154th Annual Meeting of the

Kansas Academy of Science

&

Kansas Entomological Society

(92nd Annual)

Sterling College
April 1-2, 2022

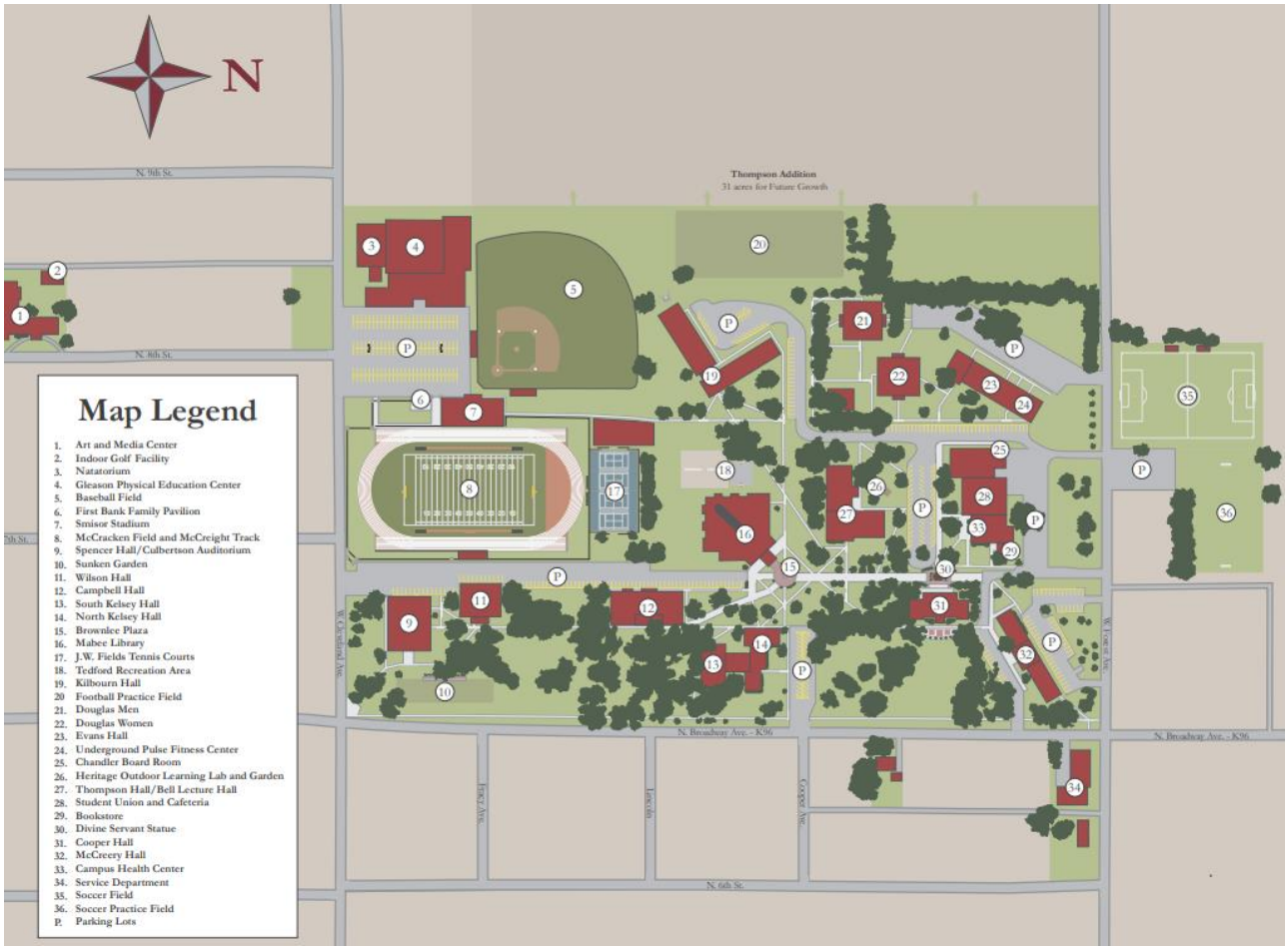
Program & Abstracts

Welcome to Sterling College!

If you have any questions while you are here, please contact one of our host committee members:

Jonathan Conard
Wai-Foong Hong
Randi Wise
Debbie Rogers
Daniel Giese
Pete Kosek
Samuel Hokamp

Sterling College Campus Map



The following meeting events will be held in these buildings

Meeting Registration: West Cafeteria (enter through the doors on the southwest side of the cafeteria)
Oral Presentations: Cooper Hall (Classrooms on 2nd and 3rd floor)
Poster Presentations: Mabee Library
Keynote Speakers, Friday Dinner & Saturday Lunch: West Cafeteria (Student Union): enter through the door on the southwest side of the cafeteria.

2022 KAS / KES Meeting Schedule

Friday, April 1

3:15 p.m.	Kansas Ethanol Plant Tour	Meet at parking lot south of Student Union
3:45 p.m.	Hyatt Life Sciences Tour	Meet at parking lot south of Student Union
4:00 – 7:00 p.m.	Registration	West Cafeteria Corridor
6:00 – 7:00 p.m.	Dinner	West Cafeteria
7:00 – 8:00 p.m.	Keynote: Dr. Sabrina Beckmann *"Taming uncultured deep sea microbes for the anaerobic oxidation of methane"*	West Cafeteria
8:00 – 9:00 p.m.	KAS Executive Council Meeting	Chandler Board Room

Saturday, April 2

7:00 – 10:00 a.m.	Registration	West Cafeteria Corridor
7:00 – 8:15 a.m.	Continental Breakfast	West Cafeteria
8:00 – 8:15 a.m.	Welcome address	West Cafeteria
8:20 – 9:40 a.m.	Oral Paper Session 1	Cooper Hall
9:50 – 10:30 a.m.	Poster Session	Mabee Library
10:30 – 10:50 a.m.	Morning Break	3rd Floor Cooper (Heritage Hall)
10:50 – 12:10	Oral Paper Session 2	Cooper Hall
12:15 – 1:00 p.m.	Luncheon	West Cafeteria
1:00 – 2:00 p.m.	Keynote: Dr. Jacob Goheen *"A Game of Thorns: Megaherbivores and Mutualists in an African Savanna"*	West Cafeteria
2:00 – 2:15 p.m.	KAS Business Meeting	West Cafeteria
2:20 p.m.	Award Presentations	West Cafeteria
2:45 – 3:30 p.m.	KES Business Meeting	Chandler Board Room

Lodging

Lodging options include locations in Sterling and nearby Lyons (8 miles north).

Sterling

Country Inn
430 S. Broadway
Sterling, KS 67579
620-904-4424

AirBnB includes several good options for lodging in the Sterling area.

Lyons

Celebration Center Inn & Suites
1108 East Highway 56
Lyons, Kansas 67554
620-280-6022

Campus Internet access:

Wireless access on campus is available through the BYOD-STUDENT network using the pass: SCW@rriors4Life!

Oral Presentations:

Equipment:

The computers provided in the sessions will be Windows based PCs with Microsoft Office software. Your presentation should be in Microsoft Powerpoint (.ppt or .pptx) or Adobe PDF format (.pdf). Please bring a copy of your presentation on a USB drive to load prior to your session.

Length and format:

There will be 15 minutes allotted for each talk and 5 minutes for questions.

Moderators:

Session moderators will be designated to facilitate each session. The names of the moderators are noted in the session schedule. The session moderator will provide technical assistance with displaying your presentation.

Poster Presentations:

Poster Size:

Maximum poster size is 36 inches high x 48 inches wide in landscape format.

Poster setup:

Posters will be displayed in Mabee Library throughout the conference. Set-up for posters is between 7:00 – 9:30 AM on Saturday, April 2nd. Authors should be present during the entire poster session time period, 9:50 – 10:30 AM on Saturday. Posters should be removed from Mabee Library by 1:00 PM on Saturday. All poster boards will be numbered, make sure that you place your poster in the correct location. Pushpins and display boards will be provided.

Kansas Academy of Science Field Trips

Field Trip I: Kansas Ethanol Plant Tour

Field Trip Leader: Randi Wise & Daniel Giese

Friday, April 1st 3:15 PM – 4:45 PM.

Location: Meet at 3:15 p.m. in the parking lot directly south of the Sterling College Student Union.

Kansas Ethanol is a 55-million gallon ethanol plant that uses corn and milo for biofuel production. The tour will take visitors through different areas within the plant and explore the production process from incoming grain to outgoing ethanol in this behind-the-scenes experience.

Group Meeting Location: Meet at 3:15 at the parking lot on the south side of the Student Union. We will carpool to the Kansas Ethanol Plant (approximately 6 miles north of Sterling).

Maximum tour capacity of 20 individuals. Please reserve your field trip spot during your meeting registration. Wear close-toed shoes and long pants for the tour.

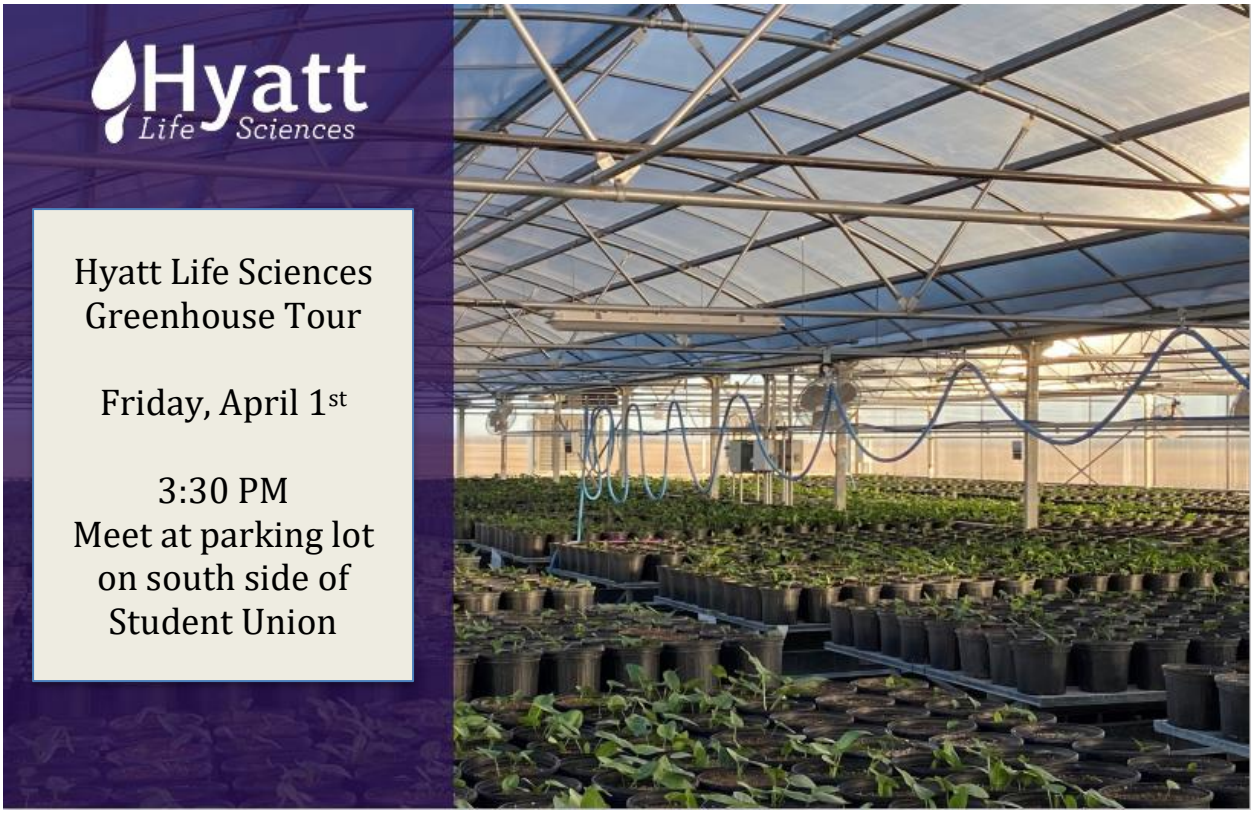
Field Trip II: Hyatt Life Sciences Greenhouse & Production Tour

Field Trip Leader: Wai-Foong Hong & Jonathan Conard

Friday, April 1st: 3:45 PM – 4:45 PM.

Location: Meet at 3:45 p.m. in the parking lot directly south of the Sterling College Student Union.

Hyatt Life Sciences scientifically evaluates botanical compounds used in traditional medicine to produce a range of supplements. See what's growing at the Hyatt Life Sciences greenhouse and learn about the process of plant-based nutraceutical applications. The greenhouse tour focuses on the production of *Arum palaestinum* (black calla lily) which has been used for centuries in traditional Middle Eastern medicine and is a key part of supplements produced by Hyatt Life Sciences.



Keynote Presentations

Friday, April 1st: 7:00 – 8:00 pm

"Taming uncultured deep-sea microbes for the anaerobic oxidation of methane"

Dr. Sabrina Beckmann
Department of Microbiology
Oklahoma State University

Methane, a potent greenhouse gas, is prevented from entering our atmosphere by microbial oxidation in the deep-sea subsurface carried out by methanotrophic archaea (methanotrophs). Yet little is known about these methanotrophs, microbial mechanisms and environmental controls responsible for the methane removal. Methanotrophs need electron acceptors to oxidize methane as you need oxygen to breath, a process where you transfer reducing equivalents (or electrons) to the electron acceptor oxygen. Since we are in the deep sea, sulfate is ubiquitous in the ocean representing a widely available electron acceptor for methane oxidizers. Interestingly, our surveys showed a lack of sulfate reducing bacteria and sulfate reducing genes in the hot spots of methane oxidation: cold seep carbonates! Instead, we detected a diverse methanotrophic archaeal community across these carbonates in the Atlantic and Pacific Margins, that can utilize a broad range of electron acceptors including oxidized nitrogen compounds, chlorinated compounds, and isoprene to fuel methane oxidation. We successfully enriched distinct methanotrophic consortia of Bathyarchaeota, Dehalococcoidia and CPR. Our cultures showed that direct interspecies electron transfer (DIET) is playing a significant role for the methane oxidizing Bathyarchaeota. Metagenomes of the enrichments have shown that other bacteria, in particularly CPR, are performing helping functions for the microbial consortia to maintain methane oxidation. These enrichments demonstrate the possibility of microbial activity at very low reduction potential, which is common throughout the deep-sea subsurface, and show how microbes are partnered to gain the most energy out to fuel their metabolic processes in energy limited systems. These finding significantly extend our current views regarding the physiology of methane oxidizing archaea and the spectrum of electron acceptors and microbial partnerships facilitating methane oxidation in the deep-sea biosphere.

Saturday, April 2nd: 1:00 – 2:00 pm

"A Game of Thorns: Megaherbivores and Mutualists in an African Savanna"

Dr. Jake Goheen

Associate Professor, Department of Zoology & Physiology, University of Wyoming

Ecologists who work in savanna ecosystems often adhere to a non-equilibrial worldview, in which drought and fire prevent community and ecosystem properties from reaching a stable balance. Across East Africa, a plant defense—ant mutualists—creates monocultures of myrmecophytic trees, thereby preventing elephants from transforming hundreds of kilometers of savanna bushland to open grassland. However, an invasive species--the big-headed ant--has recently disrupted this mutualism, rendering trees defenseless against elephants. I will discuss the ecology of this ant-tree-elephant interaction, its implications for wildlife conservation, and the consequences of its disruption for lions and their primary prey, plains zebra. Species interactions like predation, herbivory, and mutualism deserve our attention in working to understand the structure and function of African savannas.

Oral & Poster Presentations

(Student Competitors: (1) = Undergraduate, (2) Masters, (3) Doctoral)

Oral Presentation Session 1, Cooper Hall, 8:20 – 9:40

Incubation I (Cooper Hall Second Floor) (Moderator: Jack Sytsma, Technology: Daniel Giese)

8:20	**Hammond, S.T.[1], (2), Baumfalk, D.R.1, Horn, A.G.[1], Kunkel, O.N.[1], Parr, S.K.[1], Ade, C.J.[1,2] and Behnke, B.J.[1,2]. 1. Department of Kinesiology, Kansas State University, Manhattan, KS and 2. Johnson Cancer Research Center, Kansas State University, Manhattan, KS.** THE ROLE OF EXERCISE IN PREVENTION OF 5-FLUOROURACIL CHEMOTHERAPY INDUCED CARDIOTOXICITY.
8:40	**Singleton, E. (1) Department of Natural Sciences, McPherson College.** DEVELOPING A GREENER METHOD FOR THE DIELS-ALDER REACTION.
9:00	**Wade C. Henke (2),[1] Yun Peng,[1] David C. Grills,[2] Dmitry E. Polyansky,[2] Etsuko Fujita,[2] and James D. Blakemore[1] 1. Department of Chemistry, University of Kansas and 2. Chemistry Division, Brookhaven National Laboratory, Upton, New York.** MAPPING THE TRANSIENT HYDRIDE AND CP*H INTERMEDIATES IN HYDROGEN EVOLUTION WITH CP*RH(BPY)
9:20	**Schrock, J.R. Biology Professor Emeritus, Emporia State University.** CHINA ASCENDS IN SCIENCE: SUMMARY OF REPORTS.

Incubation II Classroom (Cooper Hall Second Floor) (Moderator/Technology: Wai-Foong Hong)

8:20	**Paradise, E. (1) Department of Natural Sciences, McPherson College.** EFFECTS OF SOIL MICROBIAL COMMUNITY VARIABILITY ON *SILPHIUM INTEGRIFOLIUM, LESPEDEZA CAPITATA,* AND *ANDROPOGON GERARDII* GROWTH.
8:40	**Serrano, G.(1), Hernandez, C., Beyale, J., Stueven, S., Lock, B., Jimenez, B., Atha, M., Hodge, S., and Hong, W-F. Natural Science Department, Sterling College.** EVALUATION OF *Bacillus mojavensis* AND *Bacillus vallimortis* ON TOMATO AND WHEAT PLANTS.
9:00	**Clark, B.J. (1)[1], Dea, H.I.[2], McKenzie D.A.1, and Jumpponen, A.[2] 1. Department of Biological Sciences, Emporia State University, and 2. Division of Biology, Kansas State University.** FOLIAR FUNGAL COMMUNITIES DIFFER BETWEEN TWO HOSTS, BUT NOT ALONG A PRECIPITATION GRADIENT.
9:20	**Hartung, E. (2), Sarkar, S., Fogarty, K., Kazarina, A., Systma, J., Holloman, K., Amiar, N., How, K., Jumpponen, A., Lee, S., Johnson, L. Division of Biology, Kansas State University**. DO WET AND DRY ECOTYPES OF A DOMINANT GRASS GROW BETTER WITH THEIR NATIVE SOIL MICROBES?

Presentation Classroom (Cooper Hall Third Floor) (Moderator/Technology: Debbie Rogers)

8:20	**Zielke, M.G. (2) and Stark, W.J. Department of Biological Sciences, Fort Hays State University.** FUTURE EVALUATION OF THE GREEN TOAD, *ANAXYRUS DEBILIS*, IN RESTRICTED WESTERN KANSAS RANGE.
8:40	**Russell, E. (2) and Stark, W. J. Department of Biological Sciences, Fort Hays State University.** STATUS SURVEY AND NATURAL HISTORY INVESTIGATION OF THE RED-SPOTTED TOAD.
9:00	**Hallyburton, S.E. (2), Stark, W. Department of Biological Sciences, Fort Hays State University.** EDNA PROTOCOL DEVELOPMENT AND SURVEY FOR THE KANSAS STATE ENDANGERED MUSSEL - CYLINDRICAL PAPERSHELL (*ANODONTOIDES FERUSSACIANUS*).
9:20	**Pardis, A. (2), Stark, W.J. Department of Biological Sciences, Fort Hays State University.** DRONE IDENTIFICATION OF AQUATIC NUISANCE SPECIES (*PHRAGMITES AUSTRALIS*) AND EFFECTS ON YOY FISH IN A KANSAS IMPOUNDMENT.

Poster Session, Mabee Library, 9:50 – 10:30 AM

1	**Bajracharya, A. (1) and Ayella, A., Chemistry Department, Washburn University.** CHANGING NON-POLAR GLYCINE TO POLAR ASPARTIC ACID IN LDH TO STUDY BINDING CONSTANT.
2	**Basnet, B.[1], Moore, L.[2], and Rossi, V.M.[1] 1. Department of Physics & Astronomy, Washburn University. 2. Department of Biology, Washburn University.** DETERMINING THE APOPTOTIC TIMELINE IN BREAST CANCER CELLS UNDERGOING PHOTODYNAMIC THERAPY VIA OPTICAL SCATTER IMAGING
3	**Bass, T. (1), Minette, J., Keoshkerian, N., and Russell, F.L. Department of Biology, Wichita State University.** INVESTIGATING SEASONAL VARIATION IN BROWSING PATTERNS OF WHITE TAIL DEER (*Odocoileus virginianus*)IN CROSS TIMBERS WOODLANDS.
4	**Boardman, N.A. (2) and Crupper, S. Department of Biological Sciences Master of Science Forensic Program at Emporia State University** SOIL EXTRACTION METHODOLOGY AND DETERMINING SOIL MICROBIOME SEASONALITY WITH NEXT-GENERATION SEQUENCING
5	**Bowen, M.A.[1] (2) and Sun, M.[2] 1. Department of Biological Sciences, Emporia State University, 2. Department of Physical Sciences, Emporia State University.** APPLICATION OF PAPER CHROMATOGRAPHY TO THE DETECTION OF COCAINE AND ITS ADULTERANTS
6	**Cuba, Lisa A. and Crupper, Scott S. Department of Biological Sciences, Forensic Science Program, Emporia State University** THE COLLECTION, LIFECYCLE, AND DNA BARCODING OF BLOW FLIES IN RURAL KANSAS
7	**Davies, B. (1), Adem, S., and Kandal, R. Chemistry Department, Washburn University.** COLORIMETRIC DETECTION AND ANALYSIS OF PB^{2+} WITH DITHIZONE MODIFIED GOLD NANOPARTICLES.
8	**Dhimal, A.[1] (1), Nguyen, H.L.[2]. 1. Department of Biology, Washburn University, and 2. Department of Chemistry, Washburn University.** GRAPHENE-BASED QUANTUM DOT SYNTHESIS FOR BIOIMAGING
9	**Gutierrez, Mirtha (2)[1], Kristin Rindom[1], Jeremiah Morris[2], and Melissa Bailey[1] [1]Emporia State University, Department of Biological Sciences - MSFS Program [2]Johnson County Sheriff's Office Criminalistics Laboratory, Crime Scene Investigation** COMPARISON OF IMPACT SPATTER PATTERNS GENERATED BY EQUAL FORCE ON RIGID VERSUS ELASTIC TARGET SURFACES - A PRELIMINARY STUDY
10	**Jones, R. Physical Science Department, Emporia State University.** PHILOSOPHY UNDERGIRDING SCIENCE
11	**Kandel, R. (1) and Nguyen, H.L. Department of Chemistry, Washburn University.** A MICRO FABRY-PEROT CAVITY FOR CHEMICAL CHARACTERIZATIONS OF NANOSCALE PARTICLES VIA RAMAN SPECTROSCOPY

12	**Long, K.R. (1), McLoud, J.D. Department of Biological Sciences, Tabor College.** OBSTACLES IN DECIPHERING OPERATIONAL TAXONOMIC UNITS FOR FUNGAL SPECIES: WHAT DOES THE DATA SUGGEST?
13	**Muñoz-Ortiz, Iris[1], Destiny Costley[2], Kelsey Lynch[2], and Melissa M. Bailey[1] [1]Emporia State University, Department of Biological Sciences - MSFS Program [2]Johnson County Sheriff's Office Criminalistics Laboratory, Crime Scene Investigation.** THE EFFECT OF SUBSTRATE AND CLEANSER ON THE ABILITY OF LUMINOL TO DETECT CLEANSER.
14	**Munsell, K[1]. (1), Zimpfer, R[1]. (1), and Leung, S. [2] (2). Department of Chemistry, Washburn University**. PROGRESS TOWARD THE ADDITION OF PHOTOSENSITIZER ON GLASS SURFACE VIA AMIDE LINKAGE.
15	**Powell, I., and Ayella, A. Department of Chemistry, Washburn University.** CRISPR CAS9 MEDIATED MUTATION OF LDH IN COLON CANCER CELLS.
16	**Rutherford, N. West, T., and Gress, J. Emporia State University.** MEASUREMENT OF SHORT-TERM LEARNING OF HONEY BEES USING PROBOSCIS EXTENSION RESPONSE (PER) TRIALS WHEN EXPOSED TO PESTICIDES AND CBD.
17	**Shen, C. (3). Department of Ecology and Evolutionary Biology, and Biodiversity Institute, University of Kansas.** THE SEXUALLY DIMORPHIC NEOPTERYGIAN FISH *Wushaichthys exquititus* (MIDDLE TRIASSIC, CHINA): TAXONOMIC IMPLICATIONS AND PHYLOGENETIC RELATIONSHIPS
18	**Shrestha, S (1). and Sadikot, T. Department of Biology, Washburn University.** IDENTIFICATION AND ANALYSIS OF GENOMIC ELEMENTS IN *DROSOPHILA BIPECTINATA* USING COMPUTATIONAL GENOMIC TOOLS
19	**Sierra, N.(1), Millhouse, M., Lock, B., and Hong., W-F. Department of Natural Science and Mathematics, Sterling College.** A SURVEY OF THE BROWN RECLUSE SPIDER IN PUBLIC BUILDING OF RURAL KANSAS.
20	**Sprague, T.A.[*], Loveland, M.A.[*], Agbedanu, P.N. Division of Science, Technology, Engineering, and Mathematics, Friends University.** VORINOSTAT CAUSES INFERTILITY AND WING DEFECTS IN *DROSOPHILA MELANOGASTER.*
21	**Stout, M.S.[1,2] (1), Jones, M.S.[1,2], Beard, K.C.[1,2] 1. Biodiversity Institute, University of Kansas, and 2. Department of Ecology and Evolutionary Biology, University of Kansas.** AN ANALYSIS OF A PATHOLOGICAL LOWER LEFT THIRD MOLAR OF A *MAMMUTHUS COLUMBI* AND OTHER PROBOSCIDEANS FROM CLARK COUNTY, KANSAS WITH IMPLICATIONS OF PALEOECOLOGY AND DIET.
22	**Stucky, K. (1), and Hong, W-F**. **Department of Natural Science and Mathematics, Sterling College**. CASE STUDY OF A HERITABLE CANCER GENE ATM IN A FAMILY.
23	**Tidd, J.A.[1](1), Carpenter, M.E[1], Osborne, J.M. [1], Bohnenstiehl, M.C. [1], Hovorka, M.J. [1], Miller, W.R. [1], Morris, E.R[1]. 1. Department of Biology and Chemistry, Baker University.** SPECIES IDENTIFICATION OF TARDIGRADES USING DNA BARCODES.

24	**Todwong, S. A. A. (1), and Mercader, R. J. Department of Biology, Washburn University.** INFLUENCE OF PRIOR EXPERIENCE ON THE DECISION-MAKING OF *CALLOSOBRUCHUS MACULATUS*.
25	**Travelbee, J., Rogers, D. and Hong, W-F. Department of Natural Sciences and Mathematics, Sterling College.** A PRELIMINARY STUDY IN OBSERVATION OF CHICKEN EMBRYO OUTSIDE THE EGG SHELL.
26	**VanHorn, S.D. (1), and Rogers, D.J. Natural Science Department, Sterling College, Sterling, Kansas.** LEARNING STYLES IN STUDENT ATHLETES.
27	**Wiest, T.A.M (1), Gress, J., and Rutherford, N.P. Emporia State University.** ANALYSIS OF HEMP POLLEN'S EFFECT ON IMIDACLOPRID AND COUMAPHOS INDUCED OXIDATIVE STRESS IN *APIS MELLIFERA* THROUGH GENE EXPRESSION.

Oral Presentation Session 2, Cooper Hall, 10:50-12:10

Incubation I Classroom (Cooper Hall Second Floor) (Moderator/Technology: Samuel Hokamp)

10:50	**Fessler, B. (1) Department of Natural Sciences, McPherson College.** LEAF MORPHOLOGY IN RESPONSE TO CHANGES IN LIGHT INTENSITY IN *CONVOLVULUS TRICOLOR*.
11:10	**Cory, B.J., and Russell, F.L. Department of Biological Sciences, Wichita State University.** DEER BROWSING AND LIGHT AVAILABILITY LIMIT OAK SAPLING GROWTH AND POST-FIRE RECOVERY IN A XERIC WOODLAND.
11:30	**Jack Sytsma (2),[1] Kori Howe,[1] Matthew Galliart,[2] Sara G. Baer,[3] Eli Hartung,[1] David Barfneckt,[4] Loretta Johnson[1] 1. Department of Biology, Kansas State University; 2. Department of Biological Sciences, Fort Hays State University; 3. Ecology and Evolutionary Biology, University of Kansas; 4. School of Biological Sciences, Southern Illinois University Carbondale.** DOMINANT PRAIRIE GRASS IN RECIPROCAL GARDENS ACROSS THE RAINFALL GRADIENT OF THE MIDWEST: DECADAL EVIDENCE OF LOCAL ADAPTATION
11:50	**Trible, M.L.[1, 2] and Jameson, M.L.[2] 1. Wichita State University and 2. Newman College.** DUNG BEETLE COMMUNITIES DIFFER ON CATTLE- AND BISON-GRAZED PASTURES.

Incubation II Classroom (Cooper Hall Second Floor) (Moderator/Technology: Randi Wise)

10:50	**Matthews, C.T. (2) and Gardner, S.G**. **Department of Biological Sciences, Emporia State University.** THE INTERACTIONS OF PHOU1 AND PHOU2 HOMOLOGS IN *STAPHYLOCOCCUS AUREUS*.
11:10	**Hodge, S. (1), Rogers, D., Wise, R., Hong, W-F. Department of Natural Science and Mathematics. Natural Science Department, Sterling College.** STUDIES OF BACILLUS VALLISMORTIS AND EXTRACTION OF MELANIN-LIKE PIGMENT.
11:30	**Hall, M. Department of Natural Sciences, McPherson College.** THE ANTIFUNGAL ACTIVITY OF *MELALEUCA CAJUPUTI*, *MELALEUCA QUINQUENERVIA,* AND *MELALEUCA ERICIFOLIA* ESSENTIAL OILS AGAINST *CANDIDA ALBICANS.*
11:50	**Gress, J.C., Wiest, T. and Rutherford, N. Department of Biological Sciences, Emporia State University.** WHAT'S THE BUZZ ABOUT CBD: DOES CANNABIDIOL OIL PROVIDE A PROTECTIVE EFFECT AGAINST PESTICIDE EXPOSURE IN THE HONEY BEE GUT?

Presentation Classroom (Cooper Hall Third Floor) (Moderator/Technology: Pete Kosek)

10:50	**Hoffman, B.L., and Hageman, S.A. Department of Natural and Physical Sciences, Park University.** THE STERNBERGS, *SQUALICORAX,* AND SCAVENGING IN THE WESTERN INTERIOR SEAWAY.
11:10	**Jones, M.F.[1,2] (2), and Beard, K.C.[1,2] 1. Biodiversity Institute, University of Kansas, and 2. Department of Ecology and Evolutionary Biology, University of Kansas.** A DIVERSE FAUNA OF INSECTIVOROUS MAMMALS (MAMMALIA, NYCTITHERIIDAE) FROM THE LATE PALEOCENE OF SOUTHWESTERN WYOMING, USA.
11:30	**Sload, A.M.[1], Hageman, S.A.[2], Hageman, S.J.[3], and Hoffman, B.L.[2] 1. RJ Lee Group, 2. Park University, and 3. Appalachian State University.** PRELIMINARY ANALYSIS OF RAUP COILING METHOD APPLIED TO FUSULINID TAXONOMY AND ONTOGENY.
11:50	**GRADUATE STUDENT PANEL DISCUSSION**

ABSTRACTS: Oral Presentations

Clark, B.J.(1)[1], Dea, H.I.[2], McKenzie D.A.1, and Jumpponen, A.[2] 1. Department of Biological Sciences, Emporia State University, and 2. Division of Biology, Kansas State University.
FOLIAR FUNGAL COMMUNITIES DIFFER BETWEEN TWO HOSTS, BUT NOT ALONG A PRECIPITATION GRADIENT.

Tallgrass prairies are one of the most endangered ecosystems in North America because of anthropogenic environmental change. Plant associated microbes, such as phyllospheric fungi, are a largely overlooked aspect of diversity within prairie systems. Phyllospheric fungi play important roles in plant health through their functions as pathogens, commensals, and potential mutualists. We aimed to determine how precipitation and plant host species affect the diversity of phyllospheric fungi on two important prairie species. We examined foliar fungal communities within big bluestem (Andropogon gerardii, Poaceae) and leadplant (Amorpha canescens, Fabaceae) across the precipitation gradient of Kansas, USA. We sampled leaf clippings of both plants from five sites, each with varying amounts of Mean Annual Precipitation (MAP). Disks from sampled leaves were separately washed, homogenized, and the extracted fungal DNA was Illumina MiSeq sequenced to characterize communities and analyze their diversity and composition. We compared several richness and diversity metrics and tested differences among the communities using permutational analogs for analysis of variance (PERMANOVA). The data suggest that while phyllospheric communities differ between the two hosts, MAP has no strong effect on the composition of these communities. We will further explore linear regression models to better understand the trends in the diversity and composition of these communities. The importance of phyllospheric fungal communities in prairie systems remains poorly understood. Our findings of intraspecific community differences strongly suggest that more research is needed to effectively manage for compounding biodiversity in this system.

Cory, B.J., and Russell, F.L. Department of Biological Sciences, Wichita State University.
DEER BROWSING AND LIGHT AVAILABILITY LIMIT OAK SAPLING GROWTH AND POST-FIRE RECOVERY IN A XERIC WOODLAND.

In many eastern North American forests, oak regeneration is insufficient to sustain oak dominance. Intense browsing by white-tailed deer (*Odocoileus virginianus*) and light limitation due to expansion by fire-intolerant tree species are hypothesized to limit oak regeneration. In a xeric oak woodland, we are using a deer exclusion experiment in natural canopy gaps to determine 1) Does juvenile post oak (*Quercus stellata*) growth and survival increase with gap size and light availability? 2) Do ambient levels of deer browsing reduce juvenile post oak performance? 3) Do effects of deer on juvenile post oak performance vary with light availability? and 4) For saplings that were top-killed in a fire, how do light availability, deer browsing and their interaction affect re-growth rate? After five years, sapling height growth increased with light availability. Protection from deer increased sapling growth in height and aboveground biomass. For most measures of sapling performance, deer effects were similar across the range of light availability in canopy gaps. Protection from deer shortened the time required for saplings to attain their pre-fire height from five to three years. Our results suggest that current levels of deer browsing are reducing post oak regeneration in canopy gaps in Cross Timbers woodlands.

Fessler, B. (1) Department of Natural Sciences, McPherson College.
LEAF MORPHOLOGY IN RESPONSE TO CHANGES IN LIGHT INTENSITY IN *CONVOLVULUS TRICOLOR*.

Convolvulus tricolor, native to the Mediterranean regions of Europe, has spread across the world as an ornamental plant used in gardens and flowerpots. Multiple countries have classified this plant as invasive. Members of the *Convolvulus* family cause environmental damage due to the ability to spread and monopolize resources. In order to explore why this plant is so successful and invasive across

different conditions, we examined the anatomical and morphological leaf characteristics across two light levels. The results showed that plants in the high light group have a greater leaf area and perimeter. Leaf shape also varied across the two light treatments, with the high light group having a greater perimeter to area ratio. While more stomata were present on the adaxial and abaxial sides of the leaves in the high light treatment, there were no differences in overall stomatal density across the treatment groups for ether leaf side. One interesting trend showed a greater relative investment of low light plants into stomata on the adaxial leaf surfaces. More research is needed to demonstrate that these differences are light-dependent. These responses may contribute to this plant family's ability to thrive in a variety of environmental conditions.

Gress, J.C. [1], Wiest, T.[1] and Rutherford, N.[1] 1. Department of Biological Sciences, Emporia State University.

WHAT'S THE BUZZ ABOUT CBD: DOES CANNABIDIOL OIL PROVIDE A PROTECTIVE EFFECT AGAINST PESTICIDE EXPOSURE IN THE HONEY BEE GUT?

Pesticides used in agriculture can be harmful to non-target insects including pollinating bees. When exposed foragers return to the hive, they inadvertently expose their fellow workers to toxic pesticide residues. Neonicotinoid and organophosphate pesticides alter the levels and expression of antioxidants in forager bees causing oxidative stress and damage to tissues, especially in the gut. Cannibidoil oil (CBD) is a non-psychoactive phytocannabinoid from *Cannabis sativa* that has been shown *in vitro* to have antioxidant properties. To examine if CBD has an antioxidant effect on the bee gut in terms of gene expression, we measured the impact of pesticides on foragers exposed to 10nmol of either Imidacloprid or Coumaphos alone or in combination with 100nmol of CBD in a 1M sucrose solution using qPCR and RNA-seq. Our initial study found that that the addition of CBD to foragers dosed with either coumaphos or imidacloprid caused an upregulation of several genes involved in the antioxidant/detoxification pathway in the gut. For honeybees given the combination of CBD+ coumaphos, a significant upregulation of Sod1 and 2 occurred. These genes help to rearrange superoxides to oxygen and hydrogen peroxide. Additionally, SelT was upregulated, which acts as a peroxidase and can assist in protein re-folding, redox signaling, and hormone metabolism. The addition of CBD+ imidacloprid caused a significant upregulation of several antioxidant genes including Sod1, Cat, Trx1 and MsrA. To further examine the protective effect of CBD in the bee digestive system, we conducted RNA-Seq analysis of the bee abdomen after pesticide and CBD exposure.

Hall, M. (1) Department of Natural Sciences, McPherson College.

THE ANTIFUNGAL ACTIVITY OF *MELALEUCA CAJUPUTI*, *MELALEUCA QUINQUENERVIA,* AND *MELALEUCA ERICIFOLIA* ESSENTIAL OILS AGAINST *CANDIDA ALBICANS.*

The recent rise in fungi that are resistant to common antifungal drugs has led to the need for other methods to treat these kinds of infections, whether that be new drugs or natural remedies, the search for a solution is ongoing. Researchers have found tea tree oil to be an effective natural antifungal (*Melaleuca alternifolia*). Few experiments have been conducted on the antifungal properties of other essential oils coming from plants in the same family as tea tree. In this experiment, three oils related to tea tree: cajeput (*Melaleuca cajuputi*), niaouli (*Melaleuca quinquenervia)*, and Rosalina (*Melaleuca ericifolia*), were tested for their antifungal properties at concentrations of: 100%, and dilutions with dimethyl sulfoxide of 75%. 50%, 25%. The fungus chosen for study was *Candida albicans*, a common fungus known to cause irritation upon infection. The oils were tested using a disc diffusion method; potato dextrose agar plates were inoculated with fungus, and oil inoculated discs were added within 15 minutes. The plates were then incubated at 37 degrees Celsius for 24-48 hours. As a control, the oils were run in a trial against a solution of 1% clotrimazole, a common antifungal drug. All oils at concentrations of 100%, 75%, and 50% were effective in inhibiting growth, lower concentrations resulted in lower inhibition. At 25% concentration, none of the oils displayed measurable inhibition.

Rosalina oil showed the greatest inhibition after 48 hours, showing near complete inhibition at 100% concentration.

Hallyburton, S.E. (2), Stark, W. Department of Biological Sciences, Fort Hays State University. EDNA PROTOCOL DEVELOPMENT AND SURVEY FOR THE KANSAS STATE ENDANGERED MUSSEL - CYLINDRICAL PAPERSHELL (*ANODONTOIDES FERUSSACIANUS*).

Anthropogenic global climate change is forcing the mass extinction of wildlife across the globe. Humans depend on freshwater ecosystems for many aspects of life including agricultural production, sanitation, and recreation. Healthy levels of biodiversity in freshwater environments ensure economically beneficial ecosystem services are maintained. Freshwater ecosystems are hotspots for biodiversity with higher levels of imperiled organisms compared to terrestrial and marine systems. Within freshwater systems, freshwater mussels (Family: Unionidae) are the most imperiled with over 70% of North American species being classified with conservation concern. The objective of this study is to develop an aquatic environmental DNA (eDNA) protocol that increases detection sensitivity to target rare and endangered aquatic organisms in Kansas. Increased detection sensitivity will be necessary for successful conservation strategies as we proceed through the Anthropocene. This protocol, in conjunction with traditional sampling efforts, will aid in future monitoring and recovery plans of native aquatic species. The Cylindrical Papershell mussel (*Anodontoides ferussacianus*) was listed as endangered in Kansas in 2019. This species was used for protocol development due to its contracting distribution and low population density. Six locations with highest probability for Cylindrical Papershell presence in Kansas were sampled after protocol development.

Hammond, S.T.1, (2), Baumfalk, D.R.1, Horn, A.G.1, Kunkel, O.N.1, Parr, S.K.1, Ade, C.J.1, 2 and Behnke, B.J.1,2. 1. Department of Kinesiology, Kansas State University, Manhattan, KS and 2. Johnson Cancer Research Center, Kansas State University, Manhattan, KS.
THE ROLE OF EXERCISE IN PREVENTION OF 5-FLUOROURACIL CHEMOTHERAPY INDUCED CARDIOTOXICITY.

Though effective in treatment of cancer, 5-Flurouracil (5FU) chemotherapy often causes adverse cardiovascular toxicity resulting in deviation from preferred cancer treatment regimens. The purpose of the present investigation was to assess the efficacy of an acute exercise protocol in prevention of 5FU induced cardiac and vascular toxicity using a clinically relevant dosing model. METHODS: Sprague-Dawley rats were randomized to receive 5FU (n=16) or saline (CON, n=12) via a 50mg/kg jugular bolus followed by a 2-hr., 265mg/kg infusion. Each group was further randomized to include an exercise (n=4 exCON, n=8 ex5FU) and sedentary (n=8 sCON, n=8 s5FU) condition. Exercise (4x 25-min. runs) commenced 3-days prior to treatment, with the final bout concluding ~1-hr. prior to treatment onset. Cardiac and vascular function were evaluated at baseline and 2-hr. via echocardiography and aortic pulse wave velocity (PWV), respectively. Cardiac and vascular tissue were excised upon protocol completion and stored at -80°C for future gene and protein expression analyses. RESULTS: Echocardiography measures of ejection fraction and fractional shortening were significantly reduced from baseline to 2-hr. in all groups except exCON, with no differences apparent between any groups at either timepoint. Similarly, no differences in PWV were present between groups at either timepoint, however, s5FU experienced a significant increase in PWV from baseline to 2-hr. that was mitigated in ex5FU. Preliminary gene expression analyses found no differences between groups in common cardiac inflammatory markers. CONCLUSION: These findings suggest exercise pretreatment may prevent the onset of 5FU cardiotoxicity, namely those which present within the vasculature.

Hartung, E. (2), Sarkar, S., Fogarty, K., Kazarina, A., Systma, J., Holloman, K., Amiar, N., How, K.,

Jumpponen, A., Lee, S., Johnson, L. Division of Biology, Kansas State University.
DO WET AND DRY ECOTYPES OF A DOMINANT GRASS GROW BETTER WITH THEIR NATIVE SOIL MICROBES?

Big bluestem (*Andropogon gerardii)* is a dominant grass of the Great Plains accounting for roughly 70% of tallgrass prairie biomass. Its distribution across a steep rainfall gradient in the Great Plains has given rise to locally adapted wet and dry ecotypes. Abiotic factors driving the evolution of ecotypes have been well-studied. However, the role of soil microbes in local adaptation is less clear. We investigated how local soil microbes affect *A. gerardii* growth and whether ecotypes are locally matched to these microbes. We predicted that ecotypes would grow better when grown with their native microbes. We collected *A. gerardii* seed and soil from six western KS (500 mm rainfall annually) and Illinois (1200 mm) populations and grew plants in greenhouse in garden soil. Root and soil microbes were isolated and cultured in lab. We reciprocally inoculated wet and dry microbes (plus mock control) into ecotype soils weekly for 12 weeks. Plant measurements were taken weekly. Ecotypes differed morphologically and wet ecotypes produced more biomass and were taller than dry ecotypes. Physiological traits, such as chlorophyll absorbance, a proxy for photosynthesis, were enhanced in ecotypes growing with their local microbes. Notably, dry ecotypes produced ~30% more biomass when grown with local microbes. Altogether, results suggest ecotype specific microbe-mediated nutrient availability. Because *A. gerardii* is widely used in restoration and as forage, understanding interactions with soil microbes is crucial. These results will help managers and conservationists optimize forage and restoration through use of and matching with beneficial microbes.

Henke, Wade C. (2),[1] Yun Peng,[1] David C. Grills,[2] Dmitry E. Polyansky,[2] Etsuko Fujita,[2] and James D. Blakemore[1] 1. Department of Chemistry, University of Kansas, 1567 Irving Hill Road, Lawrence, Kansas 66045 USA, and 2. Chemistry Division, Brookhaven National Laboratory, Upton, New York 11973-5000, USA.
MAPPING THE TRANSIENT HYDRIDE AND CP*H INTERMEDIATES IN HYDROGEN EVOLUTION WITH CP*RH(BPY)

Protonation reactions of organometallic complexes are ubiquitous in redox chemistry, and often result in generation of metal hydrides. However, some organometallic species supported by η^5-pentamethylcyclopentadienyl (Cp*) ligands have recently been shown to undergo ligand-centered protonation by direct proton transfer from acids or tautomerization of metal hydrides, resulting in the generation of uncommon [η^4-Cp*H] complexes. Understanding the properties of these Cp*H intermediates is of interest for rational design of improved catalysts, especially those involving hydride and H-atom transfer reactivity. Here, we report time-resolved pulse radiolysis (PR) and stopped-flow (SF) spectroscopic studies of the kinetics associated with elementary electron- and proton-transfer steps mediated by [Cp*Rh(bpy)] complexes during hydrogen evolution. Stopped-flow with infrared and UV-visible detection reveals that the sole product of initial protonation of Cp*Rh(bpy) is $[Cp^*Rh(bpy)H]^+$, an elusive hydride that has been often discussed in the literature but not isolated. We find that this hydride tautomerizes to cleanly form $[(Cp^*H)Rh(bpy)L]^+$ when the system is examined in the presence of a suitably weak acid, and that both the hydride and related Cp*H complex can be involved in further reactivity. We will discuss our latest work, including variable temperature studies that have been used to extract activation energies as well as highlights of the multiple pathways leading to hydrogen evolution with this platform.

Hodge, S. (1), Rogers, D., Wise, R., Hong, W-F. Department of Natural Science and Mathematics. Natural Science Department, Sterling College.
STUDIES OF BACILLUS VALLISMORTIS AND EXTRACTION OF MELANIN-LIKE PIGMENT.

Bacillus vallismortis was isolated from a redworm (*Eisenia fetida*) composting box in Kansas. The milky white round colony will turn into dark brown color and release dark pigment on TSA media after

growing few days on 37°C. However, the colony would not change color if the salt concentration was raised to 10% and 15%. This Gram-positive bacterium showed antimicrobial activity against Gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis,* and against Gram-negative bacteria *Escherichia coli*, *Pseudomonas aeruginosa* and yeast *Candida albicans.* We also discovered that it promoted growth in tomato plants. The chemical property of the extracted pigment is similar to the characteristics of melanin. It is suggested to be DOPA-melanin because it enhanced pigment in the L-tyrosine containing medium. Performance of IR spectroscopy for further characterization of the pigment will provide information on functional groups and details of the structural analysis of the pigment is under progress.

Hoffman, B.L., and Hageman, S.A. Department of Natural and Physical Sciences, Park University.
THE STERNBERGS, *SQUALICORAX,* AND SCAVENGING IN THE WESTERN INTERIOR SEAWAY.

In 1919, Charles H. Sternberg sold a collection of Cretaceous dinosaur bones from "Red Deer River, Alberta, Canada" (now Dinosaur Provincial Park) and Cretaceous marine fossils from the "Niobrara Group, Logan County, Kansas" to Park College (now Park University). Although deemed to be of less than museum quality, some of the fossils in this collection have yielded interesting observations, including the only known *Ichthyodectes ctenodon* fossil with stomach contents. Three of the Logan County specimens show evidence of scavenging by the anacoracid shark *Squalicorax falcatus*: *Toxochelys latiremis* humerus, a mosasaur humerus, and a mosasaur ilium. All the bite marks have scalloped edges resulting from serrated teeth being drawn across the bone. Most of the bite marks were made at a shallow angle, likely while shearing muscles from the bone. The deepest bite marks are evident on the medial aspect of the mosasaur humerus and clearly show engagement of multiple teeth in the same row. The *Toxochelys* humerus has parallel serrated bite marks, but also made bite marks that appear to be conical. These conical marks were likely caused by the twisting of a serrated tooth which scooped out a bit of bone, perhaps to dislodge the forelimb from the turtle carcass. Several *Squalicorax falcatus* teeth were recovered from this site by Sternberg and included in the collection sold to Park. These specimens have been part of the teaching collection of a liberal arts college/university for over 100 years and reinforce the value of studies using natural history collections.

Jones, M.F.[1,2] (2), and Beard, K.C.[1,2] 1. Biodiversity Institute, University of Kansas, and 2. Department of Ecology and Evolutionary Biology, University of Kansas.
A DIVERSE FAUNA OF INSECTIVOROUS MAMMALS (MAMMALIA, NYCTITHERIIDAE) FROM THE LATE PALEOCENE OF SOUTHWESTERN WYOMING, USA.

Nyctitheres (Mammalia, Nyctitheriidae) are an enigmatic group of small Paleogene insectivorous mammals known from Asia, Europe, and North America. The taxonomic position of nyctitheres has been disputed and previous authors have suggested a close relationship between nyctitheres and mammals as diverse as bats, primates, and hedgehogs. Here we describe a fauna of nyctitheres from the early Clarkforkian (late Paleocene) Big Multi Quarry locality in southwestern Wyoming consisting of at least five genera and eight species, making it the most diverse assemblage currently known. Among this fauna is a new species of *Ceutholestes* including the first reported upper dentition belonging to the genus. We note similarities between *Ceutholestes* and such taxa as *Placentidens* and *Remiculus* and on this basis assign *Ceutholestes* to the nyctitheriid subfamily Placentidentinae. Postcranially associated dentition of a new species of *Plagioctenodon* allows for comparison to younger species of *Plagioctenodon* from the Bighorn Basin of northern Wyoming, and to isolated nyctithere postcrania from Europe. Significant new material of *Wyonycteris chalix* and *Limaconyssus habrus* provide for a better understanding of those taxa and allow for further comparison to nyctithere faunas from the Bighorn Basin. The diverse nyctithere assemblage of Big Multi Quarry is unique among fossil and extant insectivorous mammals, raising the question of how all of these species might have coexisted. We suggest possible trophic partitioning among Big Multi nyctitheres—like that observed in living southeast Asian tree shrews—may have allowed this diverse fauna to persist.

Matthews, C.T. (2) and Gardner, S.G. **Department of Biological Sciences, Emporia State University.**
THE INTERACTIONS OF PHOU1 AND PHOU2 HOMOLOGS IN *STAPHYLOCOCCUS AUREUS*.

Methicillin-resistant *Staphylococcus aureus* (MRSA) is an aggressive, opportunistic bacterium and challenging to treat antibiotic-tolerant bacterial cells) formation. PhoU homologs are critical in defining the regulation of persister cell formation and phosphate (P_i) metabolism in invasive due to the rise in antibiotic resistance. The pathogenesis of *S. aureus* is closely related to virulence factors and persister (transiently bacteria. Specifically, two PhoU protein homologs in *S. aureus*, PhoU1 and PhoU2, are instrumental in regulating the PstSCAB phosphate transport complex and key to the formation of persisters. How these homologs interact within *S. aureus* phosphate regulation remains unclear. Previous research in *Escherichia coli* shows that a single PhoU regulates PstSCAB and PhoR-PhoP phosphate transporters. This comprehensive research focused on the two proteins interaction using a Bacterial Adenylate Cyclase Two-Hybrid (BACTH) system. In addition, the level of interactions between proteins was determined using quantitative Beta-galactosidase and qualitative colorimetric assays. Model protein structures of PhoU1 and PhoU2 dimers were predicted using Phyre2 and ClusPro protein modeling software. These observations indicate PhoU1, PhoU2, and PhoR self-dimerizes. The analyses revealed there is minimal interaction between PhoU1 and PhoU2. PhoU1 interacts with PstB; however, there is no interaction with PhoU2 and PitA. Furthermore, research findings also indicate the structure of PhoU1 and PhoU2 homodimers protein structure models. This study provides a coherent understanding of PhoU1 and PhoU2 interaction with other proteins and points to potential models of how PhoU1 and PhoU2 are involved in phosphate signaling, transport, and gene regulation.

Paradise, E. Department of Natural Sciences, McPherson College.
EFFECTS OF SOIL MICROBIAL COMMUNITY VARIABILITY ON *SILPHIUM INTEGRIFOLIUM, LESPEDEZA CAPITATA,* AND *ANDROPOGON GERARDII* GROWTH.

The complex interactions between biodiversity and plant production have been researched for decades by the scientific community. Ecologists previously believed that species coexistence was determined by competition for available resources, however, new evidence indicates that the soil microbial community is one of the main driving forces for coexistence. Research has shown the vital role of the soil microbiome for providing a rise in plant yield. In this study, three species native to Kansas were grown in differing soil treatments to determine how the soil microbial community affects plant growth. Many of the response variables that we measured were not significantly different among *Silphium integrifolium, Lespedeza capitata*, and *Angropogon gerardii*. Across the three species, only *Silphium* showed a significant difference in above and below biomass for the control soil treatment compared to the other soil treatments. There is still more research needed to fully understand how soil microbial communities affect plant productivity and plant species richness.

Pardis, A[1] (1), Stark, W.J.[2] 1. Department of Biological Sciences, Fort Hays State University.
DRONE IDENTIFICATION OF AQUATIC NUISANCE SPECIES (*PHRAGMITES AUSTRALIS*) AND EFFECTS ON YOY FISH IN A KANSAS IMPOUNDMENT.

Phragmites australis is an Aquatic Nuisance Species (ANS) in Kansas, a non-native reed that threatens lake and river ecology, displaces desirable species, impedes movement of wildlife and humans, and can have detrimental economic effects on communities. The majority of *Phragmites* research is in brackish ecosystems and the effects of *Phragmites* in freshwater systems and especially on fishes is undocumented, even as many states and agencies invest substantial resources in management. As freshwater systems face a biodiversity crisis, prevention and control of non-native species invasion is critical. Effective management therefore requires a thorough understanding of the effects these

invaders have on ecosystems and the application of modern and efficient technologies in management. The strong trophic links of aquatic systems make them ideal communities to observe change and cascade effects as invading species establish. This project establishes the extent of trophic level effects by measuring habitat indices specific to warm water fishes and comparing fish assemblages within invaded and non-invaded areas. Additionally, methods developed novel drone (UAS) techniques to spectrally identify *Phragmites* and other species of interest to inform dispersal of this ANS. These data and techniques will inform fisheries and land managers of ecosystem effects and provide a framework to apply modern UAS tools to facilitate early detection, inform efficacy of mitigation strategies, and monitor invasive species management at meaningful spatial and temporal scales. This research is vital to developing precise mitigation strategies to address the effects of this invasive species and combat the freshwater biodiversity crisis.

Russell, E. and Stark, W. J. Department of Biological Sciences, Fort Hays State University.
STATUS SURVEY AND NATURAL HISTORY INVESTIGATION OF THE RED-SPOTTED TOAD.

Amphibians are facing global declines and arid-adapted anurans may be particularly susceptible to declines because of their reliance on ephemeral pools for successful reproduction. Because arid-adapted anurans are difficult to study, little is known about their habitat preferences. In June and July 2021, I made preliminary observations on the habitat preferences of Red-Spotted Toads (*Anaxyrus punctatus;* RST), a Kansas Species in Need of Conservation. I confirmed the presence of RST in Barber and Comanche counties by searching near areas where they have been historically recorded. Additionally, I used audio recorders to document chorusing activity. I observed 39 RST, and all, except one of these observations, were made at night, usually at least one hour after sunset. Toads were typically observed on the gypsum outcrops. No chorusing activity was detected. In 2022, I plan to revisit the sites I surveyed and conduct mark-release-recapture and telemetry studies to estimate their abundance and define the habitat used in the active season. I will also continue to search for their presence in new and historic areas. This study will increase our understanding of the habitat preferences of RST and will provide valuable information regarding the conservation of this species.

Schrock, J.R. Biology Professor Emeritus, Emporia State University.
CHINA ASCENDS IN SCIENCE: SUMMARY OF REPORTS.

In the last eight months, a series of reports document China's rise and the U.S. decline in science research. The ISI "Highly Cited Researchers" found China nearly doubled its portion of highly cited research while the U.S. dropped nearly 12 percent. The Belfer Center for Science & International Affairs at the Harvard Kennedy School published "The Great Tech Rivalry: China versus the U.S." documenting the U.S. is falling behind China in AI, 5G, solar power and other fields. Georgetown University released its "Center for Security and Emerging Technology" report documenting how China universities surpassed the U.S. in graduating science doctoral students in 2007. 2019 data show the U.S. graduated 33,759 STEM PhD students while China graduated 49,498. By 2025, we will produce 39,959 graduates while China will produce 77,179. About 42 percent of U.S. university science doctoral recipients are international students educated K-12 in foreign countries and come here for graduate training. About three-fourths of foreign-born STEM PhD graduates stay in the U.S. for at least ten years. If we only consider the American-born students trained in the U.S., then China will produce more than three times as many science doctorates as the U.S. in 2025 (23,256 compared to China's 77,179). The just-released report by our NSF, "The State of U.S. Science and Engineering 2022" confirms China surpassed the U.S. in total annual science papers published (in 2017) and patents awarded (in 2019). The U.S. fell behind China in contribution to global research spending growth over the past 2 decades: China (29%), United States (23%). I describe Chinese science from on-site experience.

Serrano, G.(1), Hernandez, C., Beyale, J., Stueven, S., Lock, B., Jimenez, B., Atha, M., Hodge, S., and

Hong, W-F. Natural Science Department, Sterling College.
EVALUATION OF *Bacillus mojavensis* AND *Bacillus vallimortis* ON TOMATO AND WHEAT PLANTS.

Bacillus mojavensis and *Bacillus vallimortis* were found in a same redworm compost box in Kansas. Both were identified by DNA of 16S RNA sequences and stained as Gram positive, rod shape, capsule, and endospores. Using cross streak method, both bacteria showed antimicrobial activity against Gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis,* and against Gram-negative bacteria *Escherichia coli*, *Pseudomonas aeruginosa* and yeast *Candida albicans.* Preliminary studies of soil inoculation into tomato plants shown that they promote growth in height and number of leaves. When *Bacillus mojavensis* was inoculated to the wheat seedling on plate without soil, the height of the wheat cotyledon is 8% higher than control and *Bacillus vallimortis* treatment in the first week.

Singleton, E. (1) Department of Natural Sciences, McPherson College.
DEVELOPING A GREENER METHOD FOR THE DIELS-ALDER REACTION.

As modern society continues to develop and look for change in our current habitation conditions, it seems to be a necessity to begin looking for various new methods in industrial performance and scientific methods to provide greener alternatives. Various chemical industries use many organic syntheses to produce important biological molecules, drugs, fragrances, agrochemicals, and pharmacological products. In industry, there are numerous varieties of solvents being used in production processes that lead to the eventual waste of these chemical substances. One reaction that is prevalent in these industries is the Diels-Alder reaction. The Diels-Alder reaction is a common lab that we often see in the undergraduate organic chemistry lab curriculum. The most common Diels-Alder reaction synthesis in lab manuals uses xylene as the solvent in the reaction between anthracene and maleic anhydride. However, xylene is a high-boiling, toxic, aromatic solvent. This experiment focuses on developing a greener method for the Diels-Alder reaction that is carried out in undergraduate organic chemistry labs. Different solvents and reaction times were evaluated to replace xylene as the solvent. The results suggest that both ethyl acetate and ethanol with a reaction time of one hour can replace xylene with a slightly lower percentage yield of the product compared to the traditional reaction done with xylene as a solvent. Since ethanol is a relatively much greener solvent with a lower boiling point than xylene, the results of this experiment suggest that ethanol can replace xylene to make the reaction much greener. Furthermore, the results of this experiment would allow our college to use the anthracene and maleic anhydride available in our stock room to produce a much greener outcome in the undergraduate teaching labs.

Sload, A.M.[1], Hageman, S.A.[2], Hageman, S.J.[3], and Hoffman, B.L.[2] 1. RJ Lee Group, 2. Park University, and 3. Appalachian State University.
PRELIMINARY ANALYSIS OF RAUP COILING METHOD APPLIED TO FUSULINID TAXONOMY AND ONTOGENY.

David Raup developed the first computer modeling program to examine shell coiling. The purpose of this study is to analyze Foraminifera (Fusulinacea) to determine the usefulness of Raup's model to fusulinid classification and growth. Initially, 40 specimens (24 species and seven genera) displaying fusiform and planispiral coiling were analyzed to evaluate four aspects of coiling: 1) comparison to other coiled fossils; 2) variations between and within genera; 3) variations between and within species; and 4) variations in ontogeny. Three mathematical parameters describe the shape of coiling: W (whorl expansion rate), D (distance of generating curve from coiling axis), and T (translation of generating curve along the coiling axis). The necessary measurements were taken from proloculus-centered, axial thin sections. After reviewing and graphing the results, the following conclusions were reached: 1) Fusulinids are most comparable to cephalopods. While they do not plot in the same area, they share the same morphospace; 2) Coiling differences are insufficient to reveal distinctions among or between genera; 3)

Coiling differences were also insufficient for species classification but there are indications that clustering may occur in certain species and is being investigated; 4) Ontogenetic growth can be studied through coiling rates and projected coiling. This can help explain fusulinids age, likely years, and also show seasonal variations caused by key variables (nutrients, water depth, sunlight for possible algal symbionts,…); and 5) Wealth of data collected for this index fossil could be utilized more for paleoecology instead of biostratigraphy and allows for more comparisons with macroinvertebrates.

Sytsma, Jack[1] Kori Howe,[1] Matthew Galliart,[2] Sara G. Baer,[3] Eli Hartung,[1] David Barfneckt,[4] Loretta Johnson[1] 1. Department of Biology, Kansas State University; 2. Department of Biological Sciences, Fort Hays State University; 3. Ecology and Evolutionary Biology, University of Kansas; 4. School of Biological Sciences, Southern Illinois University Carbondale.
DOMINANT PRAIRIE GRASS IN RECIPROCAL GARDENS ACROSS THE RAINFALL GRADIENT OF THE MIDWEST: DECADAL EVIDENCE OF LOCAL ADAPTATION

Big bluestem (*Andropogon gerardii*) is a dominant grass species for forage, conservation, and restoration. This grass has a wide distribution across the Great Plains' precipitation gradient (500-1200 mm rain/yr), leading to formation of wet and dry ecotypes. Ecotype adaptation is a fundamental phenomenon in evolutionary biology with implications for conservation, restoration, and climate change. To study local adaptation, we established reciprocal gardens in 2009 in four sites (dry to wet: Colby, Hays and Manhattan, KS to Carbondale, IL) and measured biomass and cover of each ecotype and surrounding communities under ambient and experimentally reduced precipitation. We predicted that each ecotype would outperform the foreign ecotype in home site and local adaptation would result in competitive dominance over the community. We found that wet and dry ecotypes performed best in their home site demonstrating local adaptation. Across all years, the mesic ecotype had intermediate cover and biomass, suggesting this ecotype is a generalist. Rainfall reduction supported results of the natural precipitation gradient—we observed decreased performance of the wet ecotype in the dry site and increased performance of the dry ecotype in the wet site, as compared to ambient. These results indicate the prominent role of ecotypes across precipitation gradients. Patterns of adaptation strengthened over time, as local adaptation in some sites was not observed until later years. Finally, local adaptation often resulted in competitive dominance over the community, where maladaptation resulted in competitive release. Restorations should consider utilizing locally adapted ecotypes to mitigate future drought.

Trible, M.L.[1, 2] and Jameson, M.L.[2] 1. Wichita State University and 2. Newman College.
DUNG BEETLE COMMUNITIES DIFFER ON CATTLE- AND BISON-GRAZED PASTURES.

Dung beetles are vital soil engineers that improve pastures for grazers, increase the water retention capacity of the soil, reduce flies and parasites, and increase carbon sequestration. In the grasslands of the Great Plains, differences in the foraging behavior of cattle and bison could impact vegetation structure and drive differences in dung beetle communities. There is a significant gap, however, in this research. To address this, we examined dung beetle community structure and composition on bison-grazed versus cattle-grazed grasslands in Barber County, KS (April-December 2018). Our sample design included 2 sites (a bison-grazed ranch and a cattle-grazed ranch) and 4 transects at each site comprised 3 sample points (8 total transects; 24 total sample points). For both ranches, livestock were rotationally grazed and treated with Cydectin® antiparasitic. A total of 225,268 dung beetles in 17 species were recorded. There was no significant difference in total dung beetle abundance or species richness between the bison-grazed and cattle-grazed sites, but NMDS ordination showed that dung beetle communities differed between sites. This pilot study is the first to provide evidence that dung beetle communities associated with bison- and cattle-grazed pastures differ, and these results may have implications for grasslands management.

Zielke, M.G. (2) and Stark, W.J. Department of Biological Sciences, Fort Hays State University.
FUTURE EVALUATION OF THE GREEN TOAD, *ANAXYRUS DEBILIS*, IN RESTRICTED WESTERN KANSAS RANGE.

The Green Toad is a small, cryptic, and arid-adapted toad native to extreme western Kansas. Since the Dust Bowl in the 1930s, they have been largely considered extirpated from Morton County in southwestern Kansas and appear to be restricted to the canyon-prairie system of southeastern Wallace and southwestern Logan counties, along the Smoky Hill River. They are listed as a Kansas Threatened Species and monitoring efforts have confirmed their current range. However, there has been no focus study of natural history in their current range and there in no Recovery Plan. The objective of this study is to monitor this species to estimate their relative abundance, habitat preferences and spatial and temporal occurrence to better understand their conservation status in the state. We will use audio recording devices, visible implant elastomer tags, radio telemetry tags, and unmanned aerial vehicles to gain insights on important aspects of their natural history.

ABSTRACTS: Poster Presentations
Poster Session 9:50 – 10:30 Mabee Library

Bajracharya, A. (1) and Ayella, A., Chemistry Department, Washburn University. CHANGING NON-POLAR GLYCINE TO POLAR ASPARTIC ACID IN LDH TO STUDY BINDING CONSTANT.

Lactate dehydrogenase (LDH) reversibly converts lactate to pyruvate using NAD^+/NADH as cofactors in anaerobic metabolism hence it affects colon cancer cells metastasis via the Warburg effect. Previous research done by Ayella Protein Chemistry lab has found that single amino acid mutation at position 68 (G68K) in *Barracuda* wild type (WT) LDH affected the pH optimum at which it functioned. In this research, we performed a G68D mutation using site directed mutagenesis methods. Plasmid DNA obtained from positive clones were sent for sequencing and then transformed and expressed to grow in BL21-DE3 cells. Isolation of WT and mutant LDH proteins was done using sonication, centrifugation, and affinity chromatography. Characterization was done through SDS-PAGE and Michaelis-Menten kinetics model. We found the Km value for wildtype LDH to be 1.9 mM with lactic acid as our substrate. The G68D mutant had a comparatively lower Km value of 7.2×10^{-11} mM. Additionally, the kcat value for wildtype LDH was 899.68 min^{-1}, and for the G68D mutant it was 3.77×10^{13} min^{-1}. Compared to previous data from another G68D mutant, the Km value was 0.65 mM, and Kcat was 1580 min^{-1}. This data affirms that single amino changes affect function of LDH thus be used in cancer cell metastasis. Discrepancy in the Km and Kcat values for the mutant needs to be further verified and compared to G68K. Further investigation on binding of lactic acid and NAD^+ with both WT and mutant LDH proteins also remains to be done.

Basnet, B.[1], Moore, L.[2], and Rossi, V.M.[1] 1. Department of Physics & Astronomy, Washburn University. 2. Department of Biology, Washburn University. DETERMINING THE APOPTOTIC TIMELINE IN BREAST CANCER CELLS UNDERGOING PHOTODYNAMIC THERAPY VIA OPTICAL SCATTER IMAGING

Light scattered by cells provides a deeper insight into cellular structure. Optical Scatter Imaging (OSI) provides a unique tool for analyzing scattered light in cellular imaging. Observed changes over time of the light scattered by cells are indicative of morphological changes within cells in time. We have designed and constructed a Digital Fourier Holographic Microscope (DFHM) for cellular imaging. With our system we can measure morphological changes in cells in real time and generate holographic reconstructions of cells. We are interested in the morphological changes in breast cancer cells undergoing aminolevulinic acid (ALA) mediated Photodynamic Therapy (PDT). ALA is a photosensitizing agent that when exposed to light converts oxygen molecules to Reactive Oxygen Species (ROS), which damage cells. During ALA-mediated PDT, mitochondria are the targeted site for damage, thereby causing cells die via apoptosis. We are using the DFHM and OSI in order to observe the mitochondrial swelling associated with the onset of apoptosis in ALA-mediated PDT of breast cancer cells. This project aims to determine the timeline of the onset of apoptosis in breast cancer cells undergoing ALA-mediated PDT.

Bass, T. (1), Minette, J., Keoshkerian, N., and Russell, F.L. Department of Biology, Wichita State University. INVESTIGATING SEASONAL VARIATION IN BROWSING PATTERNS OF WHITE TAIL DEER (*Odocoileus virginianus*)IN CROSS TIMBERS WOODLANDS.

White-tailed deer *(Odocoileus virginianus)* browsing can have devastating effects on populations of preferred plant species. However, there is still a knowledge gap concerning predicting spatial variation in browsing intensity. In particular, The Edge Resource Model suggests that deer browsing near habitat edges may vary seasonally as resources in adjacent habitats change across the year. The aim of this study was to quantify variation in deer browsing patterns between spring and autumn in Kansas Cross

Timbers woodlands. Acorns represent an important woodland resource that is unique to the fall. We investigated seasonal variation in 1) preference among tree species, 2) effect of distance from woodland-grassland edges upon browsing and 3) effect of sapling height on browsing. In September-October 2021, we quantified the proportion of stems browsed on tree saplings that were within 10m2 plots along six transects originating at a woodland-grassland edge and extending into oak woodland. Data were collected at two sites in the Cross Timbers region. The browsing patterns found in the fall were compared to patterns documented in spring (Minette el al. in revision) through a series of generalized linear mixed models. Effects of proximity to woodland-grassland edge and of sapling height were consistent across the seasons. Browsing decreases with the distance from edge and browsing increases with sapling height. Deer browsing preference among sapling species changed seasonally. Hickories were preferred in spring but not autumn. Preferences for other tree species were similar across seasons. Our results can help inform protocols for monitoring deer effects on Cross Timbers woodlands.

Boardman, N.A. (2) and Crupper, S. Department of Biological Sciences Master of Science Forensic Program at Emporia State University SOIL EXTRACTION METHODOLOGY AND DETERMINING SOIL MICROBIOME SEASONALITY WITH NEXT-GENERATION SEQUENCING

Bacterial DNA can be isolated from soil as a forensic tool in criminal investigations. Unfortunately, the wide variety of molecules found in soil can be problematic and lead to low DNA yields. This project's goals were to evaluate different DNA isolation kits for their utility in obtaining quality DNA from soil suitable for Next-Generation Sequencing and to evaluate the impact of season on the soil microbiome. Extractions were performed using four commercially available kits: two specifically for soil, and two for other media (insects/tissue and bacteria/fungi). The kits were utilized to analyze either soil or the buffer portion of buffer-saturated soil. Obtained DNA was evaluated using the polymerase chain reaction (PCR) to amplify the bacterial 16S rRNA gene. Analysis by agarose gel electrophoresis demonstrated no amplified products from extractions when only soil was used. However, the insect/tissue kit and one soil specific kit yielded a PCR product from buffer-saturated soil. To assess the effect of seasonal soil collections, soil samples from spring, summer, fall, and winter were assessed by Next-Generation Sequencing and bioinformatics. Statistical analysis was performed to compare data obtained from different seasons. We found that while using a DNA extraction kit meant for soil would seem the obvious method to extract DNA from soil, our data indicates that kits developed specifically for soil DNA isolation may not necessarily be the best choice for that procedure. Our analysis also found no significant differences in the ratios of microbial Phyla or Classes in soil obtained from all four seasons.

Bowen, M.A.[1] (2) and Sun, M.[2] 1. Department of Biological Sciences, Emporia State University, 2. Department of Physical Sciences, Emporia State University.
APPLICATION OF PAPER CHROMATOGRAPHY TO THE DETECTION OF COCAINE AND ITS ADULTERANTS

The current presumptive test for cocaine is the Scott Test. Recently, concerns have arisen about the test's reagents and reliability that have created a need for a new presumptive test for cocaine. From a health and safety standpoint, chloroform, the solvent used in the Scott Test, is a hazardous chemical. From a legal standpoint, the Scott Test is known for its false positives. Therefore, an accurate and safer presumptive test for cocaine is needed. Paper electrophoresis and paper chromatography are promising techniques for the separation of cocaine from other drugs and adulterants in seized samples. The goal of this research is to examine the efficacy, reliability, and ease-of-use of these techniques and to subsequently develop a handheld field test prototype. The utility of paper chromatography was tested with nine mobile phases: acetone, dichloromethane, methanol, ethanol, hexanes, cyclohexane, cyclohexane/ethanol (95:5 v/v), hexanes/ethanol (95:5 v/v), dichloromethane/methanol (50:50 v/v), dichloromethane/methanol (75:25 v/v), and dichloromethane/methanol/acetic acid (75:20:5 v/v). The indicator used was cobalt (II) thiocyanate, which was spotted below the drugs. For all mobile phases,

excluding dichloromethane/methanol/acetic acid (75:20:5 v/v), cocaine, diphenhydramine hydrochloride, and quinine were tested. No separation was achieved with all the mobile phases, excluding dichloromethane/methanol/acetic acid (75:20:5 v/v). Cocaine and five common adulterants (diphenhydramine hydrochloride, quinine sulfate, levamisole hydrochloride, doxylamine succinate, and myo-inositol) were tested with the dichloromethane/methanol/acetic acid (75:20:5 v/v). Statistically significant separation via a single factor ANOVA test ($p < 0.05$) was not achieved between cobalt (II) thiocyanate, cocaine, or any of the adulterants.

Cuba, Lisa A. and Crupper, Scott S. Department of Biological Sciences, Forensic Science Program, Emporia State University. THE COLLECTION, LIFECYCLE, AND DNA BARCODING OF BLOW FLIES IN RURAL KANSAS

In forensic science, determining the post-mortem interval (PMI) of a deceased body is common. Fly lifecycles can be used with meteorological data to determine the rate at which maggots grow at a given temperature. During an investigation, maggots are collected from a deceased body, and used to determine the PMI. Knowledge of the fly species in a geographic area and their lifecycles must be known. DNA Barcoding has been utilized to identify flies on a molecular level.
The objective for this study is to build a working database for blow fly species in Lyon and Coffey Counties in Kansas. Adult flies were collected and preserved, while larvae and eggs were collected and reared. DNA Barcoding was performed with two mitochondrial Cytochrome Oxidase I (COI) gene regions, the COII gene, and the Internal Transcribed Spacer 2 (ITSII) gene. These genes were evaluated for their ability to identify species collected. DNA isolations were conducted with the ZR Tissue and Insect DNA Miniprep™ Kit from Zymo Research. Subsequently, Polymerase Chain Reaction (PCR) was utilized to amplify DNA regions that have shown utility in previous blow fly DNA barcoding efforts. Amplified DNA products were evaluated by agarose gel electrophoresis prior to DNA sequence determination at a commercial facility. The sequences were analyzed using the Basic Local Alignment Search Tool to make genus and species identifications of the samples. Data evaluated to date indicates a predominance of *Lucilia coeruleiviridis.* Studies of this nature are important first steps to utilize blow fly data in post-mortem studies.

Davies, B. (1), Adem, S., and Kandal, R. Chemistry Department, Washburn University. COLORIMETRIC DETECTION AND ANALYSIS OF PB^{2+} WITH DITHIZONE MODIFIED GOLD NANOPARTICLES.

A new analytical reagent consisting of hexadecyl trimethyl ammonium bromide (CTAB) and dithizone modified gold nanoparticles is developed for the colorimetric detection of Pb^{2+} ions. The color change is rapid and noticeable to the naked eye when the analyte Pb^{2+} ion was introduced to the developed reagent at both nanomolar and micromolar concentrations. Stability of the developed reagent, dithizone, and gold nanoparticles (AuNPs) are monitored using UV-Vis spectroscopy. The UV-Vis spectroscopy is also used to study the relationship between the Pb^{2+} ion concentration and the instrumental response at the nanomolar and micromolar range. Two sets of standard solutions of Pb^{2+} ions at 50-100 nM and 10-100 µM were prepared to determine the limit of detection for the analysis. While the colorimetric detection was rapid and noticeable to the naked eye for both sets of concentrations, we observed a linear relationship between concentration of the analyte and instrument signal for the standard solutions of 10-60 µM, which was used to calculate the limit of detection. The limit of detection from this curve was calculated to be 0.38 ± 0.02 µM.

Dhimal, A.[1] (1), Nguyen, H.L.[2]. 1. Department of Biology, Washburn University, and 2. Department of Chemistry, Washburn University. GRAPHENE-BASED QUANTUM DOT SYNTHESIS FOR BIOIMAGING

Quantum dots (QDs) are nanocrystals whose optical properties are dependent on their sizes. The versatility and potential biocompatibility of quantum dots allows their widespread applications in

various fields, including medicine, engineering, and manufacturing. At the same time, the tiny size and high cytotoxicity of heavy metal-based quantum dots create a high difficulty barrier for extensive use inside biological systems. In this project, we are investigating the synthesis protocols of graphene based QDs from pyrene. These graphene-based particles carry many advantages of graphene, including low toxicity, high surface area, and good solubility, in addition to the inherent strengths of quantum dots such as stable fluorescence, and adjustable band gap. Graphene quantum dots (GQDs) are therefore suitable for applications in biological imaging, tracking, and sensing inside a cell. The main of goal this project is to synthesize and fine-tune GQDs. We are working on characterizing the size and optical properties of our synthesized dots and will later introduce them into living cells and quantify their cytotoxicity.

Gutierrez, Mirtha (2)[1], Kristin Rindom[1], Jeremiah Morris[2], and Melissa Bailey[1] [1]Emporia State University, Department of Biological Sciences - MSFS Program [2]Johnson County Sheriff's Office Criminalistics Laboratory, Crime Scene Investigation COMPARISON OF IMPACT SPATTER PATTERNS GENERATED BY EQUAL FORCE ON RIGID VERSUS ELASTIC TARGET SURFACES - A PRELIMINARY STUDY

The pattern produced by the impact of an object into a pool of blood is predictable, allowing for the possibility of determining the area of convergence and the area of origin of the blood source. Much of the research done on impact patterns has been performed by striking blood on a fixed, rigid, non-absorbent target where kinetic energy from the object is mostly, if not completely, transferred to the pool of blood. However, these surfaces do not adequately represent the human body and little published research to date has focused on patterns generated by striking such surfaces. The purpose of this study is to compare impact patterns generated by impacting blood on a traditional rigid surface and on an unclothed rubber training dummy using the same amount of force and to determine the difference in force needed to generate similar spatter patterns from impacting each surface. An electromagnet was used to drop a 2.3kg weight from a height of 90.5cm onto blood pools on both surfaces. The force of the impact was measured using a NeuLog force plate and software. White butcher paper was used to construct a 3-sided chamber. All spatter patterns were photographed before the paper was replaced. The results indicate that more force is needed to generate similar spatter patterns from impacting blood on an elastic surface than it does for a rigid surface. If force is estimated in a crime reconstruction based on data obtained from rigid surfaces, it likely greatly underestimates the actual force used.

Jones, R. Physical Science Department, Emporia State University. PHILOSOPHY UNDERGIRDING SCIENCE

Logic is the formalization of sound reasoning. Since there are different ways of reasoning there are different logics. Various philosophers have used alternative logics to build alternative metaphysics, alternative realities. Plato employs a fuzzy logic, Plotinus paraconsistent logic, Hegel dialectical logic,… Hierarchy of Laws: Regularities/patterns (laws) that are exhibited at one level of detail/abstraction, and using one set of concepts, may not be found on other levels. i.e. laws which are valid when applied to one level in this hierarchy may be invalid if applied to another level. e.g. Newton's laws are valid on a level describing the macroscopic world. They are invalid when describing the microscopic. Personal Identity: The body theories, memory theories, and soul theories all attempt to tie our personal identity to an enduring entity, be it physical or nonphysical. Perhaps that entity is a complex causal sequence/network or a combination of a body theory, a memory theory, and a causal network theory. Qualia: are internally "processed and interpreted" signals filtered by sensor nonlinearities and limitations, any preprocessors, the set of learned internal concepts available to be activated, any concepts that have been previously activated, etc.

Kandel, R. (1) and Nguyen, H.L. Department of Chemistry, Washburn University. A MICRO FABRY-PEROT CAVITY FOR CHEMICAL CHARACTERIZATIONS OF NANOSCALE PARTICLES VIA RAMAN

SPECTROSCOPY

Raman spectroscopy is a powerful analytical technique that detects a shift in optical wavenumber between the incident light and light scattered from the analyte. The Raman shift is dependent on the vibrational mode of the chemical bonds inside the analytes and capable of generating a chemical fingerprint of molecules. The resulting Raman spectrum enables the chemical identification of various analytes, allowing for a wide range of applications in chemistry and biological studies. However, conventional Raman requires a relatively high sample concentration, making it not suitable for direct cellular investigation. A micro Fabry-Perot cavity system could amplify the optical Raman signal when the scattered light from the sample meets the resonance condition of the cavity. A Fabry-Perot simple cavity is formed when two highly reflective surfaces positioned within a few micrometers facing one another. The resonance condition of the cavity can be fine-tuned by fixing one mirror and moving the other mirror precisely using a shear piezo. The precision in the movement of the mirror-on-shear-piezo was calibrated with a motion-voltage response rate of 13.41 nm V^{-1}. However, we are working on improving the stability of the mirrors to allow for an more stable cavity and more well-defined resonances.

Long, K.R. (1), McLoud, J.D. Department of Biological Sciences, Tabor College. OBSTACLES IN DECIPHERING OPERATIONAL TAXONOMIC UNITS FOR FUNGAL SPECIES: WHAT DOES THE DATA SUGGEST

With an increased effort to develop real-time molecular surveillance methods for airborne fungi that contribute to seasonal allergies, the species criteria of 97% homology used in metagenomic investigations needs to be tested using airborne fungal isolates. Fungal isolates were collected outdoors on culture plates with a QUICKTAKE® 30 at Hillsboro, Kansas. Isolates were independently deep sequenced to 100K paired-end reads. The ITS1 and ITS4 barcoding primer pair was used for DNA sequencing. Raw sequences were processed with QIIME 2. Cleaned sequence reads for each isolate were clustered using QIIME 2, which determined unique Operational Taxonomic Units (OTU). Isolate OTUs were identified with Basic Local Alignment Search Tool from GenBank and Pairwise alignment from MycoBank. A cladogram was constructed with MAFFT V.7 including all OTUs, which determined relationship between isolate OTUs. Airborne isolates identified and unique OTU number for each isolate were: *Bullera alba* with 4, *Cladosporium velox* with 3, *Epicoccum nigrum* with 7, *Hannaella coprosmae* with 5, and *Vishiacozyma carnescens* (formerly *Cryptococcus*) with 7. Every isolate was observed in 2 clades, but not every clade was a mixture of isolates. Results suggest that the ribosomal-DNA internal transcribed spacer (ITS) regions 1 and 2 of these airborne fungal isolates should not be processed with the 97% homology criterion commonly used in metagenomics investigations. This novel finding suggests that future investigations should use different bioinformatics tools to process the cleaned sequence reads of airborne fungi to determine the range of intra- and inter-genomic variation for allergenic airborne fungi.

Muñoz-Ortiz, Iris[1], Destiny Costley[2], Kelsey Lynch[2], and Melissa M. Bailey[1] [1]Emporia State University, Department of Biological Sciences - MSFS Program [2]Johnson County Sheriff's Office Criminalistics Laboratory, Crime Scene Investigation. THE EFFECT OF SUBSTRATE AND CLEANSER ON THE ABILITY OF LUMINOL TO DETECT CLEANSER.

Although not visible to the naked eye, latent blood stains are some of the most valuable pieces of evidence at a crime scene. Luminol is a fast-acting test that can detect blood stains and can be used on a variety of porous and nonporous surfaces. Sodium hypochlorite, an active ingredient in bleach, reacts with luminol. However, previous research has shown that the presence of this compound causes bright flashes of chemiluminescence as opposed to the gradual chemiluminescence caused by blood. The purpose of this study was to determine if other household cleansers at various strengths produce a

similar reaction to the slow dull reaction produced by blood. A total of 38 cleansers at 4 different dilutions and 7 substrates were tested. For every cleanser at every dilution tested, 0.25ml of defibrinated sheep's blood was placed inside a pre-stenciled circular area of each of the substrates. The dried blood was then cleaned using the cleansers until no blood was visible on the substrate, then allowed to dry for 60 minutes before testing. Each test was photographed from the time luminol was applied until no chemiluminescence was visible. The results of this study confirm that bleach-containing cleansers tested alone displayed bright flashes of chemiluminescence that were noticeably different from the chemiluminescence from blood controls, and non-bleach-containing cleansers do not react with luminol in a manner similar to blood. Some cleansers were effective in removing blood so that blood was not detected with luminol. Absorbent substrates mute luminol chemiluminescence.

Munsell, K[1]. (1), Zimpfer, R[1]. (1), and Leung, S. [2] (2). Department of Chemistry, Washburn University.
PROGRESS TOWARD THE ADDITION OF PHOTOSENSITIZER ON GLASS SURFACE VIA AMIDE LINKAGE.

In the past few decades, the use of photodynamic action has been directed toward cancer therapy due to non-invasive procedure and specific cancer treatment potential. More recently photodynamic action has been applied in an antibacterial setting. The current idea for application of photodynamic action is to attach a photosensitizer to a common surface such as glass or cloth. Such surfaces could be antibacterial in the presence of light with the appropriate wavelength. In this work attempts were made to derivatize glass slides with 3-aminopropyltriethoxysilane (APTES) in order to provide amino groups on the glass surface that will allow the attachment of a photosensitizer through an amide linkage. Generally, a harsh cleaning procedure on glass was performed to remove any obstructions prohibiting proper interaction between the hydroxyl groups on the silica based glass surface and ATPES. The clean glass was then treated with APTES. Subsequent attachment of methyl red (a model compound for a photosensitizer) using a dicyclohexylcarbodiimide (DCC) coupling reaction was unsuccessful. Currently, reliable procedures for the application of the APTES solution to glass and for the confirmation of amino groups on the glass surface are being investigated.

Powell, I., and Ayella, A. Department of Chemistry, Washburn University. CRISPR CAS9 MEDIATED MUTATION OF LDH IN COLON CANCER CELLS.

Cancer related diseases are a leading cause of death in the world. Cancer cells in the colon carry out metabolic processes at a higher rate than normal cells. By inducing anaerobic conditions, colon cancer cells develop high expression levels of lactate dehydrogenase (LDH). LDH plays an important role in anaerobic metabolism by catalyzing the conversion of pyruvate to lactate. Using the CRISPR - Cas9 system allows for targeting of the LDH gene in cancer cells. Editing of the LDH gene can lead to decreased expression and activity of the LDH protein in colon cancer cells and lower metabolic rates. In this study, SW480 colon cancer cells will be co-transfected with a CRISPR - Cas9 LDH gene construct. New mutant cells will be sorted and measured for expression and activity using flow cytometry and the EZ drop spectrometer. Previous work was done by a research student to generate and sequence the CRISPR - Cas9 gene construct to be used. In this study, co-transfection of SW480 cells will be carried out. Mutant cells will be sorted using Fluorescence-Activated Cell. Protein isolation will be carried out and characterization of protein will be performed using the EZ drop spectrometer. This research utilizes emerging technologies and has the ability to generate data to be used in further studies.

Rutherford, N. West, T., and Gress, J. Emporia State University MEASUREMENT OF SHORT-TERM LEARNING OF HONEY BEES USING PROBOSCIS EXTENSION RESPONSE (PER) TRIALS WHEN EXPOSED TO PESTICIDES AND CBD.

The investigation of short-term learning of honey bees is critical to understand how common insecticides used in agricultural farming and urban gardening affect the forager bee’s ability to learn

behaviors such as flower routes for the collection of pollen. Neonicotinoid and organophosphate insecticides alter learning and cognitive functions. Low levels of neonicotinoids act as nicotinic acetylcholine receptor (nAChR) agonists and disrupt normal function of the neurons in the bee brain impairing learning and leading to cell brain death. Cannibidoil oil (CBD) is a non-psychoactive phytocannabinoid from *Cannibis sativa* that has been shown *in vitro* to have neuroprotective qualities. To examine if CBD has a neuroprotective effect on the bee brain in terms of learning and memory we measured the impact of insecticides on forager bees exposed to 10nmol of either Imidacloprid, Coumaphos, or Thiamethoxam alone or in combination with 100nmol of CBD in a 1M sucrose solution using PER trials. Our initial results showed a moderate impact of learning when dosed with the pesticides individually, but a large reduction in learning capabilities when dosed with CBD and a pesticide. To test if CBD offers a neuroprotective effect on the bee brain in terms of neuron health, we are conducting RNA-Seq analysis of the mushroom bodies, the part of the brain associated with learning and memory, to investigate up and down regulated genetic expression with insecticide and CBD exposure.

Shen, C. (3). Department of Ecology and Evolutionary Biology, and Biodiversity Institute, University of Kansas. THE SEXUALLY DIMORPHIC NEOPTERYGIAN FISH *Wushaichthys exquititus* (MIDDLE TRIASSIC, CHINA): TAXONOMIC IMPLICATIONS AND PHYLOGENETIC RELATIONSHIPS

Wushaichthys exquisitus, a small fish from the Ladinian of Xingyi, Guizhou Province, southern China, was named a few years ago and interpreted as the most primitive species in the Thoracopteridae (Triassic 'flying' fishes with a EuroAsian distribution). However, this hypothesis was questioned, because *Wushaichthys* also shares features with Peltopleuridae. A detailed morphological re-description of *Wushaichthys* was conducted based on new specimens, plus a revision of previously studied ones, as well as of members of *Peripeltopleurus* and thoracopterids, and their relationships were tested with a phylogenetic analysis based on 137 characters and 54 taxa. The results suggest that *Wushaichthys* is a member of a clade that is interpreted here as the new superfamily, which contains *Wushaichthys, Peripeltopleurus* and Thoracopteridae and is the sister taxon of the nonmonophyletic family Peltopleuridae among Peltopleuriformes. The new superfamily is strongly supported by numerous synapomorphies. Although Thoracopteridae is monophyletic, one of its genera, *Thoracopterus*, is not. Consequently, the content of Thoracopteridae was re-evaluated. The family containing *Wushaichthys* is supported by a unique combination of characters, and the results confirm it as a thoracopteroid, but not a thoracopterid. The characters of *Wushaichthys* are relevant for understanding the taxonomy and systematics of thoracopteroids, especially the evolutionary morphological modifications of the paired fins and the lower lobe of the caudal fin, which are some of the main characters of these sexually dimorphic fishes. The sexual dimorphism of *Wushaichthys*, *Peripeltopleurus*, and *Potanichthys* among thoracopteroids involves modifications of the anal fin rays and associated scutes in males.

Shrestha, S. and Sadikot, T. Department of Biology, Washburn University. IDENTIFICATION AND ANALYSIS OF GENOMIC ELEMENTS IN *DROSOPHILA BIPECTINATA* USING COMPUTATIONAL GENOMIC TOOLS

The genome of *Drosophila melanogaster* has been a highly studied genome in biology since the annotation was completed in 2000. This organism is a model for studying development and cellular processes common to higher eukaryotes and can be used as a reference for identifying genes and genomic elements in other Drosophila species. In this project, the *D. melanogaster* genome was used as a reference to analyze and annotate genes and genomic elements in contig70 of the related *D. bipectinata* species. The data files and resources for this project was obtained through the Genomics Education Partnership (GEP) sponsored by Washington University, Saint Louis. The analysis of contig70 of the *Drosophila Bipectinata* genome determined the presence of five genes homologous with genes Best2, CG10163, CG10226, Ldh and Mdr65 of *D. Melanogaster*. Incomplete genes or non-consensus

genes were not found within this contig.

Sierra, N.(1), Millhouse, M., Lock, B., and Hong., W-F. Department of Natural Science and Mathematics, Sterling College. A SURVEY OF THE BROWN RECLUSE SPIDER IN PUBLIC BUILDING OF RURAL KANSAS.

The brown recluse spider (*Loxosceles reclusa*) is a medium size arachnid with a venomous bite. It is easily identifiable by the dark to medium brown violin pattern located on the top side of the cephalothorax in addition with its eye pattern. It has been reported that the recluse's distribution range 27 states include Oklahoma, Texas, Arkansas, Missouri, Alabama, Mississippi, Kentucky, Tennessee, and Illinois. Early discoveries of the recluse spider assume a natural outdoor habitat. Later, it has been noted that the habitat of the recluse was found more adapted in buildings rather than nature areas. A other study found recluse spider in an old house, we propose to study the population of the recluse spider in public buildings. Sticky traps were used for identification of male, female and juvenile of brown recluse in conjunction with other arthropods. Sacs and eggs were exanimated and counted in the buildings. By understanding the population between seasons and the life cycle, we may help in controlling the brown recluse population in future.

Sprague, T.A.[*], Loveland, M.A.[*], Agbedanu, P.N. Division of Science, Technology, Engineering, and Mathematics, Friends University. VORINOSTAT CAUSES INFERTILITY AND WING DEFECTS IN *DROSOPHILA MELANOGASTER.*

Many cancer patients are concerned their treatment might cause infertility or birth defects. Previous studies show histone deacetylase inhibitors may result in infertility or developmental defects. However, the data are sparse and incomplete for vorinostat (an FDA-approved HDAC inhibitor). We exposed adult and larval *Drosophila melanogaster* to vorinostat. In larvae, 200 mM vorinostat results in notched wings. Significant infertility develops after both male and female adults are exposed to 400 mM vorinostat for 48 hours. These findings agree with studies on trichostatin A, a similar HDAC inhibitor. Our data demonstrate vorinostat diminishes fertility and alters development in *Drosophila*. Patients on vorinostat should be made aware of these potential side effects. [*]These authors contributed equally.

Stout, M.S.[1,2] (1), Jones, M.S.[1,2], Beard, K.C.[1,2] 1. Biodiversity Institute, University of Kansas, and 2. Department of Ecology and Evolutionary Biology, University of Kansas. AN ANALYSIS OF A PATHOLOGICAL LOWER LEFT THIRD MOLAR OF A *MAMMUTHUS COLUMBI* AND OTHER PROBOSCIDEANS FROM CLARK COUNTY, KANSAS WITH IMPLICATIONS OF PALEOECOLOGY AND DIET.

Mammuthus columbi was by far the most common species of a mammoth in the continental United States during the Pleistocene epoch. These large mammals fed on grasses in the steppe of Ice Age North America, until their extinction 11,000 years ago along with the other Pleistocene megafauna. A handful of specimens found in the late 1920s in Clark County, Kansas, including a deformed molar of *M. columbi*, have yet to be studied and have remained relatively ignored in the collection of the University of Kansas (KUVP) Natural History Museum collection. Pathologies in mammoth teeth and bones have been linked to improper nutrition in the past and have yet to be studied in *M. columbi* specimens. Analyses of microwear and isotopic samples, especially looking at δC^{13} of enamel, in proboscidean teeth have been linked in previous research to reconstructing diet and paleoenvironment and could potentially provide insights regarding the impact of climate change on the megafauna in Pleistocene North America. In this study, we compared the pathological *M. columbi* specimen with three other third molar specimens from the same locality: two *Mammuthus* sp. and one *Mammut americanum*. A morphological report was made of the listed specimens, with a comprehensive description of the pathological and non-pathological specimens.

Stucky, K. (1), and Hong, W-F. **Department of Natural Science and Mathematics, Sterling College**. CASE STUDY OF A HERITABLE CANCER GENE ATM IN A FAMILY.

There are many types of gene mutations that are related to breast cancer including, BRCA1, BRCA2, ATM, BARD1, BRIP1, CDH1, CHEK2, EPCAM, FANCC, MLH1, MSH2, MSH6, NBN, PALB2, PMS2, PTEN, RAD51C, RAD51D, TP53 and XRCC2. ATM (Ataxia telangiectasia-mutated) is one of these genes that supposes to prevent cancer by repairing DNA after radiation and related to induce cell production after cell damage. However, the mutation of this gene will increase the risk of breast cancer by 20-60% and highly associate with other form of cancers such as prostate cancer, colorectal cancer and lung cancer. A pedigree tree of a family associated with ATM mutated gene has been established and estimated the risk of family members. This mutated gene called c. 2623del will be compared with other variants of the same gene. Although it is an autosomal recessive disorder, it has been reported that some penetrance shows in some individuals with one mutated ATM gene. In hence, establishing a family tree is important for risk estimation.

Tidd, J.A.[1](1), Carpenter, M.E[1], Osborne, J.M. [1], Bohnenstiehl, M.C. [1], Hovorka, M.J. [1], Miller, W.R. [1], Morris, E.R[1]. 1. Department of Biology and Chemistry, Baker University. SPECIES IDENTIFICATION OF TARDIGRADES USING DNA BARCODES.

Tardigrades are microscopic aquatic animals that exhibit many interesting biological characteristics, including survival in extreme environments and the ability to do cryptobiosis. Tardigrades are found across the planet and 1,300+ species have been categorized into two classes, Eutardigrada and Heterotardigrada (and one other debated: Mesotardigrada) based on morphological characteristics. Numerous studies of other taxa include molecular analysis to determine evolutionary relationships, but this work has been limited in Tardigrades. Recently, better techniques for extracting DNA from single animals has been developed and will make molecular Tardigrade work easier. The goal of our work is to strengthen the taxonomic classification system of Tardigrades by gathering specimens across Kansas, collecting molecular species identification data, then combining this with the morphological data to better understand evolutionary relationships. The cytochrome oxidase 1 gene (*COX1* or *COI*) has been sequenced in many other taxa and used as a species identifying "barcode" as this sequence varies at a rate to make it unique at the species level. In Tardigrades, four genes have been identified for sequences specific to the level of class, order, genus and species; *18S*, *28S*, *ITS*, and *COX1*. We have extracted DNA from 40+ individual animals, attempted to PCR amplify and sequence these four genes from each. Comparing the BLAST results to available Tardigrade sequences confirms some morphological categorization, but also highlights the challenges of molecular identification when the reference database is limited. Building a database of molecular barcodes for Tardigrades will help scientists across the world as they collect and identify animals.

Todwong, S. A. A. (1), and Mercader, R. J. Department of Biology, Washburn University. INFLUENCE OF PRIOR EXPERIENCE ON THE DECISION-MAKING OF *CALLOSOBRUCHUS MACULATUS*.

Prior experience has been shown to influence decision-making across multiple animal taxa. Here we tested whether prior experience (distance travelled) could influence decision making in a different context (response to host quality) in the Chrysomelid beetle *Callosobruchus maculatus*. Specifically, we tested if distance traveled altered a) exploration of habitat patches and b) response to host quality. Egg laying was assayed in environments consisting of two sets of patches with connected by either a long or short distance from a starting patch. One environment type consisted of identical patches of readily accepted hosts (*Vigna unguiculata*). In a second environment type, the first habitat patch encountered after the short or long distance travelled contained hosts with low acceptance rates (*Cicer arietinum*)

and all other patches contained the readily accepted host. Distance traveled did not affect ovipositional patterns in environments containing only readily accepted hosts or when hosts varied and travel distance was short. In contrast, when distance traveled was long, the quality of the first patch encountered had a significant effect on the ovipositional pattern on subsequent patches encountered. These results indicate that prior experience (distance travelled) significantly affected behavioral responses in a different context (response to host quality).

Travelbee, J., Rogers, D. and Hong, W-F. Department of Natural Sciences and Mathematics, Sterling College. A PRELIMINARY STUDY IN OBSERVATION OF CHICKEN EMBRYO OUTSIDE THE EGG SHELL.

The chicken embryo has been traditionally used as a developmental model. Calcium, an important component in growth and development of the skeletal system and nervous system is also a major component of the chick shell (95% calcium carbonate). Our experiment is designed to show how important shell calcium is to the developing chick embryo. Using a modified protocol from "A Novel Shell-less Culture System for Chick Embryos Using a Plastic Film as Culture Vessels". Embryonic day 2 chick embryos were placed into individual shell-less containers composed of polystyrene cups. These were maintained in an incubator at 37.5°C with humidified positive air flow. Test parameters involved incubating embryos with no calcium, 300 mg calcium carbonate or chick embryos incubated within their shell. The shell-less chick embryos with and without calcium additives were compared to shelled chick embryos for their viability and macroscopic structural development.

VanHorn, S.D. (1), and Rogers, D.J. Natural Science Department, Sterling College, Sterling, Kansas. LEARNING STYLES IN STUDENT ATHLETES.

A learning style is the method a student uses to acquire academic information. A student's learning style is unique, but generalized categories can be applied to types of learning styles. Students knowing their learning style can allow them to better tailor their study habits and become more efficient in learning assigned material. Knowing in general the learning style of a class could benefit the instructors as they can design coursework to better target their students. This study was conducted to investigate if a specific sport might attract athletes with similar learning styles and if there were any gender differences in learning styles of student athletes. The VARK© online questionnaire divides the learning styles into visual, aural, reading, and kinesthetic categories. The VARK© online questionnaire was used to determine the preferred learning styles for student athletes at Sterling College. Ninety-two students volunteered to participate in this study. These students took the VARK questionnaire, to discover their primary learning style. The students self-reported their learning style, the sport they were currently playing at Sterling College, and their gender in an anonymous format. Categorical data analysis used raw counts and percentages from the ninety-two volunteer student athletes to compare their learning styles with sports participation.

Wiest, T.A.M (1), Gress, J., and Rutherford, N.P. Emporia State University. ANALYSIS OF HEMP POLLEN'S EFFECT ON IMIDACLOPRID AND COUMAPHOS INDUCED OXIDATIVE STRESS IN *APIS MELLIFERA* THROUGH GENE EXPRESSION.

Honeybees are increasingly exposed to different compounds both inside and outside the hive. Outside the hive, honeybees encounter different neonicotinoids. This class of pesticide is linked to gene regulation of many honeybee detoxification genes that metabolize toxic molecules. Inside the hive is Coumaphos, a widely available organophosphate-based acaricide used to help manage the varroa mite parasite (*Varroa destructor*) in bee colonies. Chronic exposure can result in reduced foraging activity and increased levels of programmed cell death within bee tissues. Cannabidiol (CBD) is one of the main pharmacologically active phytocannabinoids of *Cannabis sativa L*. CBD has been shown to affect redox balance by modifying the level and activity of both oxidants and antioxidants, and therefore may be able

to combat the harmful effects of these pesticides. *C. sativa* cultivation is increasing as laws surrounding the production of hemp are loosening and the demand for hemp oils are increasing. Honeybees have been reported to utilize hemp pollen as a protein source, especially in late summer. In addition, hemp pollen may provide access to crucial phytochemicals including CBD that improve survival and pesticide tolerance in honeybees. The objectives of this study are to determine if hemp pollen offers a protective effect through assessing antioxidant gene expression through qPCR in the honeybee gut after exposure to pesticides. This may lead to the development of new management strategies for honeybees and hive survival.