcissism and criminal behavior.

87. - How Strongly are Substance Abuse and Risky Behavior Related?

First Author: Hannah Kaup
Eastern Kentucky University

Co-author: Tyler O’Daniel
Eastern Kentucky University

Co-author: Shelby Moreland
Eastern Kentucky University

Co-author: Ashley Bragg
Eastern Kentucky University

We wanted to investigate whether or not there is a direct relationship between substance abuse and risky behaviors. In order to do this, we conducted a meta-analysis using the Psyc Info database. Beginning with broad key terms like ‘substance abuse’ and ‘risky behavior,’ we specified our searches to different substances including marijuana, alcohol, cocaine, opioids and even nicotine; the risky behaviors we chose to focus on are sexual behaviors, driving behaviors, gambling and criminal activity. At the conclusion of our meta-analysis, we found that those who engage in substance abuse of the aforementioned substances are 40.3% more likely to engage in the risky behaviors in question.

88. - Driving Performance while Under the Influence of Different Distractions
Losing the life of a loved one in a car accident is a horrific thing, especially when the accident is due to careless or distracted driving, but which distraction has the most influence on driving performance? The goal of our research was to explore the effects that texting, drinking alcohol, and smoking marijuana can have on driving. To answer our research question, we located five studies (total sample size N = 433) that measured different levels of driving performance while under the influence of different distractions. We coded these articles and recorded the effect size (Cohen’s d) for the relationship. The result of our study showed no effect between driving and THC, a moderate effect between driving and alcohol consumption (d = 0.38), and a large effect size between texting and driving (d = 0.66). Our results provide insight into which types of distractions are most dangerous.

89. - The Effectiveness of Telepsychology with Rural Populations: A Meta-Analysis

According to the Substance Abuse and Mental Health Services Administration (SAMHSA) (2016), 1 in 5 U.S. residents live in a rural area. SAMHSA (2016) also stated that compared to people in urban populations, people living in rural areas experience mental health disorders at the same rate. Research has suggested that rural populations are not receiving sufficient mental health care (Hendryx, 2008). The American Psychiatric Association (APA; 2018) has reported multiple barriers to mental health care for rural populations. Those barriers include geographical isolation, access to transportation, and a shortage of mental health care professionals in rural areas (American Psychiatric Association, 2018). Research has suggested that telemental health, which is the use of technology to provide mental health care, is a promising solution to the barriers rural populations face when it comes to mental health care (Hicks, Baeyer, & McGrath, 2005). Few review studies on telemental health with rural populations are present in the literature (Caxaj, 2016). The present study aims to add to the literature on the efficacy of telemental health with rural populations by using meta-analytic methods to test whether telemental health-delivered services are effective and whether they are parallel to services delivered in person. So far, we have found 38 studies that we believe will help us answer this research question. Our initial findings suggest that telemental health is an effective method of providing services to rural populations.

90. - Is marijuana addictive? Cannabis, Heroin and their Brain Effect

Is marijuana addictive?

The most recent census on drug addiction shows that at least 24 million Americans (9.4%) have used illicit drugs in the preceding month. Of these, approximately 19.6 million have, or have had, a substance abuse disorder in the preceding year (NorthPoint Staff, 2017). Addiction is a complex condition, a brain disease that is manifested by compulsive substance use despite harmful consequence (APA, 2019). Does marijuana fall under this spectrum? Our research was completed through EKU libraries’ PsychInfo using key terms such as marijuana, addiction, heroin, white matter, brain activity, and functional/static brain imaging. The research articles provided peer-reviewed brain imaging comparisons of marijuana and heroin usage effects. The participants used were screened beforehand to eliminate any outliers in brain composition. Our findings concluded similar effects on brain activity through marijuana and heroin usage. While marijuana does not meet the ‘criteria’ placed upon addictive illicit drugs, this is important
information due to the drug crises in the United States and how marijuana can be hypothesized within this information.

91. - Effects of Distractions on Driving

First Author
Chase Compton
Eastern Kentucky University

Effects of Distractions on Driving
We conducted a meta-analysis on how strong the relationship between distractions is and driving performance. There are many factors to consider when thinking about distracted driving and its outcomes. This meta-analysis includes three of the top disablers for safe driving. We compared drunk driving, high driving, and texting while driving. We used five different studies that included the impairments and statistics of how it affected you're driving. We came to a conclusion of an overall rate of distraction is .44 which is moderate. We learned that drinking and driving impairs your driving the most out of the three. For the weakest marijuana, our results gave us the sum of .22. The next in line in the middle is texting which was relatively close to alcohol consumption which is .31 and alcohol stood at .38.

92. - On the relation between O-T-C medication labels and demographics.

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Studies in our lab have investigated labels for over-the-counter medications. These studies presented name brand and generic labels with and without a highlighted area containing essential information about the drug such as dosage, active ingredients, and purpose for drug. Participants rated sample labels regarding informativeness, trustworthiness, aesthetics, and likeliness to buy. Our investigation was concerned with the relation between demographic information and label preferences. The data from an archival database were used. The data were the result of a survey administered to Amazon Turk Master Workers through Survey Monkey. A total of 94 participants were used for the study. The participants were required to rate labels of over-the-counter medications according to trustworthiness, informativeness, aesthetics, and the likeliness to buy. Additionally, demographic data for income level, education level, race, age, and handedness were provided. The demographic data were used as quasi variables to investigate their relation to the rating data. Race, education level, and income were significantly related to the ratings. Gender seemed to have no effect on how labels were ranked. An interesting relation was found between handedness and many of the characteristics of the labels. One of the characteristics of the labels was a highlighted area with relevant information about the drug on the label. The highlighted area, if it was contained within the label, was always on the right-hand side. This finding, if confirmed with other studies might suggest that vital information should be contained within a key highlighted area on the upper center of the drug label.

93. - Predicting likeliness to buy O-T-C medicine from label design

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In earlier research performed in our lab, consumer preference levels were examined regarding both brand name and generic over-the-counter medication labels. The participants were 105 Amazon TURK Master Workers and archival data were used for this study. The participants were presented with a survey of labels that identified four different types of medications; antihistamine, antacid, stomach relief and pain relief. The survey was delivered to the participants through Survey Monkey. For each type of medication, generic and name-brand labels were presented with and without highlighted critical information such as dosage, active ingredients, and the purpose for the drug. Participants ranked the labels based on their informativeness, trustworthiness, aesthetics, and likeliness to buy. A multiple linear regression analysis was used to identify which variable or variables were the best predictors of likeliness to buy. The regression model accounted for 83% of the variance. The best predictor of likeliness to buy was the rating for informativeness.

94. - Re-Evaluating the Relationship Between Socioeconomic Status and PTSD Rates

First Author
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Eastern Kentucky University

Co-author
Angela Van Berkel
Eastern Kentucky University

Psychologists have assumed that there is a strong link between socioeconomic status (SES) and post-traumatic stress. Lower SES has been associated with higher levels of posttraumatic stress disorder (PTSD) as a result of adverse childhood experiences, such as abuse, neglect, and exposure to violence. In order to quantitatively evaluate the association between SES and rates of PTSD, we conducted a meta-analysis. We searched PsychINFO and JSTOR and located seven studies that examined socioeconomic status and PTSD prevalence. We included studies that measured SES broadly and conceptualized post-traumatic stress as both chronic and event-based. Our results show that the relationship between SES and PTSD rates are not nearly as strong as the literature suggests (d = 0.32). This meta-analysis presents a discrepancy between the anecdotal/quantitative evidence that proposes a strong relationship and the quantitative evidence that suggests the strength is weak-to-moderate at best. As therapists, we should re-evaluate the role we give SES in our treatments of PTSD.

95. - The Effects of Different Kinds of Distracted Driving

First Author
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Eastern Kentucky University

Co-author
Elizabeth Goff
Eastern Kentucky University

Co-author
Kennedi Fields
Eastern Kentucky University

The Effects of Different Kinds of Distracted Driving
We all know someone that has been affected by a distracted driver. According to the Center for Disease Control, every day, there are approximately 9 people killed and more than 1,000 injured in car accidents that are reported to involve a distracted driver. Our research question is 'What impact does texting, alcohol, and marijuana have on driving?'. We found five research articles from PsycINFO that provided data about how bad distracted driving actually is. The overall weighted average effect size was computed from the effect size of each study. The overall effect sizes were moderate for alcohol, strong for texting, and very weak for marijuana. We concluded that smoking marijuana had no effect on driving, while texting and drinking alcohol did.

96. - Sex Differences in PTSD Symptom Presentation and Severity for Military Veterans

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Military service-related traumatic events impact each individual differently. The purpose of our project was to investigate the degree to which the sex of military service-members affects their adjustment outcomes, as measured by the occurrence and severity of presenting posttraumatic stress disorder (PTSD) symptoms. In order to evaluate this relationship, we located 14 studies (total sample size N=27,494) that reported a correlation between sex and post-service presentation of PTSD symptoms. We coded these articles and recorded the effect sizes (correlations) for this relationship. The result of this study showed a small effect size between sex and occurrence of PTSD symptoms post-military service. This indicates that female veterans had a higher occurrence of PTSD symptoms than
male veterans. This study provides insight into how intersectional concerns such as sex can affect trauma and adjustment outcomes of individuals in various ways.

97. - The Effects of Driving Distracted, Drunk, and High.

People drive every day, and although driving is an inherently dangerous activity, many people drive under distracted conditions. This research examines people's ability to drive while intoxicated on alcohol, high on marijuana, or distracted by texting. We performed a meta-analysis of 6 studies found on PsycINFO that compared people's ability to drive while drunk, high, or distracted. The overall weighted average effect size of all distractions on people's ability to drive is $d = 0.59$, which is a moderate effect size. The weighted average effect size of texting $d = 0.71$, drinking is $d = 0.38$, and marijuana is $d = 0.00$, which is no effect at all. It is important to realize that texting is a much larger distraction than being inebriated or high due to the fact that it requires we take our full attention off of the road and away from other drivers.

98. - The Effectiveness of Telepsychology with Veterans: A Meta-Analysis

Veterans who are exposed to combat are more likely to display higher levels of post-traumatic stress disorder (PTSD), major depression, generalized anxiety, intermittent explosive disorder, and substance misuse after returning from conflict (Lazar, 2014; SAMHSA, 2012; Tanielian et al., 2008). Research suggests that veterans are not receiving adequate mental health services. For example, Lazar (2014) surveyed veterans who returned from conflict and found that only 23-40% with a diagnosable mental health condition reported receiving help from a provider. Two key obstacles noted in the literature include lack of access to mental health services (e.g., lack of transportation to a provider) and negative stigma associated with utilizing mental health services (GAO, 2011; Tanielian et al., 2008). Telemental health, or the use of technology to provide mental health services, is often viewed as a potential solution for increasing access to treatment and reducing negative stigma associated with seeking treatment for veterans (Chen et al., 2019; Torgoose, Ashwick, & Murphy, 2018). Few review studies on telemental health with veterans are present in the literature (Torgoose et al., 2018). The present study seeks to add to the literature on the efficacy of telemental health with veterans by using meta-analytic techniques to test whether telemental health-delivered services are effective and whether they are equivalent to services delivered face-to-face. So far, we have identified 38 studies that we believe will help us answer this research question. Our preliminary findings suggest that telemental health is an effective method of providing services to the veteran population.

99. - The Effectiveness of Telepsychology with Women: A Meta-Analysis

Veterans who are exposed to combat are more likely to display higher levels of post-traumatic stress disorder (PTSD), major depression, generalized anxiety, intermittent explosive disorder, and substance misuse after returning from conflict (Lazar, 2014; SAMHSA, 2012; Tanielian et al., 2008). Research suggests that veterans are not receiving adequate mental health services. For example, Lazar (2014) surveyed veterans who returned from conflict and found that only 23-40% with a diagnosable mental health condition reported receiving help from a provider. Two key obstacles noted in the literature include lack of access to mental health services (e.g., lack of transportation to a provider) and negative stigma associated with utilizing mental health services (GAO, 2011; Tanielian et al., 2008). Telemental health, or the use of technology to provide mental health services, is often viewed as a potential solution for increasing access to treatment and reducing negative stigma associated with seeking treatment for veterans (Chen et al., 2019; Torgoose, Ashwick, & Murphy, 2018). Few review studies on telemental health with veterans are present in the literature (Torgoose et al., 2018). The present study seeks to add to the literature on the efficacy of telemental health with veterans by using meta-analytic techniques to test whether telemental health-delivered services are effective and whether they are equivalent to services delivered face-to-face. So far, we have identified 38 studies that we believe will help us answer this research question. Our preliminary findings suggest that telemental health is an effective method of providing services to the veteran population.
Women are more prone to develop eating disorders, major depressive disorders, anxiety disorders, PTSD, and somatoform disorders than men (American Psychiatric Association, 2019). Research suggests that, historically, women have not received adequate mental healthcare services. For example, the American Psychiatric Association (2019) suggests that barriers to mental health services for women include finances, lack of awareness about available services, and stigma. Inequity in the diagnosis of mental disorders between men and women occurs, which may lead to women being hesitant to receive treatment (Mizock & Russinova, 2015). Telemental health, or the use of technology to provide mental health services, is often viewed as a potential solution for increasing access to treatment and reducing negative stigma associated with seeking treatment for women, as well as catering to their specific needs (Goldstein, et al., 2018). Few review studies on telemental health, or telepsychology, with women are present in the literature (Goldstein, et al., 2018). The present study seeks to add to the literature on the efficacy of telemental health with women by using meta-analytic techniques to test whether telemental health-delivered services are effective and whether they are equivalent to services delivered face-to-face. So far, we have identified 57 studies that we believe will help us answer the research question. Our preliminary findings suggest that telemental health is an effective method of providing services to female populations.

100. - The Effectiveness of the MMPI-2-RF in Detecting Feigned Psychopathology: A Meta-Analysis

First Author       Co-author       Co-author
Colbey Brooke Adair Taylor Chille
Eastern Kentucky Eastern Kentucky
University         University

Response styles such as feigning and malingering are highly prevalent in forensic assessment. The Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF), a commonly used personality and psychopathology instrument, contains overreporting validity scales designed to detect for feigned mental disorders (F-r, Fp-r), feigned cognitive impairments (RBS and FBS-r), and feigned medical complaints (Fs). This meta-analytic review of 26 studies examines the effectiveness of the MMPI-2-RF validity scales in detecting feigned psychopathology. Results indicate that overreporting scales F-r (d = 0.52), Fs (d = 0.63), FBS (d = 0.57), and RBS (d = 0.59) proved to be moderately effective at differentiating feigned from genuine psychopathology. However, Fp-r (d = 0.43) yielded a slight effect. To conclude, the MMPI-2-RF is a clinically useful tool for the detection of feigned psychopathology in forensic assessment.

101. - The effects of driving while distracted

First Author       Co-author       Co-author
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Eastern kentucky   Eastern kentucky Eastern kentucky
university         university

Practically everyone has a cell phone in the pocket or bag, and many people keep their cell phone visible while driving. There are lots of announcements about don't text and drive, but how bad is texting and driving, especially compared to doing drugs and driving? To answer this question, we located five studies that looked at texting, drinking, and doing drugs while driving. Each study had to compare a baseline condition to texting, drinking, or doing drugs. We computed the effect size for each study, and then we computed the overall weighted effect size for texting, drinking, and doing drugs. Our results showed that text impairs driving performance even more than either drinking alcohol or smoking marijuana. It is very important that people do not text and drive.

102. - Is Improvement Really Improving: The Effectiveness of Social Skills Groups for Individuals With ASD

First Author       Co-author       Co-author
Molly King         Myresha Hinton Gabriella Martin
Eastern Kentucky Eastern Kentucky Eastern Kentucky
University         University

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by difficulties with social interaction and communication. Social skills groups are offered in order to provide a structured environment where these skills can be learned and put into practice. While commonly considered beneficial, the efficacy of these groups still needs to be evaluated. The present study aims to examine the effectiveness of social skills groups for individuals with ASD.
A meta-analysis was conducted to evaluate social improvement. A total of 11 studies were synthesized to calculate the overall weighted effect size. The effectiveness of social skills group demonstrated a weak overall effect ($d = 0.22$). Although the findings suggested a small effect, most of the studies analyzed showed improvement, but different assessments were used to measure social outcomes. Based on these findings, we suggest that a single comprehensive social skills outcome measure should be adopted to measure social skill improvement for future research.

103. - The Effectiveness of Telepsychology with Racial and Ethnic Minorities: A Meta-Analysis

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Racial and ethnic differences should be considered when addressing the effectiveness of telepsychology (Yellowlees et al., 2008). People of color do not receive the same mental health care as their counterparts (McCall, Schwartz, Khairat (2019)). McCall, Schwartz, Khairat (2019) points out that out of the African American women in the United States who reported having a mental illness, 64.2% did not receive any mental health care treatment. This shows the underutilization of mental health care in diverse ethnicities. Current research has shown that telepsychology is effective in treating diverse populations (Dorstyn et al. (2016)). The present study aims to add to the literature on the efficacy of telemental health with racial and ethnic minorities by using meta-analytic techniques to assess whether telemental health-delivered services are effective and if they are equivalent to in-person services. Preliminary findings suggest that telemental health is an effective method of providing treatment to racial and ethnic minority populations.

Saturday, November 2, 2019 8:59am - 10:30am

Geography - Oral Presentations

| Room 251, MAC Science Building | Section meeting follows talks at 10:15 |

9:00 - Impacts of precipitation and seasonal land cover change on fluvial sediment loads of the Upper Floyds Fork watershed, KY

First Author
Christopher Day
University of Louisville

During the post-harvest non-growing season, cropland and pasture may lie fallow for several months in mid-high latitude climates, leaving the soil exposed and vulnerable to erosion during wetter periods. These erosive processes increase in higher relief watersheds with much of the soil depositing into the watershed tributaries resulting in sediment pollution degrading riparian zones physically, chemically and biologically. We developed a GIS-based soil erosion model to estimate sediment delivery ratios and identify areas within the Upper Floyds Fork watershed acting as significant sediment contributors on a monthly basis as a function of precipitation and seasonal vegetation cover change. Watershed soil erosion loss was estimated using the revised Universal Soil Loss Equation (RUSLE) using a series of 30m rasters to represent the rainfall erosivity, soil erodibility, topographic factors and cropping management practices across the watershed. To calculate the corresponding sediment yield we deployed a turbidity sensor at the watershed outlet in situ with a USGS streamflow gage, and then constructed a statistical relationship between turbidity and samples of suspended sediment obtained throughout the year for a range of flow conditions. Our results indicated that mean soil losses ranged from 0.02-0.43 tons/ha/month, with corresponding sediment yields of 2.23-5939 tons/month. June experienced the greatest sediment delivery ratio of 90%, compared to a low of 0.1% for
August and September. These results were strongly influenced by the changing seasonal vegetation cover and frequent storm activity in May and June while August and September saw extremely limited rainfall activity and erosive events.


First Author
Dallas McKinney
Western Kentucky University

Determining Atmospheric Boundary Layer Behavior over Mountainous Terrain Using Aircraft Vertical Profiles from 2009-2018 NASA Student Airborne Research Program Data

Atmospheric boundary layer (ABL) heights separate turbulently mixed air and pollutants emitted at the ground from the free troposphere above and are an important parameter in numerical weather prediction and air pollution dispersion models. Discerning the ABL height over mountainous terrain has historically been difficult because of, for example, complex interactions with upper level winds, venting of humidity and aerosols into the free troposphere, and large spatiotemporal variability. Mountain ABL's can closely follow the terrain, be flat, or be shallower than surrounding valleys depending on the time of day, season, and synoptic conditions. To determine the extent to which the ABL heights follow terrain, water vapor, potential temperature, and turbulence collected by NASA aircraft during ascents and descents over mountains across Central and Southern California during the 2009-2018 Student Airborne Research Programs (SARP) were plotted versus altitude. United States Geological Survey elevation data were spatially joined with the aircraft data in a geographic information system so the topography underlying the aircraft vertical profiles could be determined. North American Regional Reanalysis data were used to evaluate the synoptic weather conditions influencing ABL heights. Vertical profiles created by the aircraft ascending and descending over the southern Sierra Nevada and Coastal Ranges indicate that ABL heights follow the topography of these areas during ridging synoptic patterns, being higher over ridges and lower over valleys. This characterization of ABL behavior can then be used to improve numerical weather prediction and discern whether mountaintop greenhouse gas monitoring stations are sampling the free troposphere.

9:30 - Quantification of tree canopy gaps in a central Kentucky wildlife management area forest using UAS and R

First Author
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William Lyons
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Buddhi Gyawali
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Co-author
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Will Rogers
Kentucky State University

Unmanned aerial systems (UAS) equipped with advanced sensor technology are an important component in modern decision support systems involving operations of managed land areas. The widespread adoption of UASs has led to the need for advanced training and capacity building at the end-user level about issues related to data storage and management, which are particularly cumbersome for small-scale farmers and land managers. For this project, we investigated the utility of forgoing generation of the orthomosaic and relying instead on individual images for the enumeration of open tree canopies caused by downed ash trees in a wildlife management area near Frankfort, Kentucky. Image processing methods were developed using the open-source programming language R for 1) the extraction of embedded EXIF metadata; 2) use of coordinate and attitude data for spatial referencing and composition of images; 3) the classification and feature extraction of open canopy; and 4) return of products intended for end-users and land managers. To measure the efficacy of this approach, comparisons were made between 1) the application-returned count and location of canopy gaps with this approach and 2) an expert's manual location-enabled count conducted using the generated orthomosaic. Preliminary results show both approaches are highly effective at the required task. While the application delivered almost instant turnaround of results, it tends to
overestimate gaps in the tree canopy for high shadow areas. The new approach saves money by reducing the need for paid subscriptions for generating information for decision making.

9:45 - Investigating the impact of rurality on cancer outcomes in Kentucky

First Author
Charlie Zhang
University of Louisville

Co-author
Michael Egger
University of Louisville

This research aims to investigate patterns of spatial disparities in cancer outcomes and examine the impact of rurality or geographic isolation on cancer diagnosis and mortality rates in Kentucky. The project will examine the degree to which poor cancer outcomes in rural areas are related to advanced stage at diagnosis or difficulty in accessing comprehensive, multi-disciplinary cancer care. The findings in this study are important for public health in the United States, as they will lead to a better understanding of the issues of both cancer prevention and access to care for residents in rural America.

10:00 - Food Insecurity in Historically Disenfranchised Parts of Jefferson County, KY

First Author
Kaitlyn Smith
University of Louisville

The concept of foodscape centers around a food environment and its boundaries shift as the food environment expands or contracts. For the purpose of this study Louisville's 'foodscape' refers to the Eastern downtown area and the West End of Louisville. These neighborhoods that are included in these two areas are Shawnee, Old Louisville, Russell, Parkland, Chickasaw, Smoketown, and Shelby Park. This research is framed through data that has been collected through a local non-profit, The Louisville Community Grocery, whose mission is to build a cooperatively owned grocery store that supports the local economy by providing healthy, affordable foods. Through the use of interviews and participant observation, this study investigates the availability of nutritious foods through the perspectives of local non-profits in Jefferson, County, KY. This study also seeks to understand how residents and non-profits feel about strategies that build community through the use of food. Local non-profits were asked from their perspective about meaningful research regarding food insecurity, this alongside interviews that have been conducted with residents have suggested overlapping themes of topics that have been commonly identified as barriers to food insecurity or areas that need additional research. This approach helps bridge the gap between local universities and neighborhoods in the community who have expressed frustration with being overly researched by these institutions.

Saturday, November 2, 2019  9:00am - 3:00pm

Exhibitors' Tables

2nd floor atrium, MAC
Science Building

ASRC Michelin
UK Chemistry Graduate School
Uof L School of Interdisciplinary & Graduate Studies
Kentucky Heritage Land Conservation Fund
Kentucky Organization of Field Stations
Kentucky Society for Natural History
Kentucky State University NSF STEM
Kentucky State University College of Agriculture, Communities and the Environment
University of Kentucky College of Pharmacy
WKU Chemistry Graduate Program
Student Competition Awards

MAC Science Building, 1st floor

If you win an award for your talk or poster, your name will appear on the screens in the MAC science building. Come down to the pendulum to get your photo taken and congratulations!

Teacher workshop: Chemistry of Art

Room 170, MAC Science Building

In this hands-on workshop, participants will learn and practice one of these fascinating applications of chemistry in art silk scarf dyeing, brass medallion etching, and Prussian blue pigment synthesis! Workshop participants will get to try each activity and leave with both the final product, as well as handouts and instructors notes for incorporating these artful applications in a chemistry course. Please bring a thumbdrive for an electronic version of materials. Presented by Mary Robert Garrett of Berea College.

Teacher workshop: Photovoltaics

Room 230, MAC Science building

This hands-on inquiry-oriented workshop will prepare you to teach fundamental technology and applications of solar cells. We will discuss both the photovoltaic creation of electricity and basic electrical concepts such as current, voltage, and resistance. Participants will receive a classroom photovoltaic set with enough material for 30 students. Presented by Jon Saderholm of Berea College. This workshop is generously supported by the Charles Rayburn Solar Fund at Berea College.
Saturday, November 2, 2019  10:00am - 1:00pm

Statistics Consultations
MAC Science Building, 1st floor

Saturday, November 2, 2019  11:00am - 12:00pm

Keynote Speaker LaTrice Montgomery
Phelps Stokes Chapel

Welcome to Berea College
President Lyle D. Roelofs
Dean of Faculty Matt Saderholm

LaTrice Montgomery

Assistant Professor and licensed Clinical Psychologist University of Cincinnati College of Medicine
Department of Psychiatry and Behavioral Neuroscience, Addiction Sciences Division

LaTrice Montgomery is an Assistant Professor and licensed Clinical Psychologist in the Addiction Sciences Division of the Department of Psychiatry and Behavioral Neuroscience at the University of Cincinnati College of Medicine. She received her B.A. degree in Psychology from Berea College and both her M.A. and Ph.D. in Clinical Psychology from the University of Cincinnati. She completed her National Institute on Drug Abuse sponsored clinical internship at the Yale University School of Medicine in the Division of Substance Abuse. Dr. Montgomery's research interests include marijuana and tobacco co-use (especially via blunts) and medical marijuana. LaTrice has presented her award-winning work at several local, regional and national conferences. In addition, LaTrice's work has been published in top-tier journals, including Drug and Alcohol Dependence and the Journal of Consulting and Clinical Psychology. She recently received a career development award (K23) from the National Institute on Drug Abuse to develop and evaluate a Twitter-based intervention for young adult blunt smokers.

Saturday, November 2, 2019  12:15pm - 1:30pm
### Box Lunch Pickup

MAC Science Building, 1st floor

If you ordered a box lunch it will be indicated on your name tag and registration receipt.

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### Saturday, November 2, 2019  12:15pm - 1:30pm

#### KAS Business Meeting and Past Presidents Luncheon (for KAS members)

Woods-Penniman Building

The Business meeting and Luncheon is open to KAS members by reservation.

- Governing Board Election results will be announced
- Science Education & Outreach Award winner Lenny Demoranville will share stories of taking science outside the confines of the college classroom.
- We’ll discuss ideas for the digital evolution of the Journal of the Kentucky Academy of Science
- The KAS Governing Board & staff will share reports and updates

Thank you to [314 Action](#) for Sponsoring the Luncheon

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### Saturday, November 2, 2019  1:15pm - 3:30pm

#### Zoology - Oral Presentations

Room 230, MAC Science Building

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
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<tbody>
<tr>
<td>1:15</td>
<td>New treehopper species discovered in Kentucky based on specimens excavated from Hoplosoides wasp nests</td>
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<tr>
<td>1:30</td>
<td>9 new morphologically cryptic members of the Pseudanophthalmus pubescens species group (Coleoptera: Carabidae)</td>
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**First Author**

Laura Sullivan Beckers

*Murray State University*

The discovery of a new insect species, Hebetica sylviae, is described. The solitary wasp, Hoplosoides costalis, was observed burying a number of treehopper species in a large flower bed in my yard in Murray, KY. Subsequent and repeated excavation of the flower bed uncovered thousands of developing wasps and treehoppers (Hemiptera: Membraciidae). The treehoppers found represented at least 24 different membracid species, including one, which was previously unknown to science. Here, I describe the discovery, the wasp behavior, and the formal description of the new species and the work still to be done to better understand the biology of the new species.

**First Author**

Jedidiah Nixon

*Western Kentucky University*

Pseudanophthalmus is a widespread group of cave-dwelling Carabidae endemic to eastern North America with surprisingly high species diversity. Much is yet unknown about the evolution of this genus, and it is in need of further examination at the species-group level. Here we provide a molecular phylogeny of the P. pubescens group of central and western Kentucky, including nine formerly undescribed species. We compare traditional morphological species
characterization (based in large part on male genitalia) to molecular species differentiation and geographical distribution. Historic mechanisms behind the current distribution of Pseudanophthalmus and characteristics of interest to conservation (such as high endemicity) are also discussed.

1:45 - Cercarial Swimming and Distome Emergence from the Tail Chamber in Proterometra macrostoma and Leuceruthrus micropteri

First Author: Hannah Jackson  
Co-author: Yogesh Budhathoki  
Institution: Berea College

A Comparison of Cercarial Swimming Longevity and Distome Emergence from the Cercarial Tail Chamber in the Digenetic Trematodes, Proterometra macrostoma and Leuceruthrus micropteri. The objective of this study was to investigate factors that might lead to the observed lower intensities of infection of the digenetic trematode, Leuceruthrus micropteri, compared to the digenean, Proterometra macrostoma, in their centrarchid fish definitive hosts. To assess swimming longevity, freshly emerged cercariae from naturally infected snails were monitored each hour at 20°C in a 50 ml beaker filled with 45 ml of spring water. To simulate distome release in the fish stomach, freshly emerged cercariae were pipetted into 10 ml beakers with 5 ml of cold-blooded saline adjusted to pH's of 1.5, 2.0 and 2.5 with or without pepsin at 20°C for 60 minutes. No cercariae of L. micropteri were observed swimming off the bottom of beakers after 8 hours, while 67% of P. macrostoma cercaraie were still swimming after 13 hours. Almost 100% of P. macrostoma distomes were released from their cercarial tail chambers in the six treatments, but the cercariae of L. micropteri did not emerge in pH's of 2.0 and 2.5 without pepsin, and release was slower compared to P. macrostoma with the addition of pepsin. These results may partly explain the lower intensities of infection observed in centrarchid fish with L. micropteri when compared to P. macrostoma.

2:00 - Effects of parasitism on Neoconocephalus katydids

First Author: Kyler Rogers  
Co-author: Oliver Beckers  
Institution: Murray State University

Acoustically communicating insects emit conspicuous signals to attract mates for reproduction. Signals can also be detected by eavesdropping predators and/or parasites who may exploit this communication system. This arms race can produce the phenotypic variation necessary for the communication system to evolve, offering an insightful area for research within the field of evolutionary ecology.

The katydid genus Neoconocephalus is parasitized by the eavesdropping tachinid fly Ormia lineifrons. This parasitism exerts strong selective pressure on the host because infested katydids die within two weeks, reducing their reproductive life span. The natural history of this parasitoid/host arms race is poorly understood and the focus of this study. More specifically, we present data on which Neoconocephalus species in Kentucky are used as hosts, and compare their parasitism rates, parasitoid infection numbers and developmental success to better understand the selective pressure exerted on each host.

Four of the six Neoconocephalus species collected in Kentucky were parasitized by O. lineifrons. The parasitism rates of each species varied, but the effects of parasitism were strongest in N. triops and N. velox. The average number of parasitoid larvae placed on the host ranged from one to three. The pupal weight of the parasitoids was negatively correlated with the number of larvae harbored by the host in all species. The developmental success rate to adult flies ranged from 34% to 71% among the four species. We discuss potential evolutionary ramification of our findings for the parasitoid and the hosts.

2:15 - Feeding Behaviors and Preferences of Avian Species at John James Audubon State Park in Henderson, Kentucky

First Author: Kelsey Ray  
Co-author: Shannon Finerty  
Institution: Kentucky Wesleyan College

In 2011, more than $5 billion was spent on bird food, feeders, and other products by millions of Americans (Johansen? et al.)
2014). In this research project, we observed the behaviors and preferences of different avian species who inhabit the area around the bird feeders at John James Audubon State Park in Henderson, Kentucky. Using 30-minute video recordings from two separate feeders in different locations (sunny and shady), we were able to identify 12 different species with the assistance of Birds of Kentucky: A Field Guide by Stan Tekelo. The information provided by the recordings allowed us to estimate the general population, as well as each species' population. A t-test revealed a feeder location preference, affected by temperature, during the fall semester (0.021), but not during the spring semester (0.186). The species preferred the shaded feeder location during cooler temperatures; however, once the temperature became too cold, especially during the winter months, the birds would feed from either location. This result is likely due to the low food availability during this time. Nevertheless, the results collected during the fall semester have allowed the staff at the Audubon State Park to expand their knowledge about the avian species populating the area and provide better conservation efforts in the hopes of bringing more diverse species to the area for public enjoyment.

2:30 - Overwintering of the Cercaria of the Digenetic Trematode, Proterometra macrostoma, within its Snail Host

First Author Co-author
Melanie Andrews Sarah Staat
Berea College Berea College

Survival and Development of the Cercaria of the Digenetic Trematode, Proterometra macrostoma, within its Snail Intermediate Host, Pleurocera semicarinata, Under Winter Temperature Conditions. MELANIE ANDREWS, SARAH STAAT, YOGESH BUDHATHOKI, BERNADETTE KWISERA, HANNAH JACKSON, JOSEPH MECHAM and RON ROSEN. Department of Biology, Berea College, Berea, KY 40404

Proterometra macrostoma is a digenetic trematode which is widely distributed in the eastern United States. The objectives of this study were to assess: (1) survival of intramolluscan stages (i.e., rediae and cercariae) of this trematode at a winter temperature and (2) whether or not cercarial development inside the redia ceases at or below its MDTT (minimum development temperature threshold; 10-12° C). Naturally infected snails were collected from North Elkhorn Creek. Baseline cercarial emergence was recorded over 7 days at 20° C for three replicates of 19 infected snails each. Replicates were then maintained at 7.5° C for 28 days followed by a post-cold treatment analysis of cercarial emergence over 7 days at 20° C. Approximately 95% (52/55) of infected snails shed cercariae following both the pre- and post-cold treatments, and significantly more cercariae were released/snail/7days following the post-cold treatment compared to the pre-cold treatment in two of the three replicates. No significant differences were found in the average number of the four cercarial stages within rediae pre- vs. post-cold treatment. These results suggest that during winter months there is no loss of infection with some further maturation of the Stage IV cercariae as indicated by our cercarial emergence data and not detectable by our staging criteria.

2:45 - Behavioral effects to heat in the blow fly (Phaenicia sericata).

First Author Co-author Co-author Co-author
Nicole Marguerite Douglas Harrison David Harris Robin Cooper
University of Kentucky University of Kentucky Veterinarian Univ of KY

Larvae of Drosophila and other related insects, such as the medicinal blow fly (Phaenicia sericata), demonstrate a thermal preference, which varies among species. What drives the differences in behavioral response among species is not fully understood but is likely driven by evolutionary adaptive pressure. The larvae of Phaenicia sericata when placed in the cold, after a warm exposure, will aggregate which we assume is to warm each other. The larvae of Phaenicia sericata are attracted to heat when placed in a cold environment (10oC). Additionally, larvae of Phaenicia sericata are attracted to capsaicin when placed in a cold environment, leading to the thought of an overexpression of the TRVP receptor in the larvae. However, this response is not robust in larval Drosophila with or without over expression of the TRVP receptor in sensory neurons. Larval Drosophila melanogaster with over expression of genes coding for the TRVP receptor (i.e. the capsaicin or heat receptor) in sensory neurons are repelled by capsaicin or high heat (>28oC) whereas the non-over expressers show no behavioral response to capsaicin or huddling behavior when placed in cold. The larvae of Phaenicia sericata are attracted to heat over a food source when placed in a cold environment. At 20oC the blow fly larvae preferred the food over heat and showed no preference to 24-28oC. Larvae Drosophila, with over expression of TRVP receptor, reveal robust avoidance of the heat or capsaicin even over starvation.
3:00 - Epigenetic effects introduce variation in the mating songs of the field cricket Gryllus rubens (Orthoptera: Gryllinae).

First Author
Oliver Beckers
Murray State University

In animal communication, signals and receiver preferences for the signal have to match for reproduction to take place. However, epigenetic factors related to the environment, such as phenotypic plasticity and parental effects, can lead to changes in responsive traits. Introduced variation in the communication system can disrupt communication or require adaptations to compensate for the introduced changes. In Kentucky, the cricket Gryllus rubens has a spring and a fall generation and the male mating songs differ significantly in pulse rate between the two generations. We tested whether the seasonal changes in the songs were the result of parental effects or phenotypic plasticity using rearing experiments. We report that the pulse interval duration of spring offspring was shorter than those of fall offspring, whereas all other measured song characters, and most importantly pulse rate, did not differ. For the plasticity experiments, we reared the crickets at different temperatures and photoperiods. Photoperiod did not affect mating songs, whereas rearing temperature affected all measured song characters: warmer reared males produced faster pulse rates, shorter pulses, longer pulse intervals, lower pulse duty cycles, and higher dominant frequencies than colder reared males. Overall, these changes in the song characters reflect similar changes between spring and fall males in the field, suggesting that the seasonal song variation is the result of phenotypic plasticity induced by temperature differences. The evolutionary ramifications of this song plasticity are discussed.

Saturday, November 2, 2019 1:30pm - 3:30pm

Cellular & Molecular Biology- Oral Presentations
Room 170, MAC Science Building
Section meeting follows talks at 3:15

1:30 - Characterization of a basement membrane associated protein in endomembrane system of Drosophila melanogaster

First Author
Aref Ranjbar
Co-author
Ajay Srivastava
Western Kentucky University
University

Basement Membranes (BM) are important for normal development and tumor progression in fruit flies and humans. In order to get a better understanding of BM dynamics we identified genes that encoded BM interacting proteins. One such gene is predicted to be involved in vesicle-mediated transport in Drosophila melanogaster. Here we characterize this gene by utilizing molecular biology techniques like immunohistochemistry, RNA in situ hybridization, and western blot analysis of antibodies generated in the laboratory. Developed antibodies were tested for specificity and functionality using western blot analysis, which identified this protein to be ~30.8 kilodaltons in size. Antibody staining indicates tissue- and cell-specific localization patterns for this protein. The messenger RNA (mRNA) of the gene of interest was detected using RNA in situ hybridization by using RNA probes labeled with digoxigenin. Data related to the involvement of this protein in vesicle-mediated transport will also be presented.

1:45 - Characterizing preferential RNA-binding targets of ELAVL1 during an immune challenge

First Author
Clara Reasoner
Co-author
Katherine Rothamel
Berea College
Vanderbilt University

The ability of an mRNA transcript to be translated into protein is regulated by interactions with RNA-binding proteins (RBPs). ELAVL1 is a highly conserved RBP that binds to AU-rich elements (AREs) typically within 3’ untranslated regions of target mRNAs. ELAVL1 association with AREs is thought to stabilize the half-lives of target mRNA transcripts leading to prolonged protein expression. Although previous work has identified the importance of ELAVL1
in innate immunity, it remains unclear which effects are direct. Knockdown of ELAVL1 expression in mouse cells decreases the ability of cells to resist infection by viruses. On the contrary, knockout of ELAVL1 in murine myeloid cells led to increased mRNA levels of pro-inflammatory cytokines. To reconcile these conflicting reports and better understand how ELAVL1 modulates an immune response, our lab identified the transcriptome-wide mRNA targets of ELAVL1 in a human monocytic cell line, during naive and immune activated states. To verify these results, we seek to biochemically measure the binding affinity of recombinant ELAVL1 against short RNA sequences that represent target regions identified within endogenous mRNAs. In addition, using the novel technique VIR-CLASP, we found that ELAVL1 binds directly to the Chikungunya viral (CHIKV) RNA genome immediately upon viral entry. Alphaviruses such as CHIKV are known to sequester RBPs in the cytoplasm, preventing RBPs from stabilizing the transcripts needed for antiviral response. We seek to map the binding sites between ELAVL1 and CHIKV RNA in order to better understand how ELAVL1:CHIKV interactions affect viral replication and the host transcriptome. Mapping the binding sites of ELAVL1 under different cellular conditions elucidates how RBPs shape an immune response and how such regulation can be disrupted by viruses.

2:00 - Differential regulation of Glis3 under conditions of chronically elevated glucose contributes to beta cell dysfunction

First Author        Co-author
LilyAnne Grieve  Gary ZeRuth
Murray State       Murray State
University         University

Blood glucose levels are highly regulated to maintain blood glucose homeostasis within an organism. When blood glucose levels are elevated, the pancreatic ß cells produce insulin, which signals the cells of the peripheral tissues to take up circulating glucose. In type 2 diabetes, insulin-resistance develops in the peripheral tissues, and the ß cells increase insulin production to compensate. The period of compensation transitions into a period of ß cell dysfunction wherein insulin production is dramatically downregulated in the ß cells. Prolonged exposure of ß cells to elevated levels of glucose can result in ß cell dysfunction but the molecular underpinnings of these events, termed 'glucotoxicity,' remain unclear. We have found that ß cells maintained under glucotoxic conditions have decreased expression of the transcription factor Glis3, which has previously been implicated in the development of both type 1 and type 2 diabetes. Decreased Glis3 transcription was associated with stabilized full-length protein expression suggesting that Glis3 turnover is linked to transactivation function. Expression of exogenous Glis3 partially rescued insulin expression under glucotoxic conditions indicating that ß cell dysfunction results partly from decreased expression of functional Glis3. This is consistent with our findings that Glis3 binding to the insulin promoter resulted in chromatin relaxation, while loss of Glis3 under elevated glucose conditions significantly decreased insulin regulatory region accessibility. These results suggest that Glis3 expression is regulated at both the transcriptional and posttranslational level in response to chronically elevated glucose levels, and Glis3 dysregulation contributes to beta cell dysfunction.

2:15 - Differentiation of induced pluripotent stem cells into three germ layers using a trilineage differentiation kit

First Author
Jharna Katwal
Berea College

Title: Differentiation of induced pluripotent stem cells into endoderm, mesoderm and ectoderm using a trilineage differentiation kit

Abstract: Reprogramming somatic cells into induced pluripotent stem cells (iPSCs) can be achieved through ectopic expression of the OCT4, KLF4, SOX2 and cMYC transcription factors (Yamanaka factors). This process provides an unlimited supply of cells with embryonic stem cell (ESC)-like properties, without the ethical concerns associated with the destruction of a human embryo. The resulting iPSCs have proven to be a promising tool to study human development and disease. Kogut et al. have optimized a protocol to generate iPSCs with the development of a high-efficiency RNA-based reprogramming method. Pluripotency refers to the ability of a cell to differentiate into the three primary germ layers of human embryo development- endoderm, mesoderm, and ectoderm. The objective of my research was to validate the differentiation capacity of iPSCs into these three germ layers using a commercially available trilineage differentiation kit. An iPS cell line was cultured, collected, and seeded into germ layer-specific
medium provided by the kit. Cells were cultured and allowed to differentiate into endoderm, mesoderm, and ectoderm in their respective medium over a number of days. Immunofluorescent staining using lineage-specific markers was performed, demonstrating successful differentiation of iPSCs into the endoderm, mesoderm, and ectoderm germ layers.

**2:30 - Investigating Phenotypic Changes in rad9-deficient Saccharomyces Cerevisiae Due to Altered AdoMet Levels.**

*First Author* Muhammad Akhtar

*Co-author* Ronald Burns

*Co-author* Erin Strome

Northern Kentucky University

Investigating Phenotypic Changes Attributed to Homozygous sam1 and sam2 mutations in rad9-deficient Saccharomyces Cerevisiae to Elucidate Cellular Pathway Alterations Brought About by Variations in AdoMet Levels.

*S. cerevisiae* contains two genes, SAM1 and SAM2, encoding the enzyme that catalyzes the formation of S-Adenosyl-methionine (AdoMet). AdoMet is a coenzyme involved in methylation reactions within the cell. Previous work from our group has shown that sam1 and sam2 mutations differentially affect genome stability. We used eight yeast strains missing the DNA damage checkpoint gene rad9 and various combinations of mutations of the sam1 and sam2 genes to assay for additional phenotypic differences in these cells. A Phenotypic Microarray assessed the growth difference between the control and mutants in 1440 different chemical/nutrient environments. As genome instability is a common phenotype in cancer development, we included the rad9 gene deficiency, and thus the faulty DNA damage checkpoint, to assess the combinatorial effect of these pathway mutations. With seven mutant strain growth patterns compared to the control, 10,000 conditions/mutation combinations were assessed and 1661 were found with altered growth. This represents 331 different chemicals with 83 different modes of action. Our current focus is aimed at evaluating the changes resulting from the full loss of rad9 and each of the SAM genes: rad9AfEÄ”…Ä½’rad9AfEÄ”…Ä½’ sam1AfEÄ”…Ä½’ and rad9AfEÄ”…Ä½’rad9AfEÄ”…Ä½’ sam2AfEÄ”…Ä½’sam2AfEÄ”…Ä½’ strains. This will allow us to gauge the impact of the combinations of the mutations on SAM1 and SAM2 separately. Our ultimate goal will be linking the observed alterations in growth to causative pathways related to AdoMet to understand a larger breadth of changes due to mutations resulting in the loss of these vital AdoMet synthetases.

**2:45 - Targeting endogenous genes in human induced pluripotent stem cells using CRISPR/Cas9 (DNMT3B, KRT5, and KRT18)**

*First Author* Yacine Choutri

*Berea College*

One of the challenges in stem biology is searching for methods to differentiate iPSCs into specialized cells. It is valuable to monitor this differentiation in real-time. This can be achieved using several markers, and in our project, we used three marker genes: DNMT3B, KRT5, and KRT18. DNMT3B is a marker of pluripotency, KRT18 is a marker of premature keratinocytes, and KRT5 is a marker of differentiated keratinocytes. The differential expression of these genes was observed using three fluorescent reporters: BFP, tdTomato, and 3xWasabi, respectively. We constructed a targeting vector for each marker gene that had three elements. First, homology arms to increase the gene-targeting efficiency, and they were constructed from genomic DNA through PCR reactions. Second, a fluorescent reporter whose expression correlates with the expression of the marker gene. Third, a selection cassette to help identify a successful knock-in event. To assemble our targeting vector, we first digested the plasmid backbone, and then performed a Hifi-DNA assembly. These reactions were confirmed through gel electrophoresis. Our targeting vector was then amplified through bacterial transformation and plasmid prep, and characterized by Sanger sequencing. Three targeting vectors were constructed: DNMT3B(BFP), KRT18(tdTomato), and KRT5(3xWasabi). In the next step, the targeting vector was knocked-in into the specific locus of the endogenous marker gene within iC4-4 iPSCs. The gene-editing was achieved using CRISPR/Cas9 technique and nucleofection. We were able to identify the DNMT3B(BFP)+ cells using fluorescence microscopy and isolate them using flow cytometry. These cells were expanded for future use in human disease modeling.
Lung cancer is the leading cause of cancer death in the United States. Patients whose adenocarcinoma have high integrin $\alpha^2\beta^1$ expression have poorer outcomes than patients with lower $\alpha^2\beta^1$ expression. Due to this correlation, ectodomain-targeted therapies were developed to prevent integrin-extracellular matrix binding; however, these treatments failed in clinical trials. In addition, preliminary data suggest that loss of integrin $\alpha^2\beta^1$ expression correlates with a decrease of transforming growth factor beta (TGFβ). Together, these results suggest that the integrin $\alpha^\beta\beta\beta\beta^1$ cytoplasmic tail (CT), which therapies do not address, is required for TGFβ-induced tumor growth. To define this mechanism, we used Western blotting techniques to analyze the role of integrin $\alpha^\beta\beta\beta\beta^1$ in TGFβ signaling of lung cancer. We exposed TGFβ and TGFβ receptor 1 (TGFβR1) inhibitor to multiple cell lines: TGFβR1 inhibitor in wild type (WT) $\alpha^\beta\beta\beta\beta^1$ and TGFβ in $\beta^1$-knock out (KO) cells that express either a full-length $\alpha^2\beta^1$ (WT-R), only a functioning tail (Tac-$\alpha^\beta\beta\beta\beta^1$), or a non-functional/mutated tail ($\beta^1$ mt-tail). WT cells, treated with a TGFβR2 inhibitor, showed a significant decrease in protein kinase B (AKT) activation, a protein that is critical in cell proliferation and non-canonical TGFβ signaling. In addition, WT-R and Tac-$\alpha^\beta\beta\beta\beta^1$ cells restored TGFβ- and $\beta^1$-induced AKT activation when compared to KO cells, whereas $\alpha^\beta\beta\beta^1$-mt-tail cells failed to rescue AKT activation. These results suggest that the integrin $\alpha^\beta\beta\beta\beta^1$ CT is required for TGFβ-induced AKT activation and cell proliferation. This proposes a mechanism of resistance for failed cancer therapies and a new approach for integrin $\alpha^2\beta^1$ drug therapies.
Methanogens are a group of microorganisms that break down the components of organic (animal) waste into simpler components such as methane (CH4), carbon dioxide (CO2) and other gases during anaerobic digestion. The digestion of wastes to produce biogas is accomplished by a consortium of microorganisms especially obligate anaerobic fermenters that produce short chain organic acids and hydrogen, and the archaea which use these products to produce methane. The produced methane biogas, which is a form of renewable energy, is used as a heating fuel for farmers and the anaerobic digester (AD) system making it a self-sustained system and cost saving for farmers. In addition, anaerobic digestion is used for the management of animal wastes as well as limiting the impact of greenhouse gases when methane is used within the AD system or used in the electric power, instead of being released into the atmosphere. The digested material can also be used as fertilizer for organic crop production. The purpose of this study is to investigate the impact of antibiotics in the animal waste on the level of methane production during anaerobic digestion. Antibiotics are commonly added to animal feed for prevention, control or treatment of bacterial infections. It is also known that vast quantity of the antibiotics administrated to animals are excreted through feces and urine which make up manure. We hypothesize that the presence of antibiotics in the animal manure may impact the quantity of methane production by affecting the bacteria and methanogens that are involved in methane production. We investigate the impact of sulfamethoxazole, tylosin and chlortetracycline at varying concentrations in laboratory designed digester systems. These antibiotics represent three classes of antibiotics commonly used in the food animal production system in the United States. This study will produce data that will allow us to gain insights into the
An effective method for monitoring chemical reactions is necessary to better understand their mechanisms and kinetics. The solution to this problem requires a spectroscopy technique with a fast data acquisition rate, high sensitivity, high selectivity, and structure-spectrum correlation. Additionally, for effectively monitoring aqueous reactions, a reaction monitoring method needs low water interference. Surface-enhanced Raman spectroscopy (SERS) provides these features, which makes it a valuable tool for monitoring aqueous reactions. To obtain the Raman enhancement, metallic nanostructures made of silver or gold are required. Using this method in situ has been challenging due to nanostructures aggregating and crashing out of solution. However, this problem can be remedied with the addition of a stabilizing agent. In this study, gold nanoparticles stabilized with a capping agent were used to monitor an aqueous reaction involving rhodamine 6G (R6G) and hydroxide ion. Two initial hypotheses for the reaction were developed and investigated: saponification and dimerization. Saponification is the conversion of an ester to a carboxylic acid in basic conditions, and dimerization is the process of two monomers forming a stable complex (i.e. a dimer) through strong or weak interactions. This research study shows that aqueous reactions can be monitored in situ using lightly capped SERS, which has never been done before to our knowledge.

2:30 - Effects of nutrient overload and environmental conditions on algal bloom formation: A case study of private ponds in Madison County

Madison County is home to many private ponds used for agricultural and recreational purposes. Each year, the owners of these ponds observe harmful algal blooms (HABs) that release toxins into the water, potentially limiting the use of these ponds. A pilot study in summer 2018 observed a harmful algal bloom (HAB) occurring in one pond in Madison County that roughly correlated with a rise in water sulfate levels with no detectable levels of nitrate or phosphate present. A follow-up study of this pond and others in the area aimed to identify trends in water nutrient levels and environmental conditions that would indicate the imminent formation of HABs in these locations. The nutrient levels and environmental conditions of 8 private ponds and 2 public lakes within an 11-mile diameter were monitored thrice weekly from June through August 2019. Taxonomical characteristics identified the strain(s) present in potential HABs EPA-validated methods including major anions (ion chromatography), phosphates (spectrophotometry) and turbidimetry, provided nutrient level quantification. Environmental conditions such as rainfall, water pH, dissolved oxygen, conductivity and temperature were also monitored. From this work, it was found that sulfate levels were not correlated HAB formation and confirmed that HABs can form in these water sources with nitrate and phosphate levels below detectable limits. While turbidity and dissolved oxygen levels were correlated with HAB formation, these are not causative of the HAB. This presentation will broadly outline the results of monitoring at each location and demonstrate these observed trends.

2:45 - Detection of Nitrite Using Nitrite Ionophore VI for Indirect detection of Nitric Oxide

Nitric oxide (NO) is consistently studied as a biomarker for various diseases. Direct measurement of NO is difficult due to its very short lifetime (less than 100 ms) in vivo. Therefore, the objective of this research project was to measure nitrite (NO2-), the more stable oxidation product of NO using chronopotentiometric method with nitrite selective electrodes. Nitrite ionophore VI (Cobalt II tert-butyl-salophen) was incorporated into the membranes to enhance the selectivity of the electrodes for nitrite. Membranes were prepared with varying compositions and tested
for selectivity toward nitrite, using two methods: classical potentiometry and chronopotentiometry. In classical potentiometric testing, the ionophore-containing membranes possessing different ion-exchange sites were tested against ionophore-free membranes in phosphate buffer, with and without interfering ions and the ionophore-based membrane showed no observable selectivity enhancement for nitrite. The chronopotentiometric measurement method demonstrated improvement in the selectivity of the electrodes to nitrite in a phosphate buffer.

Saturday, November 2, 2019 1:30pm - 3:15pm

Environmental Sciences - Oral Presentations
Room 251, MAC Science Building  Section meeting follows talks at 3:00

1:30 - Comparison of benthic macroinvertebrate sampling methods on non-wadeable waters: initial findings

First Author Co-author
ED WILCOX Richard Cristan
Kentucky State Kentucky State
University University

Abundant documentation exists regarding benthic macroinvertebrate sampling methods in wadeable waterways; however, limited information is available on sampling methods in non-wadeable waterways. Non-wadeable waterways are those that cannot be waded along the length or the breadth. Additionally, if equipment used for sampling in wadeable waterways, such as a D-frame net, are not useable, the waterway may also be considered non-wadeable. Benthic macroinvertebrates can be sampled in non-wadeable waterways using artificial substrates such as Hester-Dendy samplers; however, there is limited scientific research documenting the viability of non-wadeable waterway sampling methods and even less comparing effectiveness of the sampling methods. For this study, we will compare the rates of colonization and biodiversity between Hester-Dendy multi-plate samplers, leaf pack samplers, and a hybrid sampler comprised of both Hester-Dendy multi-plate samplers and leaf pack samplers. The results of this study allow us to determine which samplers are most effective for sampling benthic macroinvertebrates in non-wadeable waters. Preliminary findings will be presented.

1:45 - The Enhancement of Climate Change Science Communication and Understanding Through Glacier Tourism

First Author Co-author Co-author
Natalie Kincheloe Leslie North Cara Walters
Western Kentucky Western Kentucky Western Kentucky
University University University

Arctic tourism has increased as accessibility to these regions has improved. Additionally, as a result of 'last chance tourism,' tourists are rushing to the Arctic region to see natural features before warming atmospheric temperatures diminish the ability to visit these places. The natural environment provides the opportunity for educators to teach the general public about scientific topics that often are misunderstood in the classroom. Within the tourism industry, informal learning is a valuable, yet extremely understudied phenomenon. Iceland is a country that lies on the north Atlantic and has experienced significant increase in foreign visitors over the past decade. Since thousands of visitors participate in guided glacier tours annually in Iceland, an opportunity to couple glacier tourism with informal education is created. Specifically, since climate change science is still poorly understood among members of the general public, glacier tours could serve as a venue through which to promote climate science and engage individuals in living climate-responsible lives. This study utilized a mixed-methods approach of pre- and post-outcome assessments, semi-structured interviews, and observations to evaluate tourist perceptions during three different glacier tour experiences in Iceland. This project assessed the outcomes and applicability of informal environmental education to teach about climate change during different guided glacier tour experiences. Preliminary data analysis suggests that differences do exist between tour experience, learning, and affective behavior outcomes.

2:00 - Monitoring water quality in relation to the Burgin Sewer Project in Burgin, KY
Water quality is an important, life-sustaining resource and, when degraded, can have negative effects on health and longevity of all organisms. Anthropogenic activities, such as human disturbance and infrastructure, waste disposal, agriculture, livestock, and tourism, in addition to natural variations in climate, can negatively affect water quality and community structures of ecosystems. On-going sampling of water quality is critical to monitor the health of ecosystems. A city sewer system was recently installed in a town with no previous waste treatment system. The United States Environmental Protection Agency and the Kentucky Division of Water periodically sample various tributaries of the Cane Run Watershed and Lake Herrington, near Burgin, KY, and have found high levels of nitrogen and phosphorus. This study assessed water quality at a site upstream of the new sewer system, three locations downstream, and a stream on a nearby nature preserve. Water quality parameters sampled include conductivity, dissolved oxygen, flow rate, nitrates, pH, temperature, turbidity, and monitoring for presence of coliform and Escherichia coli. Sampling started in September 2017 and ended in April 2019. Preliminary results indicate that E. coli levels were higher downstream of the sewer system compared to the upstream site, turbidity levels were higher at the upstream site, pH was higher at the upstream site than the first two downstream sites, and dissolved oxygen levels were lower at the first downstream site versus all other sites. Additional data are being analyzed and preliminary results will be presented.

2:15 - Unexpected restoration outcomes in two urban wetlands resulting from differential groundwater flow

Whereas flood control and nutrient processing are two well-studied ecosystem services attributed to urban wetlands, one often overlooked benefit is refuge for aquatic organisms during extreme conditions such as drought. Evaporation, however, may concentrate pollutants and provide for inhospitable conditions. The dynamics of refuge benefits and detrimental effects of pollution are poorly understood in urban restored wetlands and further complicated by differences in routing of water to wetlands. To this end, we studied relationships between macroinvertebrate communities and water chemistry in two wetlands 60m apart in Louisville, KY, that were restored in August, 2017. Water-quality parameters, water levels, and family-level macroinvertebrates were sampled. Paired t-tests were used to compare the water quality of the two wetlands. During typical conditions, mean alkalinity was significantly greater in the second wetland that had periodic activation of a groundwater spring. Variance in specific conductance indicated greater delivery of road salts to the first wetland during winter months but consistent delivery of nitrate and salts to the second wetland through groundwater flow paths. The greater nitrate loading initially led to less hospitable conditions for macroinvertebrates in the second wetland due to oxygen fluctuations. However, groundwater supplementation to the second wetland during drought in the fall of 2019 provided refuge for macroinvertebrates when the first wetland was nearly dry and had concentrated levels of solutes. These results underscore the importance of seasonal monitoring of wetlands for measuring restoration success and determining expectations for trajectories of recovery.

2:30 - Vascular Plants of Pine Mountain Settlement School and James E. Bickford State Nature Preserve, Harlan County, Kentucky

Whereas flood control and nutrient processing are two well-studied ecosystem services attributed to urban wetlands, one often overlooked benefit is refuge for aquatic organisms during extreme conditions such as drought. Evaporation, however, may concentrate pollutants and provide for inhospitable conditions. The dynamics of refuge benefits and detrimental effects of pollution are poorly understood in urban restored wetlands and further complicated by differences in routing of water to wetlands. To this end, we studied relationships between macroinvertebrate communities and water chemistry in two wetlands 60m apart in Louisville, KY, that were restored in August, 2017. Water-quality parameters, water levels, and family-level macroinvertebrates were sampled. Paired t-tests were used to compare the water quality of the two wetlands. During typical conditions, mean alkalinity was significantly greater in the second wetland that had periodic activation of a groundwater spring. Variance in specific conductance indicated greater delivery of road salts to the first wetland during winter months but consistent delivery of nitrate and salts to the second wetland though groundwater flow paths. The greater nitrate loading initially led to less hospitable conditions for macroinvertebrates in the second wetland due to oxygen fluctuations. However, groundwater supplementation to the second wetland during drought in the fall of 2019 provided refuge for macroinvertebrates when the first wetland was nearly dry and had concentrated levels of solutes. These results underscore the importance of seasonal monitoring of wetlands for measuring restoration success and determining expectations for trajectories of recovery.
Pine Mountain Settlement School (PMSS), a rugged 298-ha mountainous area from 530 m to 823 m elevation, is located in northern Harlan County of southeastern Kentucky. PMSS was founded in 1913 as a school for mountain youth, and it has served as an environmental education center since 1972. PMSS is situated within the Pine Mountain Overthrust Fault of the Cumberland Mountain Ecoregion in the Eastern Kentucky Coal Field Physiographic Region. Bedrock consists of shale, siltstone, conglomerate, sandstone, and coal of the Pennsylvanian Series. Mountain colluvial and residual soils are on steep south and very steep north mountain slopes. The floristic study included the James E. Bickford State Nature Preserve (BSNP), a 141-ha mountain tract on the PMSS north face, to preserve an old-growth stand of Mixed Mesophytic Forest. The PMSS flora consists of 738 (575 native, 163 non-native) taxa from 422 genera in 128 families. Non-native taxa constitute 30 introduced and 133 naturalized with 74 state-listed invasive. BSNP is comprised of 481 taxa (65.2% of PMSS flora) in 297 genera from 111 families; 14 species are invasive. BSNP has 12 state-listed endangered, threatened, or special concern plant species.

2:45 - The stoneflies (Plecoptera) of the Black Mountains

First Author          Co-author
Madeline Metzger      Scott Grubbs
Western Kentucky      Western Kentucky
University            University

Stoneflies are excellent water quality indicators due to their high sensitivity to organic pollution and environmental changes. A predicted temperature increase of 1.8ºC−4.0 ºC is expected by the year 2100. This increase may affect cold-adapted species most profoundly due to thermal intolerances. If environmental changes accrue rapidly species may not be able to adapt to the environment and could face extirpation. Climate change is known to impact species ranges and can lead to summit traps in low montane environments. Understanding which species exist across environmental gradients will allow for futuristic climate modeling, ultimately contributing to a variety of applications in ecology and conservation efforts. Mount Mitchell State Park and adjacent Pisgah National Forest provide a protected landscape with a ca. 1,000 km elevation gradient. Ranges of many cold-water species could decrease or be lost altogether with increasing temperatures. Sampling efforts have occurred seasonally (spring, summer, fall and winter) from 2014−2019 and represent the broadest ranges of altitudes and stream sizes present within the sampling area. To date, over the course of 16 sampling trips, 56 species have been collected from 44 unique sites. Species richness estimates generally agree that 56−84 species are likely present. More species are expected with the addition of nymphal sampling. Results to date are limited. Species altitude ranges using box plots presently show that most species are altitude generalists versus specialists. This occurrence data will be used to model potential habitat range shifts and any changes in gene flow using several different climate projections.

Saturday, November 2, 2019  1:30pm - 3:30pm

KCTCS Faculty meeting
Room 206, MAC Science Building
We welcome all KCTCS faculty to join this meeting to talk with colleagues on other KCTCS campuses

Saturday, November 2, 2019  1:30pm - 2:30pm

Microbiology - Oral Presentations
Room 102, MAC Science Building
Section meeting follows talks at 2:15

1:30 - Discovery of Novel Antibiotics Produced by Soil Bacteria: Piloting the Tiny Earth Project

First Author
Michael Vacik
Kentucky Wesleyan
Antibiotic resistance is a rising epidemic in today's world. According to the Centers for Disease Control and Prevention, more than two million people contract antibiotic resistance infections every year which leads to twenty-three thousand deaths. The Tiny Earth Project is a network of students and professors from around the globe with a common goal of addressing the shortage of effective antibiotics. The goal of the Tiny Earth Project is to discover novel antibiotics produced by soil bacteria. Soil bacteria were isolated and tested for antibiotic activity against safe relatives of the ESKAPE pathogens (Staphylococcus epidermis, Enterobacter aerogenes, Pseudomonas putida, and Enterococcus raffinosus). Those with positive results were used for PCR using 16S rRNA primers followed by DNA sequencing as well as biochemical testing. BLAST was used to compare DNA sequences to other known bacteria. 16S rRNA sequence of isolate 1 was a 99% match with a strain of Streptomyces, a gram-positive genus including some bacteria known to produce antibiotic properties. 16S rRNA sequence of isolate 11 matched with both an uncultured bacterial clone and Flavobacterium. Information regarding these isolates and isolate samples will be sent to the Tiny Earth research team at The University of Wisconsin-Madison. Results from this experiment and others like it across the globe could potentially save millions of lives through the production of new antibiotics in the future.

1:45 - Identification of Bacteria in Spirit Industry Fermenters

First Author
Brittany Kelevra
Kentucky Wesleyan
College

Co-author
Rachel Pritchard
Kentucky Wesleyan
College

Identification of Bacteria in Spirit Industry Fermenters

Ethanol fermentation is a popular metabolism exploited by industries due to the consumers’ need for alcoholic beverages or biofuel. There are previous studies showing the main contaminant in biofuel fermentation is Lactobacillus. Similar but slightly different industrial processes in the production of beverages may lead to different contaminants. This goal of this study was to use a culture-based method of identification of the bacterial contaminants in the spirit fermenter tanks. Homofermentative Lactobacillus was identified based on culture technique. 16S rRNA gene sequencing for species identification supported the culture-based methods. Based on the process used for beverage production, it is likely this contaminant was present in the milled grain in the fermented mixture. This data reveals possibilities to prevent or treat the problem without the use of antibiotics, a common temporary relief, that have been shown to add to the growing problem of antibiotic resistance. Finding the cause of the contamination can be more economically feasible from a quality assurance stance as well. Enacting more specific cleaning protocol at the point of contamination is more cost-efficient than continuously upgrading the type of antibiotic used.

2:00 - Double trouble for dogs: Emergence and subsequent enzoonosis of two novel canine influenza viruses, H3N2 and H3N8

First Author
Alexander Lai
Kentucky State
University

Co-author
Shou Su
Nanjing Agricultural
University

Two novel influenza viruses appeared in canine species around the turn of the new millennium: canine influenza virus (CIV) H3N2 and CIV H3N8. CIV H3N2 originated from avian influenza virus (AIV) H3N2, while CIV H3N8 originated from equine influenza virus (EIV) H3N8, respectively. Using computational-intensive phylodynamic analysis to reconstruct the evolutionary pathways, we have established that the emergence of CIV H3N2 from AIV H3N2 was around 2002-2004, first in Asia, then subsequently spread to North America; whereas the emergence of CIV H3N8 was from EIV H3N8 around 2003, first in Florida, then subsequently spread to other geographic locations. Both CIVs are now enzootic influenza viruses in dogs, and commercial licensed bivalent vaccines are available. The
unique conditions for these interspecies transmissions and subsequent diverged evolution, as revealed by phylogenetic analysis, will be presented and discussed. Furthermore, being susceptible to multiple influenza viruses with a potential for co-infection and genetic reassortment, that dogs could be potential mixing vessels for genesis of human pandemic influenza virus is alarming.

Saturday, November 2, 2019  1:30pm - 2:30pm

**Physiology & Biochemistry - Oral Presentations**

Room 257, MAC Science Building  
Section meeting follows talks at 2:15

1:30 - Investigating HMPV Phosphoprotein Function

First Author  
Amber Earlywine  
University of Kentucky

Co-author  
Trevor Creamer  
University of Kentucky

HMPV is a respiratory virus that effects children, elderly, and those who are immunocompromised. Each year HMPV leads to many children and elderly being hospitalized and can lead to death in severe cases. Creamer and Dutch labs at the University of Kentucky are collaborating on this project to research the mechanisms by which HMPV replicates and spreads. Recently, data has shown that the Phosphoprotein (P protein) has a significant role in HMPV replication. We have identified that the P protein is involved in the formation of inclusion bodies within viral infected cells and these inclusion bodies seem to be a viral replication site.

The goal of this project is to identify the function of the P protein in HMPV viral replication and, ultimately, find a way to inhibit replication and viral spread.

1:45 - Retinol Esterification in American Lobster (Homarus americanus)

First Author  
Collin Wells  
Centre College

Co-author  
Olivia Honaker  
Centre College  
Yuzhang Li  
Centre College  
Stephanie Dew  
Centre College

Vitamin A (retinol) is a necessary nutrient for all higher animals. Many invertebrates also use vitamin A as their visual chromophore. Since animals are unable to synthesize their own vitamin A, they must get it in their diet. They must then be able to transport and store the vitamin A, and transform it into the active forms, retinal and retinoic acid. In mammals, retinol is converted into retinyl esters in three tissues: in the small intestine for export, in the liver for storage, and in the eye as part of the visual cycle. Little is known about retinol esterification in invertebrates. Mammals have two enzymes that can catalyse retinol esterification: lecithin:retinol acyltransferase (LRAT) and acyl-CoA:retinol acyltransferase (ARAT). We have identified an ARAT activity in microsomes from the hepatopancreas of the American lobster (Homarus americanus). This activity shows a linear dependence on time and microsome concentration. It shows temperature dependence and an optimal pH of 6.5. We have determined the Km and Vmax for both retinol and the acyl-CoA.

2:00 - Pak1, TGFÎ±, and Ki-67 expression in Human Gastric and Gastroesophageal Junction Adenocarcinomas.

First Author  
Michael Parritt  
Wood Hudson Cancer Research Laboratory

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Mariah Dooley  
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We examined P21 Activated Kinase-1 (Pak1) expression in formalin fixed paraffin embedded (FFPE) sections of adenocarcinomas arising in the epithelium of the stomach and gastroesophageal junction. Pak1 is a downstream effector of the transforming growth factor α (TGFα) signaling pathway which results in the activation of cell proliferation, cell motility, and transformation. TGFα is a ligand that activates the epidermal growth factor receptor (EGFR). While Pak1 and TGFα are overexpressed in cancer, we asked if these biomarkers are correlated with cell proliferation (indicated by Ki67 staining) in diffuse or intestinal subtypes of adenocarcinomas. This was done semi-quantitatively by performing immunohistochemical staining and calculating histoscores (area stained X intensity of the stain) and quantitatively (counting Ki67 labeled nuclei) in FFPE surgical specimens from 99 patients: 25 cases of gastric diffuse adenocarcinoma, 23 cases of gastric intestinal adenocarcinoma, 11 cases of gastroesophageal junction (GEJ) diffuse adenocarcinoma, and 40 cases of GEJ intestinal adenocarcinoma. Tumors arise at the gastroesophageal junction as a result of gastric reflux. Tumors arise in the gastric epithelium due to environmental conditions or genetic factors. The differences between the nuclear Pak 1 histoscores of gastric diffuse and either gastric intestinal tumors or GEJ intestinal tumors for nuclear Pak1 levels were significant (p= 0.0002 & 0.0001). Ki67 expression was less in gastric diffuse tumors than in gastric intestinal (p= 0.03) or GEJ intestinal (p=0.01) adenocarcinomas. Overall, Ki67 was inversely correlated with nuclear Pak 1 (p=0.04) and nuclear TGFα (p=0.02) whereas cytoplasmic Pak 1 and cytoplasmic TGFα were highly correlated (p=0.0001).

Saturday, November 2, 2019  1:30pm - 4:30pm

**Teacher workshop - Geology Field Trip to Big Hill & Fossil Collecting**

Meet in parking lot behind MAC Science Building

Rocks in the Berea area range in age from 360 to 320 million years old and represent environments including very deep stagnant seas, shallow subtropical seas, and wide, shallow rivers. This trip will explore Berea’s geologic history by examining the rocks left behind in each environment during the 40-million-year history. You will be able to collect several different types of sedimentary rocks and fossils from each environment. This is a hands-on trip; so, come prepared in boots and with collecting bags to work in a roadside setting. Led by Frank Ettensohn of UK Earth & Environmental Science Dept.

Saturday, November 2, 2019  2:00pm - 3:30pm

**Afternoon Coffee & Snack Break**

MAC Science Building
Saturday, November 2, 2019  4:00pm - 6:45pm

**Forest Outings**

Meet in Forestry Outreach Center Parking Lot

After our Saturday sessions are over at 3:30, we're going to the forest to enjoy the last hours of Daylight Saving time! Sunset is 6:43pm. Meet at the Forestry Center parking lot, 2047 Big Hill Rd. Berea, KY 40403. You can join a guided hike at the Berea College Forest with the Forestry Center staff. There are various trail options here including the famous Pinnacles trail. Dr. Ralph Thompson will also lead a hike here (There’s not enough time for a hike to Anglin Falls, but hike with Ralph and ask him all about it!) Dress for the weather, bring some water, take some photos (#TheSpiritOfKAS) and have fun!

**5-8pm on Saturday:** If you have little hikers with you, there’s also a family-oriented Tinkergarten Lantern Walk. Meet at the Berea Forestry Outreach Center 2047 Big Hill Rd. Berea, KY 40403.

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Sunday, November 3, 2019  10:00am - 2:30pm

**Berea College Forest Field Tour with Society of American Foresters**

Meet in Forestry Outreach Center Parking Lot

The Berea College Forest is one of the oldest managed private forests in the United States having begun its efforts in 1897 with the dawn of the American conservation movement. Management efforts focus on wood, water, wildlife and recreation, with an emphasis on sustainability. Offering both classes and outreach programs related to forestry, one of its great values is as a resource to demonstrate and evaluate the results of long-term forest management in the Southern Appalachian Region. Join the Forestry Department staff for an inside look at this unique endeavor, which includes a horse logging operation and prescribed burn areas. Join SAF Buses that will arrive in Berea around 10:00. $25, by Pre-registration.

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**Social media Photo contest**

Capture YOUR experience of the KAS Annual meeting and share it using #TheSpiritOfKAS

Post your photos by 8pm Sunday Nov 3. Contest rules are at [www.kyscience.org](http://www.kyscience.org)

KAS Twitter: @Kyscientists

KAS Instagram: kentuckyscience

KAS Facebook: Kentucky Academy of Science