

Research and the State

GRADUATE STUDENT POSTER SESSION

Program Booklet

October 23, 2020
Via Zoom

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Program Schedule

POSTER PRESENTATIONS AND JUDGING

10:00 AM - 3:00 PM

Via Zoom

Research posters will be presented by 36 K-State graduate students representing seven academic colleges and 19 graduate programs. Ten presenters will be selected by K-State faculty and post-doc judges to participate in the Capitol Graduate Research Summit (CGRS) virtually in February.

AWARDS

The 10 graduate student poster presenters selected to represent K-State by presenting their posters at the 18th annual Capitol Graduate Research Summit (CGRS) in February 2020 will be announced via the Weekly GSC email. Results will be sent via email as soon as judging sheets have been collected and quantified. The top ten presenters will receive a monetary reward of \$250.

About the Capitol Graduate Research Summit

The CGRS is an annual showcase of research conducted by graduate students from Emporia State University, Fort Hays State University, Kansas State University, Pittsburg State University, the University of Kansas, the University of Kansas Medical Center, and Wichita State University. Participants have the opportunity to present their research posters and discuss the important implications their research has for issues in the state of Kansas with state legislators, the governor, and the Board of Regents. Academic and industry representatives serve as judges to select the top presenters from each institution to receive scholarship awards.

Poster Titles and Presenters

Group 1: Agricultural and Environmental Sciences

- 1. HOW DO SHUTTLE AND SLOW-RELEASE EFFECTS OF ZINC FERTILIZERS ALTER ZINC DIFFUSION IN SOIL AND ITS UPTAKE BY WHEAT PLANTS?**
Sevendeeep Kaur, 10:00 AM
- 2. “GREEN” FERTILIZERS FROM WASTEWATERS: EXPLORING POTENTIAL USE OF PHOSPHORUS BASED RECOVERED NUTRIENT PRODUCTS IN AGRICULTURE**
Kasuni Gamage, 10:08 AM
- 3. CAN A SOIL-BASED MICROBIAL FUEL CELL TRACK NUTRIENT DYNAMICS?**
Manjot Kaur Rekhi, 10:16 AM
- 4. FINE MAPPING AND MARKER DEVELOPMENT FOR *H34*, A HESSIAN FLY RESISTANCE GENE, IN WHEAT**
Nida Ghori, 10:24 AM
- 5. DISCONTINUOUS DIET ALTERS FITNESS AND FLIGHT BEHAVIOR OF *HIPPODAMIA CONVERGENS* (COLEOPTERA: COCCINELLIDAE)**
Hannah Stowe, 10:32 AM
- 6. REGULATOR OF LEAF TRICHOME AND ROOT EPIDERMIS DEVELOPMENT IS CONTROLLED BY DEGRADATION IN PLANT CELLS**
Bibek Subedi, 10:40 AM
- 7. EFFECTS OF SALINITY ON ENVIRONMENTALLY DRIVEN HALOTOLERANCE IN ROOT-ASSOCIATED ASCOMYCETES**
Kyle Ismert, 10:48 AM
- 8. DETECTION OF LONG-TERM GRASSLAND VEGETATION TRENDS FOR THE GREAT PLAINS ECOREGION USING TEMPORAL DECOMPOSITION AND SATELLITE-DERIVED VEGETATION INDICES**
Hilda Onuoha, 10:56 AM

Group 2: Economics and Agricultural Economics

9. WHERE'S THE BEEF? THE COST OF TRACEABILITY

Hannah Shear, 10:30 AM

10. HOW COST EFFECTIVE ARE GOVERNMENT GRANTS IN MANURE MANAGEMENT – A POLICY ANALYSIS OF AGSTAR, AN EPA PROGRAM

Emily Parker, 10:38 AM

11. DOES END GUN REMOVAL REDUCE WATER USE?

Micah Cameron-Harp, 10:46 AM

12. GROUNDWATER PERMIT TRADING AND POTENTIAL GROUNDWATER SAVING IN KANSAS

Sang Su Ha, 10:54 AM

13. GENERAL TRADE POLICY UNCERTAINTY AND U.S. TRADE FLOWS

Tian Liu, 11:02 AM

14. THE ROLE OF PHOTOS TO ATTRACT MORE GUESTS FOR LOCAL COMMUNITY

Juhwan Lim, 11:10 AM

Group 3: Social Sciences

15. THE EFFECTIVENESS OF VIRTUAL GRADUATE RECRUITMENT PROGRAMS FOR 1890 STUDENTS TO 1862 INSTITUTIONS

Raymond Thomas, 11:00 AM

16. RISK PERCEPTION AND SELF-EFFICACY FOR COMMUNICABLE DISEASES AMONG AFRICAN IMMIGRANTS IN THE UNITED STATES

Barikisu Issaka, 11:08 AM

17. DOES CAMPUS BIODIVERSITY MATTER FOR STUDENTS' PSYCHOLOGICAL WELLBEING?

Jaeyoung Ha, 11:16 AM

18. THE IMPACT OF RURAL RECREATION WITHIN KANSAS

Sarah Jackson, 11:24 AM

19. UTILIZATION OF THE CASPER SURVEY TOOL IN RILEY COUNTY, KANSAS

Jason DeFisher, 11:32 AM

20. PUBLIC HEALTH PRACTICE IN KANSAS

Megan Eppler, 11:40 AM

21. DATA-DRIVEN STORIES OF OPPORTUNITY: DEVELOPMENT OF A COMPREHENSIVE COMMUNICATION PLAN FOR THE RILEY COUNTY OPPORTUNITY MAP

Jeremy Williams, 11:48 AM

Group 4: Biological Sciences

22. DETERMINING SWINE ENTERIC MICROBIOME FUNCTIONS FOR OPTIMIZED NUTRIENT UTILIZATION, GROWTH, AND HEALTH

Brandi Feehan, 1:00 PM

23. A MODIFIED LIVE PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS VACCINE INFLUENCES THE GUT MICROBIOME IN NURSERY PIGS

Pratiksha Khanal, 1:08 PM

24. SKIN BLOOD VESSEL RESPONSES FOLLOWING 5-FLUOROURACIL CHEMOTHERAPY ADMINISTRATION

Stephen Hammond, 1:16 PM

25. HIGH-INTENSITY TRAINING AND PROSTATE CANCER-INDUCED CARDIAC ATROPHY

Dryden Baumfalk, 1:24 PM

26. CHARACTERIZING THE COMBINATORY ANTI-MELANOMA POTENTIAL OF ZINC OXIDE NANOPARTICLE AND ITS PHYSIOMETACOMPOSITES WITH LL-37 PEPTIDE

Elza Mathew, 1:32 PM

27. IDENTIFYING ENZYMES LIMITING AN EFFECTIVE RNAI RESPONSE IN THE BITING MIDGE CULICOIDES SONORENSIS

Cameron Osborne, 1:40 PM

28. ENHANCING THE SAFETY AND EFFICACY OF CANCER DIAGNOSTIC AGENT FOR BETTER CANCER MANAGEMENT

Sagar Rayamajhi, 1:48 PM

29. SEEKING NEW DRUGS TO TREAT AUTOIMMUNE DISEASES WITH COMPUTER ASSISTANCE

Mian Huang, 1:56 PM

Group 5: Engineering and Physical Science

30. WEARABLE NEUTRON DETECTOR (WND) AND NUCLEAR NON-PROLIFERATION

Robyn Hutchins, 1:30 PM

31. THE FUTURE OF POWER ELECTRONICS COOLING ON RENEWABLE ENERGY PLATFORMS IS 3-D PRINTED

Christopher Bailey, 1:38 PM

32. EXPERIMENTAL ULTRASONIC VELOCITY STUDY

Ganiyat Shodunke, 1:46

33. INVESTIGATION OF OLDER DRIVERS FATAL CRASHES AT INTERSECTIONS IN THE MIDWESTERN STATES

Abdulaziz Alshehri, 1:54 PM

34. CRYSTAL ENGINEERING APPROACH IN DESIGNING ENHANCED UREA FERTILIZERS

Kelly Shunje, 2:02 PM

35. PERFORMANCE OF TRACKED AUTONOMOUS GROUND VEHICLE FOR STEEP SLOPE FARMING

Chetan Badgular, 2:10 PM

36. APPLICATION OF REMOTELY SENSED IMAGERY AND SPATIO-TEMPORAL MODELING FOR IRRIGATION SCHEDULING

*Travis Wiederstein, 2:18 PM **WITHDREW***

Poster Abstracts

Group 1: Agricultural and Environmental Sciences

1

HOW DO SHUTTLE AND SLOW-RELEASE EFFECTS OF ZINC FERTILIZERS ALTER ZINC DIFFUSION IN SOIL AND ITS UPTAKE BY WHEAT PLANTS?

Sevendeeep Kaur¹, Ganga M. Hettiarachchi¹, and Dinesh Adhikari²

¹*Department of Agronomy;* ²*Compass minerals, Overland Park, KS*

BACKGROUND AND PURPOSE: Zinc deficiency is a widespread problem. To correct these deficiencies, different organic and inorganic Zn fertilizers have been used. Various sorption-desorption reactions control the Zn concentration in soil solution and Zn availability to crops. Therefore, fertilizer Zn behaves differently in different soils depending on soil properties. **METHOD:** Greenhouse and Incubation studies were performed with two different types of soils. Zinc diffusion from the point of application was measured using incubation-visualization, and greenhouse studies and Zn plant uptake was measured in the greenhouse study. The objectives were to compare the efficiency of four Zn sources (ZnO, ZnSO₄.H₂O, Zn mix (ZnO, ZnSO₄, Zn-EDTA), and Zn-EDTA) in different soils with varying pH, using a high-Zn responsive wheat line, compared to two controls (no-Zn and No Zn+EDTA). Zinc was applied at a rate of 10 kg ha⁻¹ in the greenhouse study, while an adjusted rate (2.34 mg/petri dish) was used for the incubation-visualization studies. **RESULTS/FINDINGS:** We found that Zn diffusion and Zn plant uptake were higher for ZnSO₄.H₂O and Zn-EDTA for neutral pH soil, whereas ZnO and Zn mix treatments performed better in calcareous soil that are well known for Zn fixation. In calcareous soils, soluble ZnSO₄.H₂O and Zn-EDTA had limited effects on Zn diffusion and its bioavailability to wheat plants. **CONCLUSION:** Results from our studies suggest that the suitable Zn source should be carefully selected for efficient mitigation of Zn deficiencies in soils.

Relevance of Research to State-Related Topic(s)

Zinc is an essential element, which is generally deficient, not only in the state of Kansas but in the whole world and approximately one-third of the human population suffers from an inadequate intake of Zn. Kansas soils exhibit a wide range of pH from acidic to alkaline, while alkaline soils are common in the central and western regions of Kansas. High pH calcareous soils can cause problems to plants by reducing certain micronutrients' availability, primarily Zn. In Kansas, 51-65% of soils are Zn deficient and require Zn fertilization. Since, wheat is the primary crop grown in the state, we aim at providing beneficial knowledge from our research findings to help farmers in selecting a Zn source that is better suited for the specific soil type, which would cut down extra expenses, increase productivity of crops, and hence, profitability while following a sustainable agriculture production system.

“GREEN” FERTILIZERS FROM WASTEWATERS: EXPLORING POTENTIAL USE OF PHOSPHORUS BASED RECOVERED NUTRIENT PRODUCTS IN AGRICULTURE

Kasuni Gamage¹, Ganga Hettiarachchi¹, Prathap Parameswaran², and Stacy Hutchinson³

¹*Department of Agronomy;* ²*Department of Civil Engineering;* ³*Department of Biological and Agricultural Engineering*

BACKGROUND AND PURPOSE: Phosphorus (P) is a vital crop nutrient. The increasing demand for P sources, raises the need for exploring safe and efficient secondary P fertilizer sources. Wastewater is a renewable resource, and recovered nutrient products (RNPs) from wastewater may contain high concentrations of plant-available nutrients, and thus, can be promising alternative fertilizers. This study evaluated the effectiveness of two contrasting group of RNPs (Fe- and Ca-based) recovered from Fort Riley, Kansas municipal, and synthetic swine wastewater using an innovative anaerobic membrane bioreactor (AnMBR) technology. The overall aims of the study are to characterize and to compare the dissolution, transformations, and potential bioavailability of P in RNPs with conventional P fertilizers in mildly calcareous, acidic, and neutral soils using short term laboratory incubation studies. **METHOD:** Soils were incubated for 3-days, 1-week and 5-week in Petri dishes with four treatments: RNP, monoammonium phosphate (MAP), and triple superphosphate (TSP) plus control. After each incubation time, soils were sectioned at different distances from the point of application and soil pH, total P, and resin extractable P to assess potential plant availability, were measured. **RESULTS/FINDINGS:** Phosphorus diffuses from the center section to the next section following the TSP>MAP>RNP order. Percent resin available P in all treatments also increased during the study period. Both RNPs showed a low performance than the conventional fertilizers compared. **CONCLUSION:** Iron-based RNP is acting as a P sink, while Ca-based RNP is acting as a P source. Optimizing Ca-based RNP recovery will likely offer useful secondary P sources to use in agriculture.

Relevance of Research to State-Related Topic(s)

Our research addresses the areas of sustainable water supply and alternative and sustainable energy sources. Harvesting nutrients and energy from wastewater treatment technologies leads to build new, important interrelationships between food, energy, and water systems. Municipal wastewater treatment facilities and animal wastewater treatment facilities are primary producers of resource-rich wastewater. AnMBR technology can remove harmful substances from wastewater to produce clean water for reuse while recovering nutrients and producing soil amendments for crop production and protecting our surface waters from harmful algal blooms. In this research, Recovered Nutrient Products tailored for phosphorus applications. This reduces food and water quality deterioration from land application of livestock wastewaters and could make agriculture production more sustainable, economical, and environmentally friendly.

CAN A SOIL-BASED MICROBIAL FUEL CELL TRACK NUTRIENT DYNAMICS?

Manjot K. Rekhi¹, Ruwandi Kumarasinghe¹, Ganga M. Hettiarachchi¹, and Prathap Parameswaran²

¹*Department of Agronomy*; ²*Department of Civil Engineering*

BACKGROUND AND PURPOSE: A soil-based microbial fuel cell (MFC) is a bio-electric device that uses the soil microorganisms to convert an organic substrate into electricity. This energy generation potential of MFCs can be exploited to ‘sense’ nutrient status of agricultural soils, which would be faster than traditional soil sampling methods and analysis in laboratories. It can provide real-time data on available soil nutrients. In this study, we hypothesized that change in the level of nutrients would give us a different microbial response, hence, a different electrical signal. **METHOD:** Soil-based MFCs were set up using natural and sterilized (no microorganisms) soil at field capacity with different fertilizer, and organic carbon treatments and *Geobacter* enriched inoculum. The voltage generated was measured by a data logger and recorded every 15 minutes. Soil solution was analyzed to estimate nutrient levels, and soil gas samples (CO₂) were collected periodically as a proxy for soil microbial activities. The data collected was then compared to develop relationships between nutrient transformations, microbial activity, and soil-based MFC electrical performance. **RESULTS AND CONCLUSION:** Although the electrical signals observed were different, yet these were not clearly separated between treatments because the soil contains more than one redox-sensitive compounds and electrogenic bacteria. For the future studies, we plan to improve separation of MFC signals by using selective polymer-based anode coating to restrict other available nutrients and using selective inoculum of microorganisms for nutrient in question. If we can successfully model these relationships, this research could help improve crop production rates and ensure the Nation's food security through 2050 demands.

Relevance of Research to State-Related Topic(s)

Soil microbial fuel cells are seen as alternative and cost-effective sustainable energy sources because these utilize microorganisms present in soil to produce electricity. Adding to this, these may have the ability to work as biosensors in the agricultural fields. In order to increase crop production by 2050, soil health needs to be improved and monitored continuously. High-resolution soil data is essential but is very difficult to obtain. Researchers and farmers often rely on traditional soil sampling methods, which cannot capture spatial variability. My research focuses on establishing the soil-based microbial fuel cell as biosensor. This innovative approach can provide comprehensive information on soil health that can help farmers make informed decisions about agricultural practices and consequently, increase their crop production sustainably.

FINE MAPPING AND MARKER DEVELOPMENT FOR *H34*, A HESSIAN FLY RESISTANCE GENE, IN WHEAT

Nida Ghor¹, Mingshun Chen², Yunfeng Xu¹, Zhenqi Su¹, and Guihua Bai^{1,2}

¹Department of Agronomy; ²USDA-ARS, Hard Winter Wheat Genetics Research Unit

BACKGROUND AND PURPOSE: Wheat is a staple food crop worldwide and various insect pests cause significant yield losses to the crop every year. Among them, Hessian fly (*Mayetiola destructor*, HF) is a major destructive pest that reduces the yield up to 5-6% annually. To date, 36 HF resistance genes have been named. However, lack of diagnostic markers for these genes hampers their deployment in breeding. The goal of this study is to develop precise diagnostic markers for use in breeding programs and positional cloning of HF resistance gene *H34* in wheat. **METHOD:** *H34* was mapped on the short arm of chromosome 6B of a wheat cultivar Clark using an F₁₂ recombinant inbred line (RIL) population of Ning7840 x Clark. Further mapping using 90K Wheat SNP chips, identified markers to flank *H34* in 5.3 cM region. A cross was made between two RILs, RIL115-S and RIL118-R contrasting for *H34* alleles, and 286 F₃ lines were generated to identify heterogeneous inbred families (HIFs). **FINDINGS:** Fine mapping using the HIFs and SNPs, delimited *H34* in a 4.5 Mb interval. Genotype-by-sequencing (GBS) analysis of the four pairs of near-isogenic lines (NILs) from the selected HIFs identified additional SNPs and these SNPs were converted into Kompetitive Allele Specific PCR (KASP) markers that further narrowed the *H34* region to 670 kb. **CONCLUSION:** These flanking markers can be used in the marker-assisted selection in different wheat breeding programs. Moreover, development of these markers will reduce the cost of pesticides and other management control practices by bringing durable resistance against HF.

Relevance of Research to State-Related Topic(s)

The year 2020 is declared as “Year of plant health” by United Nations General Assembly. Also, FAO has estimated that annually, 40% of crop losses occurred due to insect pests and diseases. Wheat is one of the major food crops in Kansas and its yield has been crucially reduced due to Hessian fly every year. To overcome these losses, it is need of time to take stringent measures to deal with it which is often impossible to eradicate once they are established. Bringing genetic improvement and looking for insect resistance genes is the only durable and cost-effective strategy. I am working towards gene identification and development of tightly linked marker that can be used in breeding programs and positional cloning of this gene in wheat. So, I am very much excited to share the findings of my research with my peers on campus and with state legislators as well.

DISCONTINUOUS DIET ALTERS FITNESS AND FLIGHT BEHAVIOR OF HIPPODAMIA CONVERGENS (COLEOPTERA: COCCINELLIDAE)**Hannah E. Stowe¹, J.P. Michaud², and Tania Kim¹**¹*Department of Entomology;* ²*Department of Entomology, Agricultural Research Center – Hays*

BACKGROUND AND PURPOSE *Hippodamia convergens* is a native insect predator providing widespread biocontrol of aphids and other insect pests in the High Plains. Agricultural crops are subject to harvesting cycles and other disturbances such as drought and pesticide usage, creating landscapes with discontinuous resource availability for insect predators. These temporal discontinuities in agricultural landscapes can interfere with feeding and overall performance for these biocontrol agents. **METHODS** We examined the impact of pulsed (i.e., discontinuous) feeding schedules versus continuous resource provisioning on the reproduction and dispersal capacity of adult *H. convergens* beetles, using tethered flight as a proxy for dispersal before and after 18 reproductive days. Adults were provided two levels of access to prey over 48h periods: 12h (high access) or 6h (low access) either continuously or discontinuously over two days. Resource amount and continuity are likely to interact with greater impacts shown in treatments with less food and more discontinuity. **RESULTS** We found that fewer insects broke reproductive diapause on a discontinuous diet and both oviposition days and fecundity were reduced. Low food treatments show greater impacts of discontinuity than high food treatments in fecundity and oviposition days. Additionally, flight behavior was altered post-reproductive period both in reproductive and non-reproductive insects. **CONCLUSION** Negative effects of diet discontinuity at this small scale can indicate how resource availability gaps alter lady beetle population dynamics and ecosystem services in the wider agricultural landscape. Understanding how resource timing alters lady beetle performance can improve conservation strategies for land management and conservation biological control.

Relevance of Research to State-Related Topic(s)

This research is targeted towards understanding the agricultural ecosystem and how the variability in Kansas agriculture challenges insect pest control. Both amount and availability of food varies throughout the season for insect predators such as lady beetles causing significant barriers to development and movement and can impact biocontrol potential. Understanding resource gap effects in biocontrol agents enables land managers to make more informed plans to avoid pest outbreaks and provide sustainable biological control to regions without necessitating a complete overhaul of current practices. This could include altering cover crop timing to coincide better with period of resource scarcity or altering the mix of plants in marginal areas to bridge the resource gaps necessary for field crops. Crop field locations in the landscape could also be altered to better distribute resources across a region. These changes would be relatively minor but could increase the success of biocontrol in Kansas fields.

REGULATOR OF LEAF TRICHOME AND ROOT EPIDERMIS DEVELOPMENT IS CONTROLLED BY DEGRADATION IN PLANT CELLS

Bibek Subedi and Kathrin Schrick

Division of Biology

BACKGROUND AND PURPOSE: Leaf trichomes and the root epidermis play important roles in the protection of plants against abiotic stresses and pathogens. GLABRA2 (GL2) is one of the key regulators of epidermal development in plants. However, a mechanism to control the level of this protein remains largely unknown. In higher organisms, unwanted proteins are marked by molecular tags such as ubiquitin and these proteins are destined for degradation by the cell machinery known as the Ubiquitin-Proteasome System. The goal of this project is to identify and characterize modifications affecting the stability of GL2 protein. **METHOD:** Bioinformatics analysis of GL2 was performed to predict the amino acids representing modification sites in its structure. Candidate amino acids were mutated using molecular cloning tools and the phenotypes of the mutants were compared with those of wild type plants. Cycloheximide experiments were done to determine the GL2 protein half-life in wild-type and various mutants. **RESULTS/FINDINGS:** Use of bioinformatic tools revealed multiple ubiquitin conjugation sites within the dimerization domain of GL2. In mutants lacking this domain, the stability of the protein was enhanced, consistent with the hypothesis that this domain regulates protein degradation. Additionally, mutations of amino acids in the modification sites gave rise to abnormal curly leaf phenotype in plants. **CONCLUSION:** Taken together, degradation by the Ubiquitin-Proteasome System likely contributes to levels of GL2 protein in plants. Future studies will focus on characterization of various components of this degradation pathway. Outcomes of this work will provide valuable information to engineer agriculturally important plants for enhanced stress resistance and productivity.

Relevance of Research to State-Related Topic(s)

Increasing population growth, climate change and reduction in arable land has posed a major challenge in meeting the human calorific demands. Agriculture is the largest economic driver in Kansas which employs more than 254,000 people with agricultural export of nearly \$3.8 billion. As the “Wheat State” or “Breadbasket of the World”, Kansas needs more sophisticated ways of agriculture and crop production for its sustainable economy. The growth and yield of crops is negatively affected by various abiotic and biotic stress factors including drought, salinity, heavy metals, pests, and microbial pathogens. Thus, it is critical to dissect the molecular mechanisms underlying the plants’ response to environmental stimuli. Our results will provide new insight into the development of vital plant structures such as trichome, root hair, and seed coat that mediate the plant responses to stress factors. This will ultimately help the plant breeders to develop more resilient and high yielding cultivars.

EFFECTS OF SALINITY ON ENVIRONMENTALLY DRIVEN HALOTOLERANCE IN ROOT-ASSOCIATED ASCOMYCETES

Kyle Ismert and Ari Jumpponen

Division of Biology

BACKGROUND AND PURPOSE: Communities of species are known to differentiate across precipitation gradients, however whether or not individuals within the same species are similarly ecotypically selected remains uncertain, particularly for microbes. **METHOD:** In order to recognize environmentally driven adaptations of Ascomycota fungi to environmental conditions, we analyzed stress tolerance for five ascomycete species, with 6 unique individuals per species for a total of 30 individuals selected from sites that experienced up to two-fold differences in mean annual precipitation (MAP) across the central United States. Utilizing fungal isolates previously acquired from past research and from a multitude of locations differing in ranges of MAP were categorized as either arid (<600 mm MAP) or mesic (>600 mm MAP). We used quadrant Petri plates amended with sodium chloride (NaCl) at four concentrations (0g/L, 25g/L, 50g/L, 100g/L). Analyses of estimated NaCl concentrations that reduced the fungal growth by 50% (ED₅₀) indicated that, although the fungal isolates varied in their halotolerances, ecotypic adaptation to prevailing environmental conditions at the site of their origin was limited. **RESULTS AND CONCLUSION:** Our data suggest physiological plasticity in fungal populations adapted to environments with multiple potential stressors. Further experiments using conspecific isolates that vary significantly in their environmental tolerances to NaCl will aim to identify the underlying proteomic, genomic, and functional traits of hyaloidal stress tolerance in fungi.

Relevance of Research to State-related Topic(s)

Ecosystems worldwide are at risk of irreversible damages caused by the myriad of effects related to global warming. Global warming is resulting in an increase of extreme weather conditions such as drought. During drought conditions there is intense water loss from an ecosystem and as water leaves, salt ions concentrate. Therefore, our research is critical for comprehending and maintaining our ecosystems worldwide that we understand the effects of sodium stress on organisms.

DETECTION OF LONG-TERM GRASSLAND VEGETATION TRENDS FOR THE GREAT PLAINS ECOREGION USING TEMPORAL DECOMPOSITION AND SATELLITE-DERIVED VEGETATION INDICES

Hilda Onuoha and Shawn J.M. Hutchinson

Department of Geography and Geospatial Sciences

BACKGROUND: Grasslands cover approximately half of the terrestrial earth surface and provide a plethora of environmental benefits and ecosystem services. They have become one of the most changed biomes in the world, and therefore, proper monitoring and management of grasslands cannot be overemphasized. Vegetation indices time series dataset based on remote sensing is an effective tool to investigate large-scale vegetation change dynamics. **METHOD:** A time-series analysis of Moderate Resolution Imaging Spectrometer (MODIS) 16-day maximum value composite normalized difference vegetation index (NDVI), and Enhanced Vegetation (EVI) data (MOD13Q1 Collection 5) was performed to assess long-term trends in vegetation greenness across the Great Plains ecoregion of the United States. The Breaks for Additive Season and Trend (BFAST) decomposition method was applied to a time series of images from 2001-2017 to derive spatially-explicit estimates of gradual interannual change in grassland. **RESULTS:** Results show more 'greening' trends than 'browning' and 'no change' trends in the study area during the study period. Comparing the trend results from both vegetation indices implies that the EVI is more suitable for this analysis in the study area, especially in areas with high biomass. **CONCLUSION:** Patterns shown in the results will be the basis for the valuation of ecosystem services provided by grasslands in the region to demonstrate the influence of climate and other key regional anthropogenic factors such as fire, on shaping long-term vegetation dynamics.

Relevance of Research to State-Related Topic(s)

Grasslands are one of the most biodiverse and productive terrestrial biomes. They do provide very many benefits or ecosystem services (ES) as they are referred to. Grassland ES includes environmental regulating, social and cultural values, yet grasslands receive very low levels of protection. The temperate grasslands in the United States are one of the most threatened grassland ecosystems. Long-term studies on a major ecosystem are critical to achieving an integrated understanding of how components of ecosystems interact. Therefore, my research aims at using effective methods to assess the long-term trend of grasslands in the Greta Plains Ecoregion which contains the grasslands in The US and therefore very important for agriculture.

Group 2: Economics and Agricultural Economics

9

WHERE'S THE BEEF? THE COST OF TRACEABILITY

Hannah E. Shear¹, Dustin L. Pendell^{1,2}, Cassie K. Aherin¹, and Brad White²

¹*Department of Agricultural Economics*; ²*Beef Cattle Institute*

BACKGROUND AND PURPOSE: Livestock traceability has increasingly become a focus for the USDA, the National Cattlemen's Beef Association, high-volume beef-exporting states, and other beef industry stakeholders. Mitigating future disease outbreaks, as well as maintaining export markets through a positive international perception of U.S. beef has become a top priority. Implementing a national disease traceability program would enable the industry to track and reduce the potential losses due to an outbreak. However, such a system comes at a large cost, mainly to cow-calf producers. **METHOD:** This study utilizes a comprehensive industry budget and an equilibrium displacement model (EDM) to determine the impact of a traceability program within the U.S. The analysis allows for the estimation of costs to each segment of the beef industry. Utilizing the EDM allows us to provide a comparison of by how much the various beef sectors would be impacted by implementing a national disease traceability program. **RESULTS/FINDINGS:** It is determined that the economic cost of implementing a traceability program, like that of CattleTrace, will cost the industry \$154.9 million in the first year, with a total ten year cumulative cost of \$2.9 billion. The majority of these costs, 84%, are borne by cow-calf producers. This cost could be offset by changes in export demand (↑17.7%), domestic demand (↑1.9%), through the use of a government cost share program or some combination. **CONCLUSION:** The cost of establishing a traceability program in the United States could be offset by relatively small increases in domestic demand, export demand, and/or cost share programs.

Relevance of Research to State-Related Topic(s)

Agriculture, and most significantly livestock production is a key industry in Kansas. The beef cattle sector is the largest sector in Kansas agriculture, with cattle and calves generating \$8.27 billion cash receipts (in 2017). This accounted for more than 50% of Kansas agriculture cash receipts in 2017. Kansas also produces nearly 5.69 billion pounds of processed meat, which is nearly 11 percent of the United States total. The state's beef cattle industry employs nearly 34,000 Kansans. Beef and beef product exports from Kansas account for between 18 and 26% of total U.S. beef exports between 2015 and 2019. A disruption, in the form of a disease outbreak or even in the implementation of a traceability program, is of great concern to the producers in the state. Understanding the impact of such a policy is important to allowing the producers and industry stakeholders to prepare and make optimal decisions.

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HOW COST EFFECTIVE ARE GOVERNMENT GRANTS IN MANURE MANAGEMENT – A POLICY ANALYSIS OF AGSTAR, AN EPA PROGRAM

Emily Parker

Department of Agricultural Economics

BACKGROUND: The Environmental Protection Agency (EPA) estimated livestock manure management accounted for 14% of the total greenhouse gas emissions from the agriculture sector in the United States. The AgSTAR program was specifically created to address this issue. **PURPOSE:** The purpose of this analysis is to investigate the cost effectiveness of the EPA AgSTAR program using empirical evidence. **METHOD:** A novel data set was created, then a benchmark was used to evaluate and compare funded projects within the AgSTAR program. **FINDINGS:** On average, only 34% of the projects' capital costs were covered by government grants, and the funded projects required \$135 of government grants to reduce one metric ton of carbon dioxide equivalent per year. **CONCLUSION:** The benchmark used in this study can be used to evaluate and compare other government programs and private solutions aiming to reduce methane emissions.

Relevance of Research to State-Related Topic(s)

This study addresses alternative and sustainable energy sources as well as the improvement of water quality in communities focused on livestock production. The AgSTAR program assists livestock producers in securing government funding and operating anaerobic digestion technologies for manure management. This method of manure management increases the return to the farmer from the sale of methane and other biogases. It also reduces the chances of nutrient runoff in local water systems. Both are benefits to society. This study evaluates how cost effective the program is at providing these benefits.

DOES END GUN REMOVAL REDUCE WATER USE?

Micah Cameron-Harp and Nathan Hendricks

Department of Agricultural Economics

BACKGROUND AND PURPOSE: Programs designed to reduce water use via adoption of Water Conservation Technologies (WCTs) rarely achieve their objective. Instead, WCT adoption programs generally increase water withdrawals due to producer adaptations in irrigated acreage, irrigation intensity, or usage of water intensive crops. This adaptation is usually attributed to profit maximizing behavior by irrigators, but the dynamic nature of this process is not clear. This work examines an Agricultural Water Enhancement Program (AWEP) in Kansas to clarify producers' dynamic adjustment behavior. **METHOD:** We use a Difference-in-Differences approach to estimate the effect of the program by comparing participating irrigators with irrigators who did not remove end guns. Given its design, the program precludes the possibility of producers expanding irrigated acreage in response to the change in efficiency, allowing us to isolate the relative magnitude of the remaining two responses: increasing irrigation intensity and switching to water-intensive crops. **RESULTS/FINDINGS:** Overall, we find an increase in irrigation intensity for AWEP participants, meaning they apply more water per acre independent of crop choice. When examining producers' dynamic adjustment to removing end guns, we find producers initially reduce water use in the year following end gun removal, but then increase water use each year during the following four years. **CONCLUSION:** Our work highlights the importance of planning for producer adjustments in programs designed to encourage adoption of efficient, or removal of inefficient, irrigation technologies. We demonstrate this AWEP program achieved its intended goal temporarily, but failed to solidify these results in subsequent years.

Relevance of Research to State-Related Topic(s)

This work concerns the conservation of one of Kansas' most precious resources, water. Our work indicates that programs intended to reduce water use through changes to irrigation technologies work under narrow conditions. Additionally, we demonstrate producers will adjust to the change in technology over time in such a way as to maximize profits, not water conservation. This knowledge of their adaptation over time can help guide future programs intended to reduce water use without comprising producers' economic viability. Our work demonstrates a crucial factor is aligning the profit maximization goal with that of water conservation, and to consider how this goal changes behavior over time.

GROUNDWATER PERMIT TRADING AND POTENTIAL GROUNDWATER SAVING IN KANSAS

Sang Su Ha and Gabriel Sampson
Department of Agricultural Economics

BACKGROUND AND PURPOSE: Nearly 76.5% of farms rely on groundwater in Kansas. In spite of its critical importance for irrigated farming, the current trending of overdraft on groundwater is leading to around 70% of HPA depletion within 50 years. The Kansas State government has recognized groundwater depletion as a serious potential threat to the Kansas future economy and has introduced and continued to amend groundwater laws for groundwater management. Local Enhanced Management Areas (LEMA) was launched as a result of this change in thought in 2012. Under the LEMA, Groundwater users had to reduce 20 % of total usage but were able to use it flexibly for five years as one period. These innovative water regulations have some obstacles to deploy across Kansas due to legal, political, and user risks. First of all, the reduction order in groundwater use may constitute an uncompensated intervention under the 5th and 14th Amendments of the U.S. Constitution. Then, Kansas State may have to recompense groundwater users for property infringement. Groundwater permit trading can provide economic incentives and stimulate voluntary participation for groundwater management. **METHOD:** Groundwater permit trading was only possible within scenario areas but not between other regions. The estimated income of 24064 irrigation wells could be calculated, and the well-formed cost data were able to calculate the net profit for each specific groundwater use. **RESULT AND CONCLUSION:** Cap and Trade method reduced the amount of groundwater use by each scenario without profit loss of irrigation well.

Relevance of Research to State-related Topic(s)

Sheridan County 6 LEMA was also a small part of the GMD4. These innovative water regulations have some obstacles to deploy across Kansas due to legal, political, and user risks. First, the reduction order in groundwater use may constitute an uncompensated intervention under the 5th and 14th Amendments of the U.S. Constitution. Then, Kansas State may have to recompense groundwater users for property infringement. Second, the Chief Engineer of DWR can only execute the impairment investigation when water rights holders request it, and no active role is required to protect the HPA. As major irrigators have decision-making powers within GMDs, the Chief Engineer has no reason to make political conflict with them. Third, requesting an impairment investigation by one water right holder could lead to the reduction of neighbor permit holder's groundwater use. Groundwater permit trading by voluntary participation can be an alternative to dealing with these obstacles.

GENERAL TRADE POLICY UNCERTAINTY AND U.S. TRADE FLOWS

Tian Liu, Leilei Shen, and Peri da Silva

Department of Economics

BACKGROUND AND PURPOSE: The spectacular increase in the world exports (12.9% to 28.7% of world GDP) in the last 50 years was made possible due to the presence of a rules-based international trade system sponsored by the General Agreements on Tariffs and Trade (GATT) and its successor agreement, the World Trade Organization (WTO). In the last decade, however, there has been a substantial increase in US trade policy uncertainty (TPU) towards US allies and other WTO members. This shift in policy has further undermined the WTO efforts to transform all trade barriers into tariffs (tariffication approach). It is then imperative to better understand how TPU affects trade flows. **METHOD:** We use a text-mining approach to construct a general index of US TPU at the bilateral (140 trading partners) and industry levels (2-digit of the Harmonized System) using newspaper articles from 2001 to 2017. It enables us to control for uncertainty related to the use of highly-regulated tariff barriers under the WTO, temporary trade barriers (TTB), export restrictions, and potential reinterpretations of trade-related national security concerns, among others. **RESULTS/FINDINGS:** One standard deviation increase in TPU decreases U.S. imports by 1.2 percent and reduces US exports to those countries with large market powers by 2.15 percent. We also find that the effects of TPU are mitigated by the formation of preferential trade arrangements. **CONCLUSION:** Our findings show that TPU is an important determinant of trade, which has implications in a range of policy spaces, such as firms' decision to export, productivity and labor market outcomes.

Relevance of Research to State-Related Topic(s)

Kansas goods exports have increased by 12 percent between 2006 and 2016 and 354,400 Kansas jobs are supported by international trade, including exports and imports in 2016 (Business Roundtable, 2019). In addition, according to the Office of the United States Trade Representative, there is \$11.6 billion of Made-in-America goods exported to the world from Kansas in 2018 and these exports accounted for 6.9 percent of Kansas GDP. Using back-of-the-envelope estimates from our paper, a one standard deviation increase in TPU decreases Kansas exports by 2.15 percentage points, or \$249 million dollars and decreases total trade in Kansas by 3.35 percentage points. This translates into a loss of 18% reduction in export growth and 20% reduction in the number of new jobs in trade-related industries in Kansas.

THE ROLE OF PHOTOS TO ATTRACT MORE GUESTS FOR LOCAL COMMUNITY**Juhwan Lim** and Jichul Jang*Department of Hospitality Management*

BACKGROUND AND PURPOSE: Airbnb, a peer-to-peer accommodation sharing platform, contributes to local communities' development by attracting visitors and enhancing communities' image. In the United States, the estimated direct economic impact of Airbnb on local communities was \$34 billion in 2018. Nevertheless, the Kansas State could not fully take this financial benefit due to the inactive Airbnb business. While attracting more Airbnb guests is the key to activate Airbnb business, guests focus on Airbnb's photos due to the intangible and experiential nature of Airbnb. The purpose of this study is to analyze the way of presenting photos regarding booking intention in the Airbnb context. **METHOD:** We recruited 256 participants from Amazon Mechanical Turk. During the experiment, participants were asked to see a series of Airbnb photos and evaluate their booking intention. **RESULTS:** The results showed that a higher number of photos, organized photos, and congruent first photo with a headline increase customers' booking intention. **CONCLUSION:** The findings of this study provide Airbnb hosts a practical and effective way of presenting photos to captivate travelers by making the best use of their photos. A higher booking intention would encourage more travelers to visit the State and consume products and services, which provides economic benefits with local businesses. Moreover, increased consumption would create more job opportunities in the hospitality and tourism sectors. Eventually, an increased number of Airbnb guests could contribute to the local economy and employment in the long term.

Relevance of Research to State-Related Topic(s)

The previous studies show Airbnb has a significant impact on local community development. Visitors who stay at Airbnb properties contribute to the local economy and employment by spending their money in the local community. In 2008, the estimated economic benefits of Airbnb on local communities in the United States was \$34 billion. However, the Kansas State has enjoyed relatively fewer benefits due to a lower number of Airbnb properties. This research suggests the way to vitalize the Airbnb business using the format of photos. The proposed format of photos would encourage more travelers to visit and then consume more products and services in the travel sector contributing more than \$11 billion and 96,000 jobs in the Kansas economy. The increased consumption is expected to provide economic benefits and employment opportunities with local businesses. Ultimately, Airbnb's invigoration would contribute to the development of local communities in the Kansas State.

**THE EFFECTIVENESS OF VIRTUAL GRADUATE RECRUITMENT PROGRAMS
FOR 1890 STUDENTS TO 1862 INSTITUTIONS**

Raymond Thomas¹, Zelia Wiley², and Lonnie Hobbs Jr.³

College of Agriculture Diversity Programs Office

BACKGROUND: The number of multicultural students pursuing higher education in agriculture has increased in recent years; yet, it is incomparable to the other land grant institutions (FAEIS, 2018). Most Blacks receive undergraduate degrees in agriculture from 1890 land grant institutions in the South. Several of these institutions do not offer graduate degrees in agriculture; yet, most have limited degree offerings and low enrollments in the agricultural sciences. To increase the number of multicultural students into graduate programs, Kansas State Research and Extension (KSRE) started the multicultural fellowship program in 2006. This program enables rising 1890 institutions juniors and seniors in agriculture to participate in the KSRE summer research program to conduct summer research with a mentor. Most importantly, this program's goal is diversifying the academic workplace. In 2020, due to the current COVID-19 pandemic, the program was held virtually in order to protect the health and safety of the students and faculty. Through the use of platforms Zoom and Microsoft Teams, the fellows participated in research with their mentors and took part in series of academic and professional development seminars during the eight-week program. **METHODS:** This research compares the pretest, posttest, and overall program evaluation results from the 2020 and 2019 programs in order to gauge the effectiveness of the virtual setting in achieving the program goals. **RESULTS** The results show that there was no large difference in the average results program evaluations between the 2019 and 2020 program years. **CONCLUSION** This suggest that the program was still effective despite the virtual setting.

Relevance of Research to State-Related Topic(s)

As a result of the recent developments in the realm of social justice taking place this year, many organizations, both professional and academic, are understanding the value and importance of diversity and inclusion. Creating an environment that is welcoming to all can help the productivity gaining knowledge from outside perspectives. The goal of the KSRE program is to encourage the recruitment of minority students to Kansas State graduate programs which will contribute to the diversification of the student population. This will also contribute to exposing minority students to educational opportunities in agriculture science related fields. Evaluating the effectiveness of programs such as KSRE can provide the graduate school at K-State with useful information on how to appeal to multicultural student demographics when recruiting students.

**RISK PERCEPTION AND SELF-EFFICACY FOR COMMUNICABLE DISEASES
AMONG AFRICAN IMMIGRANTS IN THE UNITED STATES**Nancy Muturi and **Barikisu Issaka***A.Q. Miller School of Journalism and Mass Communication*

BACKGROUND AND PURPOSE: Immigrant populations are the most vulnerable to communicable diseases among ethnic minorities globally due to the poor physical, psychological, and social health outcomes and insufficient health care. In the U.S., studies show that Black immigrants are disproportionately impacted compared to immigrants of other races including Asians and Latinos. African immigrants are a comparatively smaller demographic of Blacks in the U.S., but they experience a high burden of communicable diseases including HIV, Hepatitis, Meningitis, and Tuberculosis. Although communication plays a key role in enhancing knowledge, health literacy and motivation for prevention, limited research exists that focus on understanding the risk factors or vulnerabilities for African immigrants. The goal of this study was to identify their level of risk perception, vulnerabilities, and self-efficacy in relation to media use and other communication-related factors through the lens of the protection motivation theory. **METHOD:** Data were gathered through an online survey that was distributed through social media platforms. **RESULTS:** There is a correlation between perceived risk of communicable diseases and vulnerability ($r=.542$) and with media use ($r=.357$). Prior health behavior is correlated with self-efficacy and their comfort level in discussing communicable diseases. Although participants had a moderate level of health literacy ($M=3.81$, $SD=.827$) and higher self-efficacy ($M=4.06$, $SD=.688$), they did not perceive the media highly as useful source of health information ($M=2.70$, $SD=.858$). **CONCLUSION:** With the spread of COVID-19, it is crucial to understand factors that contribute to health disparities and prevention strategies for communicable disease that are appropriate for diverse populations.

Relevance of Research to State-Related Topic(s)

The State of Kansas has many black immigrants many of who are refugees, students, military personnel, or other professionals. Knowledge of the motivation and health seeking information by African immigrants will help the state to develop communication strategies that meet the needs of this particular group. This will also help reduce African immigrant mortality rate due to communicable diseases which stems from lack of access to health communication and messages. This is particularly important in the prevention of COVID-19 which has disproportionately impacted ethnic minorities. A reduction in mortality rate through effective communication will not only increase labor force within the state but also ease the prevention and treatment costs.

DOES CAMPUS BIODIVERSITY MATTER FOR STUDENTS' PSYCHOLOGICAL WELLBEING?

Jaeyoung Ha

Department of Landscape Architecture and Regional Planning,

BACKGROUND AND PURPOSE: Many previous studies find that there is a positive association between campus green space and psychological wellbeing among students. However, few attempts have been made in exploring the association with biodiversity in green space. **Purpose:** This study investigates how two different levels of biodiversity (Low biodiversity, High biodiversity) in the campus environment are related to the student's attention restoration and psychological wellbeing. **METHOD:** 2x2 factorial design experimental research was conducted to examine the effect of biodiversity in green space on psychological wellbeing. Participants are randomly assigned to one of the two different environments (Low/High biodiversity) with sound and no sound by using Virtual Reality (VR) simulation for five minutes. One is a place with high biodiversity environment, consisting of native tall grasses and meadow plants with sound and no sound. The other is a place with low biodiversity environment with sound and no sound, comprising simple lawn yards. The survey was conducted to measure perceived restorative attention and psychological wellbeing. **RESULTS/FINDINGS:** The result shows that students with high biodiversity environment had a higher restorative effect and psychological wellbeing, compared to those not, but the nature sound can amplify psychological effectiveness. **CONCLUSION:** The result suggests that high biodiversity in the campus environment has a better effect on attention restoration and psychological wellbeing, but nature sound is also important with visual effects. Campus planners should consider planning and designing a healthier green environment for the better mental wellbeing of students.

Relevance of Research to State-Related Topic(s)

The number of college students in Kansas struggled with mental health problems such as anxiety and depression has been increased. Due to the pandemic, it is likely to worsen this situation since quarantine and social distancing. To deal with this problem, many universities offer counseling services for students. However, the cost and demand for these services have been skyrocketing. A small but growing study has been interested in the importance of campus environments on mental health of students. Many studies claim that green spaces in the campus play a significant role in improving mental health and psychological wellbeing. But, a little attempt has been made in how the design and planning of campus green space are associated with wellbeing of students. With this study, policymakers in Kansas state could provide campus planners with a guideline for the prevention of mental health.

THE IMPACT OF RURAL RECREATION WITHIN KANSAS

Sarah Jackson, Rachel Shively, Ryan Sharp, Jessica Fefer, Michael Brunson, Amy Nickel,
Dylan Doebelin, Julianna Rogowski, Cait Henry, and Brian Peterson
Department of Horticulture and Natural Resources

BACKGROUND AND PURPOSE: Cimarron National Grassland (CNG) is a rural protected area in southwestern Kansas of over 108,000 acres. The open range of public land that encompasses CNG provides an expansive area for visitors to experience. Specifically, CNG offers rural residents access to recreation experiences on public lands (Kansas is less than 2% public land). As an example, visitor numbers are higher during the fall at CNG when in- and out-of-state hunting is prominent. This research aims to examine the impact that rural recreational opportunities can have for visitors by classifying visitor use and better understanding the diverse impact of public land. **METHOD:** To assess the classification of recreational opportunities, human behavior cameras (i.e., trail cameras) and visitor counters were utilized at CNG. Data collection began in Fall 2018 and is ongoing to assess the outcomes of experiencing a rural recreational resource. Using a combination of photo analysis and counter evaluation software, we assessed the existing patterns and the resulting experiences. **RESULTS/FINDINGS:** Based on the research objective, this study is determining recreation type and frequency. Specifically, we have found a higher rate of hunting within the fall in addition to other recreational activities annually (e.g., hiking, ATV/ORV use, and horseback riding). **CONCLUSION:** Overall, this research conveys the significance that accessibility to recreation experiences can have within rural locations. CNG is a resource that provides visitors with impactful experiences and highlights public land significance for recreation within the lives of not only rural residents, but all Kansans as well.

Relevance of Research to State-Related Topic(s)

Within Kansas, the prominence of private land influences the accessibility individuals have to recreation experiences. With approximately 2% of Kansas being designated as public land, protected areas reflect the reduced level of recreation and public resources that are available for individuals to experience. This is especially relevant when considering those that reside in remote locations where a significant portion of private land is present. Cimarron National Grassland (CNG) is a primary example of the impact that public and protected areas can have by providing tourism opportunities for those from outside the area. Additionally, CNG provides an area to recreate for those that live in surrounding communities. As a result, more funds are introduced into the local community and visitors are able to benefit from the time outdoors.

UTILIZATION OF THE CASPER SURVEY TOOL IN RILEY COUNTY, KANSAS**Jason DeFisher¹** and Ellyn R. Mulcahy^{1,2}*Master of Public Health Program¹; Department of Diagnostic Medicine and Pathobiology²*

BACKGROUND AND PURPOSE: The Community Assessment for Public Health Emergency Response (CASPER) toolkit was created by the Centers for Disease Control (CDC) in the 2009. CASPER surveys begin by selecting thirty clusters such as neighborhoods or census tracts within the survey area at random. Once clusters are selected, seven random households are selected to be surveyed within each cluster. While the toolkit was originally designed to assess community health needs after a disaster, the CASPER survey method has been adapted as a method of gathering community health data quickly even in the absence of a disaster. **METHOD:** This public health practice project involved the creation of a protocol to use the CASPER toolkit in Riley County, Kansas. The CASPER toolkit was reviewed and supplementary documentation was developed to streamline the process of completing a CASPER. The supplementary documents include templates for the final report, contact lists for additional support, and guides explaining the tools that the Riley County Health Department plans to use. These documents are intended to create a faster and more simplified CASPER process. **CONCLUSION:** The students anticipate that future CASPER surveys within Riley County may be conducted and published within one to two months. Should the established process and documentation succeed in creating a streamlined CASPER protocol, other counties as well as the Kansas Department of Health and Environment would be able to adapt the templates and protocol for future use within Kansas.

Relevance of Research to State-Related Topic(s)

Despite the CASPER toolkit existing since 2009, Kansas has published only one CASPER report. The CASPER process is designed to quickly gather health data that represents the community that is surveyed and may help to guide health policy decisions in the future. CASPER surveys may be conducted even in the absence of an emergency event, such as to inform a community health improvement plan. With data quickly collected by a CASPER survey, community health could be improved more rapidly by identifying needs and implementing policy changes.

PUBLIC HEALTH PRACTICE IN KANSAS**Megan Eppler¹**, Kayla Brock¹, and Ellyn R. Mulcahy^{1,2}*Master of Public Health Program¹; Department of Diagnostic Medicine and Pathobiology²*

BACKGROUND AND PURPOSE: To determine the scope of public health practice in the state of Kansas, local public health practitioners were asked about their contributions to public health in their communities. In the media, the role of public health is poorly and inaccurately communicated to the public. Often, public health efforts are only recognized on a national scale. Interviewing local public health practitioners in Kansas demonstrated their contributions to public health, which may be more tangible to the public and other audiences. These interviews will be utilized to write a narrative to communicate the journeys, concerns, and beliefs from the public health perspective. **METHOD:** To date eight public health practitioners have been interviewed about their contributions to public health and the community they serve. Practitioners were asked about their biggest perceived barrier to public health, and if their communication methods were based on strategies for diverse audiences. **RESULTS/FINDINGS:** The eight public health practitioners believed public health education should begin earlier in the educational system. Additionally, the eight practitioners perceived a lack of public knowledge about public health programs, public health funding deficits in certain communities, and what public health was as a profession.

Relevance of Research to State-Related Topic(s)

During the COVID-19 pandemic, public health practitioners are spread thin in their areas of focus, with variable amounts of funding to cover existing or new programs needed to aid their communities. Different public health branches offer several programs designed to provide communities with accessible health care and food. Community members are unaware of these programs because of a lapse in communication between individuals in need, public health practitioners, and local community leaders. Greater communication and education is needed to facilitate the work of public health practitioners to ensure the services provided are utilized to the fullest extent in their communities.

**DATA-DRIVEN STORIES OF OPPORTUNITY: DEVELOPMENT OF A
COMPREHENSIVE COMMUNICATION PLAN FOR THE RILEY COUNTY
OPPORTUNITY MAP**

Jeremy C. Williams and Ellyn R. Mulcahy

Master of Public Health Program

BACKGROUND AND PURPOSE: Public health researchers have long been convinced of the impact of social and economic structures on health. Differences in these social determinants of health lead to many of the health disparities that impact Kansas communities. Realizing the need to highlight these disparities, in an easy to understand manner, the Flint Hills Wellness Coalition developed the Riley County Opportunity Map. This tool allows health disparities, between various census tracts in Riley county, to be visualized geographically. The purpose of this work was the development and implementation of a comprehensive communication plan that would provide relevant stakeholders access to and training about the Riley County Opportunity Map. **METHOD:** A comprehensive communication plan was developed drawing on theoretical frameworks and strategies drawn from both the communications studies and public health disciplines. The plan took into account the current limitations and challenges presented by the SARS-CoV-2 pandemic by utilizing virtual/interactive training sessions and social media tools. **RESULTS/FINDINGS:** The Riley County Opportunity Map was launched towards the conclusion of this project and is currently being utilized within target communities. Several virtual training sessions were conducted, with additional sessions scheduled. Information contained within the Riley County Opportunity Map can be utilized to bring-to-light health disparities between Riley county communities and motivate stakeholders and policymakers toward meaningful change.

Relevance of Research to State-Related Topic(s)

The ability to disseminate and effectively communicate relevant public health information is paramount in today's world. No greater testament to this exists than the current SARS-CoV-2 pandemic. The ability of Kansas public health practitioners to develop and implement comprehensive communication plans that strategically target stakeholders and provoke meaningful action is an inroad to real change. These comprehensive communication plans must be dynamic and easily tailored to audiences whom themselves have goals of their own. Additionally, communication plans must consider the preferences, in terms of technology or platforms, and learning styles of target audiences. Kansas communities each face different public health challenges and the ability of Kansas public health practitioners to effect change within each of these communities depends on their ability to tailor their messages appropriately. In a time when the public is awash in misinformation and plagued with distrust, the ability to be heard through the din becomes dire.

DETERMINING SWINE ENTERIC MICROBIOME FUNCTIONS FOR OPTIMIZED NUTRIENT UTILIZATION, GROWTH, AND HEALTH

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¹*Division of Biology;* ²*Department of Diagnostic Medicine/Pathobiology;*

³*Department of Animal Sciences and Industry*

BACKGROUND AND PURPOSE: Animal health and production play critical roles in the sustainability and competitiveness of Kansas agriculture. However, the underlying microbial communities and their associated functions, which harbor lifelong health and growth implications, are not fully understood. Improvements in swine production can be implemented through a better understanding of the critical biological and physiological mechanisms underlying nutrition, growth, and health. This study elucidated the functions of the swine enteric microbiome to build upon previous swine microbiome studies where functional and longitudinal, over swine stages of production (pre-weaning and nursery), analyses were lacking. **METHODS:** Fecal samples from seven pigs were collected during the pre-weaning and nursery stages. We extracted microbial DNA, performed shotgun sequencing, assigned microbial taxa through Kaiju, and annotated carbohydrate utilization genes in Paladin. **RESULTS/FINDINGS:** There were distinct differences in both microbial community structure and function between the pre-weaning and nursery pigs. In pre-weaning pigs, Bacteroidetes was prevalent alongside starch digestion genes. Once the pigs were weaned, Firmicutes became the most prevalent taxa. Microbial function in nursery pigs also shifted towards DNA repair through a DNA glycosylase enzyme. **CONCLUSION:** Microbial population and functional distinctions were found between two production stages of swine. These shifts are likely the result of dietary changes and weaning stress. A greater understanding and application of microbiomes would improve swine host health, growth and welfare which impact overall profitability.

Relevance of Research to State-Related Topic(s)

Kansas' swine industry is a large sector which produced \$467 million of pork in 2017 alone while supporting crop farmers; these herds consumed over \$162 million in grain sorghum, corn and soybean meal the same year. The swine industry is continuously looking for improvements to herd health, productivity, and animal welfare. The swine microbiome is a promising research topic which could lead to novel diagnostics for pathogens and health indicators, altered diets for optimized nutrient utilization, and effective alternatives to antibiotics. While the majority of microbiome research studies microbial species, the functions these microbes perform is often overlooked. This study illustrates how microbiomes change functionality throughout the lifetime of production swine. Microbial functions provide further clarification of how the microbiome interacts with and plays roles for the host. Future research will involve building upon and applying this longitudinal, functional microbiome knowledge to improve swine health and welfare.

A MODIFIED LIVE PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME VIRUS VACCINE INFLUENCES THE GUT MICROBIOME IN NURSERY PIGS

Pratiksha Khanal, Laura A. Constance, and Megan C. Niederwerder

Department of Diagnostic Medicine/Pathobiology

BACKGROUND AND PURPOSE: Porcine reproductive and respiratory syndrome virus (PRRSV) causes the most costly disease of swine production in the United States, resulting in approximately \$664 million of annual losses. Although PRRS modified live virus (MLV) vaccines are widely utilized to reduce PRRS-associated losses, the currently available vaccines are considered inadequate for disease control. Recently, the gut microbiome has been associated with vaccine efficacy and health outcomes following PRRSV infection in pigs. The objective of the current study was to investigate the effects of PRRS MLV vaccination on the gut microbiome composition and diversity of nursery pigs. **METHODS:** Weaned pigs (average age: 23.4 ± 2.1 days) obtained from a single commercial source were equally divided into two groups: vaccine and non-vaccine groups (n=12/group). The vaccine group was immunized with a commercial PRRS MLV vaccine (Ingelvac PRRS MLV; Boehringer Ingelheim Animal Health). Fecal samples were collected from both groups at 28 days post-vaccination. Gut microbiomes were compared between groups using the Lawrence Livermore Microbial Detection Array. **RESULTS/FINDINGS:** Vaccination with PRRS MLV vaccine significantly increased microbial species diversity and the Firmicutes to Bacteroidetes ratio. Significant differences were also noted in microbiome composition at the phylum, family and species level. Specifically, *Enterobacteriaceae* family was detected at a significantly higher rate in vaccinated pigs compared to nonvaccinated pigs (p=0.03; Fisher's exact test). **CONCLUSION:** These results show an association of PRRS MLV vaccination with changes in gut microbiome composition and diversity, suggesting infection with this vaccine virus modulates the gut microbiome and that certain microbiome characteristics may contribute to vaccine efficacy.

Relevance of Research to State-Related Topic(s)

As per pig inventory, Kansas ranks tenth in the nation and produces about 2.7 percent of the nation's total pork. In 2019, Kansas producers sold approximately 3.7 million pigs with gross market value totaling around \$500 million. Moreover, the Kansas pork industry supports state agriculture by utilizing Kansas-grown grains, which benefit the Kansas economy. Porcine reproductive and respiratory syndrome (PRRS) is the costliest swine disease endemic to the United States, including many Kansas farms, and results in approximately \$664 million in annual losses to the U.S. swine industry. The gut microbiome is a novel tool associated with vaccine efficacy and health outcomes following PRRSV infection in pigs. By characterizing the gut microbiome of nursery pigs after PRRS vaccination, there is an opportunity to identify microbes which may increase vaccine efficacy and help improve the health of Kansas swine herds suffering from the effects of PRRS.

SKIN BLOOD VESSEL RESPONSES FOLLOWING 5-FLUOROURACIL CHEMOTHERAPY ADMINISTRATION

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BACKGROUND: 5-Fluorouracil (5-FU) chemotherapy is associated with the second highest rate of cardiovascular toxicity among cancer chemotherapies, and is generally manifested through the occurrence of chest pain, ECG abnormalities, and in severe cases, heart failure or death. Despite this, the mechanisms by which these toxicities occur are not well understood; however, alterations in blood vessel function have been implicated and are a known precursor to similar adverse cardiovascular events in other populations. As such, non-invasive measurements of the small blood vessels of the skin may provide insight, as others have demonstrated skin microvascular health is reflective of that of the coronary circulation. We tested the hypothesis that cancer patients treated with 5-FU would exhibit impairments in skin microvascular function following administration of acetylcholine (ACh) and localized heating when compared to age matched controls. **METHODS:** Seventeen 5-FU patients (5-FU) and fifteen controls (CON) were recruited for this study. Baseline to peak vasodilatory responses following both localized heating and administration of acetylcholine (ACh) were calculated to assess skin microvascular function of the right forearm using Laser Doppler flowmetry. **RESULTS:** 5-FU exhibited a significant reduction in the vasodilatory response to localized heating (257 ± 227 %) compared to CON (662 ± 445 %) ($p = .009$) whereas no differences were present in response to ACh (5-FU 842 ± 464 %; CON 920 ± 416 %) ($p = .621$). **DISCUSSION:** To date, our findings suggest 5-FU induces alterations in skin blood vessel function, perhaps, through mechanisms involving endothelial nitric oxide production.

Relevance of Research to State-Related Topic(s)

For the year 2020, the American Cancer Society estimates colorectal cancer to have the 4th highest rate of new diagnoses and lead to the 2nd most deaths of all cancer subtypes in the state of Kansas. 5-Fluorouracil (5-FU), a chemotherapy used as primary treatment for colorectal cancer, is regularly credited with improved survival rates in this population, yet, its use is also associated with adverse cardiovascular side effects which can result in decreased efficacy of treatment. Thus, through collaboration with the Cotton O'Neil Cancer Center (Topeka, KS), the aim of our research is to better understand the mechanisms by which these cardiovascular toxicities occur, in hopes that greater insight can be provided to both clinicians and patients for early detection and prevention of 5-FU induced cardiotoxicity.

HIGH-INTENSITY TRAINING AND PROSTATE CANCER-INDUCED CARDIAC ATROPHY Dryden R. Baumfalk¹, Alexander B. Opoku-Acheampong¹, Jacob T. Caldwell¹, Carl J. Ade^{1,2}, Steven W. Copp¹, Timothy I. Musch^{1,3}, and Bradley J. Behnke^{1,2}
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Background: Prostate cancer is the most common type of non-skin cancer found in men with ~175,000 estimated diagnoses in 2020. Recent evidence suggests prostate cancer independent of treatment has atrophic effects on cardiac mass associated with fatigue. We tested the hypothesis that high-intensity exercise training will mitigate prostate cancer-induced cardiac atrophy and improve LV function versus sedentary tumor-bearing counterparts. **Methods:** Dunning R-3327 prostate cancer cells were injected in the prostate of 5-6-month-old male Copenhagen rats (n=24), and randomized into 2 groups, tumor-bearing exercise (TBEX, n=15) or tumor bearing sedentary (TBS, n=9). Five days after surgery, TBEX animals began exercise on a treadmill at 25m/min with a 15° incline for 45-60 min/day for 18±2 days. Pre-surgery (Pre), and post-exercise training (Post) animals underwent echocardiographic imaging for assessment of morphological changes. Markers of protein degradation were semi-quantified via Western Blot. **Results:** There were no significant differences in tumor mass between groups (TBEX 3.4±0.7g, TBS 2.8±0.6g, p=0.31). Heart-to-body mass ratio was lower in TBS group compared to TBEX (2.3±0.1mg/g, 2.6±0.1mg/g, p<0.05). LV-to-body mass ratio was also lower in the TBS group (1.6±0.1mg/g, 1.8±0.1mg/g, p<0.05). From Pre-Post, TBEX had significant increases in SV (0.63±0.04ml, 0.77±0.05ml, p=0.03) while TBS had no significant difference (0.68±0.02ml, 0.65±0.05ml, p=0.46). **Conclusion:** This study suggests that high-intensity exercise can improve LV function and increase LV mass concurrent with prostate cancer development, versus sedentary counterparts. Given cardiac dysfunction often manifests with conventional anti-cancer treatments, a short-term high-intensity training program, prior to treatment, may improve cardiac function and fatigue resistance in cancer patients.

Relevance of Research to State-Related Topic(s)

Recently cancer overtook heart disease as the leading cause of death in the US, and with an incidence rate, and death rate in the top 20 of all states, this is an area of major concern for Kansans. Prostate cancer is the most common type of non-skin cancer found in men making it a target of research today. Cancer is deadly, but aside from itself, the most common cause of non-cancer related deaths in cancer patients is heart disease. Heart disease is often attributed to cancer therapy regimes called cardiotoxicity. Given cancer-related fatigue or cardiovascular abnormalities can compromise the completion of anti-cancer treatment regimes, it is clinically important to understand how cancer affects determinants of exercise capacity (e.g., cardiac mass and function and skeletal muscle mass).

CHARACTERIZING THE COMBINATORY ANTI-MELANOMA POTENTIAL OF ZINC OXIDE NANOPARTICLE AND ITS PHYSIOMETACOMPOSITES WITH LL-37 PEPTIDE

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BACKGROUND: Physiologically based zinc oxide nanoparticle (ZnO NP) has been shown to be selectively toxic to B16F10 mouse melanoma cells. LL-37 is the only cathelicidin-derived AMP found in humans. In addition to its antimicrobial activity against bacteria, virus, fungi and parasites, LL-37 also has intrinsic anticancer activity. LL-37 is currently in clinical trials against melanoma. However, the combinatory anti-melanoma potential of ZnO NP and its physiometacomposite (PMC) nanoparticles with LL-37 has never been investigated. **METHODS:** Using the Malvern Zetasizer Nano Range Dynamic Light Scattering, the interaction between LL-37 with ZnO NP and its PMCs was assessed in terms of change in zeta potential. The binding parameters of LL-37 to ZnO NP were investigated by BCA assay. SDS-PAGE was used to visualize the interaction of ZnO NP with LL-37. Anticancer activity of ZnO NP and its PMCs in combination with LL-37 was assessed in B16F10 mouse melanoma cells using MTT assay. **RESULTS/FINDINGS:** Zeta potential measurements of ZnO NP and its PMCs showed changes in the presence of LL-37 suggestive of surface interaction. Payload of LL-37 on NP surface was estimated to be 200 µg per mg of ZnO NP using BCA assay. SDS-PAGE analysis of LL-37 combined with ZnO NP further demonstrated their interaction. Anti-melanoma activity of ZnO NP and its PMCs was enhanced in the presence of LL-37. This was found to be highly dependent on the concentration of the NP used as well as the duration of exposure. **CONCLUSION:** Combination of LL-37 with ZnO NP and its PMCs demonstrated enhanced their anti-melanoma activity which was found to be concentration-dependent and time-dependent which needs to be evaluated *in vivo*.

Relevance of Research to State-Related Topic(s)

Malignant melanoma is the most lethal form of skin cancer which becomes extremely dangerous upon metastasis, which means spreading to other organs in the body. Approximately, 2.3% of the population is estimated to be diagnosed with melanoma during their lifetime. Among the different stages of melanoma, the late stage or metastatic melanoma has the lowest five-year survival rate of 24.8%. The incidence rate of melanoma in Kansas is 26.6 which is higher than the national average of 22.3. Melanoma incidence has been following a rising trend of 2.7% through 2013-2017 with a death rate of 2.8%. Even though surgical removal increases survival in the initial stages, it is not enough to treat metastatic melanoma. Despite the advent of novel therapies along with the conventional treatments, mortality due to cancer is still not under control. This demands the persistent search for better treatment options, both in terms of safety and efficacy.

IDENTIFYING ENZYMES LIMITING AN EFFECTIVE RNAI RESPONSE IN THE BITING MIDGE *CULICOIDES SONORENSIS*

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BACKGROUND AND PURPOSE: The biting midge *Culicoides sonorensis* is a nuisance insect pest and a disease vector of livestock viruses in the United States. The impact of this midge on livestock herds causes substantial economic damage to producers annually. Conventional insecticides show limited success in controlling both the abundance of these insects and the spread of disease on livestock operations. RNA interference (RNAi) has the potential to provide a highly-specific and environmentally benign method of controlling these insects, which will supplement existing livestock producer management tools. RNAi, while promising, is not equally effective in all insect groups, and the mechanisms underlying this still need more investigation. My work focuses on identifying enzymes, called double-stranded RNases (dsRNases), that may limit RNAi responses in *C. sonorensis* as they do in other insect species. **METHODS:** Midge gene expression databases were mined for sequences similar to those dsRNases identified in other insect species. **RESULTS:** Seven candidate enzymes were discovered in the database, and they were compared with those described in related insect species. Software predictions show that these enzymes are secreted from midge cells; the implications of which will influence future strategies for implementing RNAi for *C. sonorensis* control. **CONCLUSIONS:** These enzymes will be characterized in different life stages of the midge to guide the development of route-specific control options for reducing the burden of these pest insects. This research will provide a foundation for a new generation of target-specific insect control.

Relevance of Research to State-Related Topic(s)

Kansas livestock producers face direct economic impacts from reduced herd health as a result of viral diseases that are vectored by the biting midge *Culicoides sonorensis*. These effects include reduced animal weight gain, milk production, and calf health. These diseases also create animal trade and movement restrictions that only increase the economic burden on farmers. Widely accepted insecticides are not highly effective for *C. sonorensis*, and these pose the additional risk of environmental contamination. RNA interference (RNAi) for pest control is potentially a highly-specific and environmentally benign method of controlling insects. Foundational work to characterize the efficiency of this response in *C. sonorensis* is currently lacking, and my research seeks to overcome these issues. A highly effective RNAi treatment for *C. sonorensis* will reduce their impact on livestock herd health, increase livestock productivity, and reduce costs that are passed on to consumers.

ENHANCING THE SAFETY AND EFFICACY OF CANCER DIAGNOSTIC AGENT FOR BETTER CANCER MANAGEMENT

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BACKGROUND AND PURPOSE: Cancer is one of the leading cause of disease-related death among Kansas residents. An early cancer diagnosis is key to reduce cancer-associated mortality as cancer diagnosed in its early stage can be often treated successfully. For example, the survival rate of breast cancer is 99% at stage I compared to 27% at stage III. The best way to diagnose cancer is by actually observing the cancerous cell using powerful imaging techniques like Magnetic Resonance Imaging (MRI). MRI uses a diagnostic agent to enhance the contrast of an image for a better diagnosis. One of the widely used diagnostic agents is a gadolinium-based contrast agent, a heavy metal that is often associated with toxicity leading to kidney failure. As such, there is an imminent need for the development of diagnostic agents that are both safe and effective for better cancer diagnosis and management. Toward this direction, we engineered gadolinium incorporated cell-derived vesicles system as a diagnostic contrast agent. **METHOD:** Vesicles were isolated from immune cell-culture and engineered with gadolinium using the membrane fusion technique. Engineered vesicles-based diagnostic agents were characterized for physicochemical properties and cancer diagnostic capacity. **RESULTS/FINDINGS:** Cell-culture and mice-tissue (histology) data showed minimal toxicity of engineered vesicles-based diagnostic agents while MRI pictures of mice with cancer showed better cancer diagnosis efficacy of the agent. **CONCLUSION:** By incorporating a cellular system of communications- vesicles with gadolinium, we successfully engineer a safe and effective cancer diagnostic agent. Such agents can be crucial for safe and early cancer diagnosis for better cancer management.

Relevance of Research to State-Related Topic(s)

According to the data from the Kansas Department of Health and Environment, more than 13,000 Kansans are diagnosed with cancer and approximately 5,300 die from the disease each year. These cancers are generally confirmed by a diagnostic imaging technique called Magnetic Resonance Imaging (MRI) which is available in many areas of Kansas including Manhattan, Topeka, Wichita, and Kansas City. MRI imaging is often accompanied by the injection of a diagnostic contrast agent before imaging. One of the widely used agents is gadolinium, which in free ionic form can have toxic consequences. There are more than 30 million MRI scans per year in the US accounting for roughly 10 MRI scans per 100 people and most of these scans use gadolinium. These staggering number of MRI scans warrants the need for safe and effective diagnostic contrast agents to avoid health hazards associated with conventional gadolinium-based contrast agents for better cancer management.

SEEKING NEW DRUGS TO TREAT AUTOIMMUNE DISEASES WITH COMPUTER ASSISTANCE

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BACKGROUND AND PURPOSE: Despite that not all autoimmune disorders are fatal, the patients still suffer severe pains, and the quality of life is strikingly reduced. Scientists have proven that the disorders, including psoriasis, Crohn's disease, and Ankylosing Spondylitis, are intimately related to the physiological activity of a protein named human retinoic acid receptor-related orphan receptor γ (ROR γ). Unfortunately, no ROR γ -inhibiting drug has passed the clinical trials. While the traditional drug discovery process costs a lot of time and money, we aim to develop new ROR γ -inhibiting drugs in a time-and-money-saving way in this project. **METHOD:** Over one million drug-like small molecules were screened by computer programs, such as iDock and DataWarrior, to funnel potential active compounds with unique chemical structures. The compounds were ranked *via* iDock scores. The inhibitory activity of the top-ranked hits to ROR γ was confirmed by cell-based assays. The interactions between ROR γ and the compounds were analyzed through biochemical and biophysical experiments. **RESULTS:** A family of active compounds, which share a chemical structure different from the known drugs, have been found to inhibit the ROR γ activity significantly. The result of the biochemical experiments indicates that they achieve the inhibitory function *via* binding to ROR γ directly. We are currently investigating the details of the binding interactions, which will provide a profound interpretation of the inhibition. **CONCLUSION:** The results demonstrate the potential of these compounds being further developed into new drugs for treating the ROR γ -related autoimmune diseases.

Relevance of Research to State-Related Topic(s)

Autoimmune disorders include over 80 kinds of diseases in which the immune system mistakenly attacks the healthy cells. According to the National Institutes of Health data, over 23 million Americans, occupying more than 7% of the U.S. population, are suffering from one of the diseases. The American Autoimmune Related Diseases Association estimates a cost of \$86 billion per year in treating the disorders. Because they affect women three times more often than men, it is considered a major woman's health issue. Therefore, it is urgent to develop effective treatment strategies to release pain and save health care costs. Our study shows the potential of a family of small molecules in treating the ROR γ -related autoimmune diseases. Moreover, this study emphasizes the application of computer methods in the initial stage, which may help speed up the drug discovery process at a much lower cost.

**WEARABLE NEUTRON DETECTOR (WND) AND NUCLEAR
NON-PROLIFERATION**

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BACKGROUND AND PURPOSE: Nuclear non-proliferation includes tracking, searching, and locating special nuclear materials (SNMs). In the post 9/11 era, ³He thermal-neutron detectors are quite expensive. The Microstructured Semiconductor Neutron Detectors (MSNDs) are high-thermal neutron detection efficiency alternatives that are fabricated and characterized to operate in Modular Neutron Detectors (MNDs). Up to 16 MNDs, when coupled together, are capable of communicating either wired or wirelessly with an android phone application to convey live time radiation count rates of an environment overt or covertly to an operator. When coupled with gas filled Geiger Müller tubes for gamma detection, once an operator is alerted to radiation presence, they can precisely locate the materials location for further investigation. For these reasons and more, MSNDs are an ideal candidate for implementation into a wearable technology known as the Wearable Neutron Detector (WND) for non-proliferation efforts. **METHOD:** The neutron response of the WND to a bare and moderated 15.6-ng ²⁵²Cf (Californium-252) source was measured at 0.5, 1, 1.5, and 2 meters as well as the angular response at 1 m. **RESULTS/FINDINGS:** The intrinsic detection efficiency for the bare ²⁵²Cf source ranged from 0.46% to 1.56% from 0.5 m to 2 m. The ambient background count rate for the WND was 0.172 ± 0.002 cps. The count rate depression at 90° is caused by the decreased solid angle from side-on irradiation. MNDs showed a low sensitivity to the incident gamma rays. Developed models will allow for more sensitive detection, source identification, and dose estimations for the operator.

Relevance of Research to State-Related Topic(s)

Kansas is economically impacted by the Wearable Neutron Detector (WND) program. Throughout the lifetime of the WND program, the Kansas State University (KSU) Semiconducting Materials and Radiological Technology (SMART) Laboratory has secured up to two million dollars in research funding from the Defense Threat Reduction Agency (DTRA) on behalf of the university, employed many undergraduate and graduate students throughout their academic careers, and has funnel the fabrication and commercial sale of the WND technology to Kansas located companies. Radiation Detection Technology (RDT) and Electronic Design Laboratory (EDL) are both owned and operated by KSU graduates employing many students and former students in Manhattan, Kansas. As result of their efforts in conjunction with KSU, RDT and EDL are encouraging the retention of college graduates when our state currently faces a mass exodus of those well-educated citizens all while securing defense contacts to keep our nation and the state of Kansas safe.

THE FUTURE OF POWER ELECTRONICS COOLING ON RENEWABLE ENERGY PLATFORMS IS 3-D PRINTED

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BACKGROUND AND PURPOSE: The continual development of integrated circuitry has resulted in their rapid miniaturization and increased power output; this, however, presents a problem. Limits in circuit size and cost have nearly been reached due to the production of excessive amounts of heat of power electronics. To solve this problem, the heat from increasingly smaller circuits must be addressed. This research aims to design vapor chambers (VCs), which are two-phase heat spreaders for distributing heat from a very concentrated area to a larger area, and oscillating heat pipes (OHPs), which expel extreme heat. The combination of these two components spreads and eliminates heat in high heat flux applications, thus providing the cooling necessary for increasingly powerful electronics. Until very recently, the only way to produce VCs and OHPs involved expensive and time-consuming machining. However, it's now possible to 3-D print both components which saves a significant amount of time and money while also providing a means to experiment with different, complex (and unmachinable) designs. **METHOD:** The effectiveness 3-D printed VCs and OHPs will be assessed using computer simulations while considering 3-D printing limitations. The expected results of this research will improve the effectiveness of VC/OHP cooling combinations on high heat producing circuitry. By experimenting with different designs, the desired outcome is to effectively cool a circuit producing a heat flux of up to 100 W/cm^2 . **CONCLUSION:** This research can impact the future size and cost of integrated circuitry without sacrificing their effectiveness due to extreme levels of residual heat.

Relevance of Research to State-Related Topic(s)

The rapid development of renewable energy technology is resulting in the generation of excessive heat. Solar panel cells, for example, can reach temperatures exceeding 149 degrees Fahrenheit (65 degrees Celsius) during a hot day. As the cells approach this temperature, the efficiency of the solar panels decreases dramatically. In addition, the on-board power electronics (e.g. converters, transistors) dissipate high heat fluxes. The use of a cooling system in this instance is necessary, and oscillating heat pipes in series with vapor chambers can provide this cooling without the need for external power (they operate passively). The ability to 3D print oscillating heat pipes and vapor chambers has the potential to revolutionize the development of renewable energy by increasing efficiency and longevity while reducing costs.

EXPERIMENTAL ULTRASONIC VELOCITY STUDY
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BACKGROUND AND PURPOSE: Due to the complexity of carbonate reservoirs, hydrocarbon wells require repeatedly updated characteristics during production. This creates added cost to well drilling but provides significant return in terms of decisive field development plans and knowledge of productive and nonproductive hydrocarbon zones. The purpose of this study is to understand the porosity, velocity and elasticity relationship in the Viola formation reservoir which has been a source of significant oil and gas production in Kansas for numerous years. One such technique is to understand porosity and how the P-wave and S-wave velocity signals travelling through the reservoir rock changes depending on the type of fluid present in the pores of that rock. **METHOD:** Rock physics experiments such as lab ultrasonic experiments and fluid replacement modelling together with seismic modelling was used to pursue a thorough understanding of the carbonate reservoir properties. Brine, oil and water were injected into the carbonate rock and the P-wave, S-wave and other elastic parameters were recorded and compared with a fluid replacement model to assess its applicability in reservoir characterization. Seismic data response to fluids and lithofacies changes were also accounted for. **RESULTS:** There was a positive relationship between the amplitude of the wave travelling through the Viola limestone and the type of fluid present. Higher amplitudes were recorded for dry rock, and lower amplitudes were recorded for brine and oil saturated rocks. Modelling of fluid replacement was compared with the results of the laboratory ultrasonic experiment. **CONCLUSION:** A better understanding helps to reduce cost spent in drilling dry holes.

Relevance of Research to State-Related Topic(s)

The oil and gas industry is a major contributor to the state of Kansas with over hundreds of thousands of oil and natural gas wells drilled in the state and 6.7 billion barrels of oil and 41.2 trillion cubic feet of gas from the 19th century through 2018. Understanding the rock property of a petroleum reservoir would help save operators money spent in drilling dry and nonproducing holes.

INVESTIGATION OF OLDER DRIVERS FATAL CRASHES AT INTERSECTIONS IN THE MIDWESTERN STATES

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BACKGROUND AND PURPOSE: Older drivers aged 65 years and older are more vulnerable to fatal crashes due to cognitive impairments and frailty. One location where older driver experience higher crash risk is intersections, mainly due to the complexity of the situation. The objective of the study was to determine factors associated with intersection-related fatal crashes involving older drivers in the Midwestern states. A five-year fatal crash dataset from 2014 to 2018, from the Fatality Analysis Reporting System (FARS), was utilized for this study. In this part of the study, single-vehicle crashes were taken into consideration. **METHOD:** The logistic stepwise selection procedure was applied to identify statistically significant predictor variables that increase the chance of having older-driver fatal crashes at intersections. **RESULTS/FINDINGS:** The model identified eight statistically significant predictor variables out of thirty explanatory variables tested. The predictors that increase older-driver single-vehicle related fatal crashes at intersections are: if trafficway type is two-way not divided, if the land use is rural, if the intersection without control, if the time is between 8pm-8am, if the age is more than 75 years old, if the posted speed limit is 55 mph or greater, if the pre-crash event is speeding, and if the most harmful event is a rollover or hitting a tree. **CONCLUSION:** These identified factors could increase the risk of older drivers being involved in single-vehicle fatal crashes at intersections. Based on the identified risk factors, countermeasure ideas are proposed to improve older driver safety at intersections, which are suitable for the Midwestern region including Kansas.

Relevance of Research to State-Related Topic(s)

This research is focused on the Midwestern Region, which includes the State of Kansas. It relates to transportation safety, which is an extremely critical topic for Kansas. There were about 4,615 fatalities and 1,550 injuries among older drivers in the Midwestern states from 2014 to 2018. In the State of Kansas, there were more than 290 fatalities and 65 injuries in vehicle crashes within the same period. It is essential to note that the issue needs to be looked at from a different perspective. As a result, characteristics related to crash, vehicle, driver, and environment have been identified. Overall, older drivers should be aware of these factors to adjust their driving habits to reduce fatal crashes and enhance safety. This concept could be applied not only in the Midwestern States, but also specifically in Kansas so that transportation safety of our aging population could effectively be addressed.

CRYSTAL ENGINEERING APPROACH IN DESIGNING ENHANCED UREA FERTILIZERS

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BACKGROUND AND PURPOSE: Urea remains the most prominent nitrogen-based fertilizer around the world, primarily because of its high nitrogen content and low cost. Unfortunately, only about 50% of the nitrogen applied is absorbed by crops and the rest is lost via leaching and/or as gaseous species which contribute to the greenhouse effect. This loss results in a significant economic and environmental cost to farmers and society at large. As such, there is need for development of technologies aimed at improving nutrient acquisition efficiency across the plant environments. Co-crystal technology involves manipulation of interactions between chemical compounds to design materials with desired functionalities. In co-crystals, an active compound (in this case urea) is combined with molecular partners (co-formers), to create new solids where physical properties, such as solubility, can be altered in a predictable fashion. The co-crystals will be investigated to establish whether they have improved physical properties such as controlled release of nitrogen into plants without negatively impacting soil nitrogen cycling, and plant growth. Co-crystals will also be studied to explore how co-formers can deliver micro-nutrients to plants while enhancing the presence of plant available nitrogen, and other essential elements.

METHOD: Liquid assisted grinding was used to screen for co-crystal formation and solution crystallization to obtain single crystals for structure solution. **RESULTS/FINDINGS:** Large scale synthesis of organic urea co-crystals was achieved with selected dicarboxylic acids and characterized using powder X-ray diffraction. **CONCLUSION:** The goal of this study is to develop sustainable, robust and scalable methods, based on co-crystal technologies, for improving plant nutrient acquisition efficiency.

Relevance of Research to State-Related Topic(s)

The goal of this program is to develop sustainable, robust, and scalable methods, based on co-crystal technologies, for improving nutrient acquisition efficiency across a wide range of plant environments. In co-crystals, an active compound –in this case urea – is combined with molecular partners (co-formers), to create new solids where physical properties, such as solubility, can be altered in a predictable and modular fashion. We are developing reliable synthetic procedures that will allow us to prepare new solid forms of urea. Our collaborators in agronomy will then examine whether the co-crystals have improved physical properties that can control release of nitrogen into plants without negatively impacting soil nitrogen cycling, chemistry, and plant growth. In addition, we will identify how the co-formers can deliver micro-nutrients to plants whilst also providing a handle for fine-tuning and enhancing the presence of plant available nitrogen, phosphorous and other essential elements.

PERFORMANCE OF TRACKED AUTONOMOUS GROUND VEHICLE FOR STEEP SLOPE FARMING**Chetan Badgajar** and Daniel Flippo*Department of Biological and Agricultural Engineering*

BACKGROUND: In 12 Great Plains states, a total of 116,000 km² area is currently under shrubs, or too steep slopes ranging from 6°-25° which are considered as marginal. Farming on these hills & uneven terrain is unsafe with large-conventional agricultural equipment's. Therefore, the project aims to design a fleet of small ground autonomous vehicles (GAV) to safely perform on hills-uneven terrain for agricultural operations (sowing to harvesting). **GOAL:** A primary objective of this study is to understand how the GAV functions on varying slopes under variable load and operating speed, specifically focusing on traction parameters, drawbar power, travel reduction and power consumption. **METHODS:** A small tracked GAV, fits in a typical 30 inch (0.762 m) crop row; fitted with an NI-myrio device in conjunction with load cell, encoders, and amperage-voltage sensors for data collection. The performance of GAV was evaluated on slope up to 0-18° both uphill & downhill operation at operating speed (20-100% duty cycle) and expressed in matrix: tractive efficiency (TE), travel reduction (TR) and power number (PN). **RESULTS AND CONCLUSION:** TE of GAV was ranged between 4-16% and downhill operation delivers significantly higher TE compared to uphill operation. The TR was found to be increased with increase in drawbar. The PN was significantly influenced by the speed and drawbar pull. The preliminary results proved that AGV generate enough tractive power to perform the basic agricultural operation on slope. The collected data was used for energy optimization, simulations, vehicle mobility and route-optimization models.

Relevance of Research to State-Related Topic(s)

Kansas is not only a major agricultural state in country but also a leader in wheat, grain sorghum and beef production. The state of Kansas falls on to the Great plains which are characterized by gentle rolling hills, broad expanse of prairie with little elevation change, steppe and grassland; used for croplands, hay pastures and grazing. These rolling hills or prairies with a slope steeper than 6° has never been cultivated in USA, due to fact, it is unsafe to cultivate with large conventional farm equipment and left for pasture. However, this technological barrier to slope farming could be potentially addressed by developing a fleet of small autonomous ground vehicle (AGV). The multi-AGV system is fast-growing trend on smart farms and small AGV's can accomplish the same work as a large machine; addition to reduced soil compaction and improved safety. This study is fundamental to understand the limitations and capabilities of Multi-AGV system which targets to expand the agricultural land to boost the state food production.

****WITHDREW****

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**APPLICATION OF REMOTELY SENSED IMAGERY AND SPATIO-TEMPORAL
MODELING FOR IRRIGATION SCHEDULING**

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BACKGROUND: Extrapolation of previous depletion rates of the High Plains Aquifer suggests that 35% of its Southern region will be unable to support irrigation within the next 30 years (Scanlon et al., 2012). More efficient irrigation practices have the potential to extend the useful life of the High Plains Aquifer in Western Kansas, but these practices often require accurate knowledge of the soil moisture content at the sub-field level. Past research has shown how remotely sensed imagery can be used to identify differences in crop water stress at regional, field, and sub-field levels. However, the tradeoff between spatial and temporal resolution of remote sensing imagery makes it difficult to use this information to make practical, real-time management decisions. **PURPOSE:** This study aims to show that combining remotely sensed images and ground measurements in a spatio-temporal model can create high spatial and temporal resolution water stress prediction maps. Future research also aims to show that these predictive stress maps can be used to develop more efficient irrigation schedules. **METHODS:** Canopy temperatures, soil moisture content, and weather data were gathered at two research plots and two Water Technology Farms in Southwest Kansas during the 2020 corn growing season. This information was used to develop and test a spatio-temporal model, which uses a multi-level statistical approach to predict future values of crop and soil water stress indices. **CONCLUSION:** This research will reveal differences in water stress at high spatial and temporal resolutions, allowing producers to make more informed management decisions and ultimately reduce their water consumption.

Relevance of Research to State-Related Topic(s)

State and Federal agencies have a vested interest in preserving socioeconomic stability in Western Kansas by protecting groundwater availability. Historically, these agencies have provided cost share assistance to producers who adopt practices that lead to more efficient water consumption. Recent updates in multispectral imagery and the rise of agricultural-focused remote sensing companies has created opportunities to develop new water conservation practices. We hope to show that remotely sensed imagery can be used to create more efficient irrigation schedules, adding to the list of water conservation practices that producers and government agencies can leverage to protect Kansas' natural resources.