

16th Annual Capitol Graduate Research Summit

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Featuring Graduate Student Research from:

Emporia State University
Fort Hays State University
Kansas State University
Pittsburg State University
University of Kansas
University of Kansas Medical Center
Wichita State University

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MULTIPLE-CASE STUDY OF RADIATION THERAPY

CRISIS

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Andrea Hight

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Research Abstracts



FILLING A PATIENT SAFETY KNOWLEDGE GAP: A MULTIPLE-CASE STUDY OF RADIATION THERAPY PROGRAMS AND THEIR RESPONSE TO THE FIELD'S CRISIS

Becky Dodge and Mirah Dow

School of Library and Information Management, Emporia State University

Despite countless initiatives to reduce the rate of medical errors in the United States healthcare system over the past decade and a half, medical errors rank as the third leading cause of death. The critical issue of patient safety is present in all areas of the healthcare industry including radiation therapy. Radiation therapy is a medical specialty that uses ionizing radiation to treat cancer and some benign diseases. In the last decade, the complexity of radiation therapy has increased dramatically due to technological advancements. While such advancements offer benefits to patients, interrelated changes to hardware, software, and human interfaces produce new opportunities for medical errors and patient harm. Longstanding recommendations from the Institute of Medicine (now the National Academy of Medicine) include the adoption of a systems perspective of patient safety, application of human factors principles to reduce or prevent harm, and the establishment of a system of reporting and learning from errors or near misses. Along with these recommendations, health professions education has been recognized as a fundamental component to effective transfer of modern patient safety information in a manner capable of meaningfully shifting the perspectives of future healthcare



These two fish species are phylogenetically distant, but independently converge on a similar feeding structure most evident in the form of a strongly supraterritorial mouth. Landmark-based GM procedures were applied to the cranial material of a series of *X. audax* and *M. atlanticus* specimens to statistically compare the shape of the jaws and other cranial elements related to feeding. Results indicate morphological differences in the feeding structure of these two fish, suggesting a lack of convergence on a functional phenotype. These results may suggest a re-assessment of what constitutes convergent evolution is a necessary next step in better understanding this phenomenon.

INFLUENCE OF SHADED CONDITIONS IN GERMINATION, VEGETATIVE DEVELOPMENT, AND REPRODUCTION OF ASTERACEAE SPECIES NATIVE TO KANSAS

Aline Rodrigues de Queiroz

Department of Biological Sciences, Fort Hays State University

Wildflowers are an integral part of the Kansas prairie. They contribute the most to species diversity and are good indicators of the condition of a grassland. Many wildflowers that occur in Kansas are species in the Asteraceae family and they are adapted to meet the constantly changing light conditions that naturally occur in their environment. Most previous studies have been about crop species, therefore some wildflowers could serve as models to understand how native plants use light in limiting amounts. During germination, the ability of plants to detect variations of light is an essential mechanism for seed survival. As they grow, plants may display two contrasting mechanisms of response when exposed to shade, shade avoidance or shade tolerance. In this study, six native Asteraceae species were exposed to shade, partial shade, and full sunlight conditions. Germination tests indicated higher light intensities to benefit germinability of most species. White Snakeroot displayed the classical shade avoidance syndrome when exposed to partial shaded conditions, including taller plants with reduced number of branches and early flower induction. However, when exposed to severe shade conditions, its responses included shorter plants without branches and no flower bud emergence. Although all species in this project are related and occur in the tallgrass prairie, our results indicate that Asteraceae species have great variation of strategies to deal with shaded conditions throughout their development. Understanding this variation has tremendous implications for crop and range production in Kansas.

GIS SPATIAL ANALYSIS AND ITS SUSCEPTIBILITY TO WILDFIRES

**POTENTIAL OF SOY PROTEIN AS AN ENVIRONMENT-FRIENDLY SEED LUBRICANT FOR
PNEUMATIC ROW CROP PLANTERS**

Sylvester Badua¹, Ajay Sharda¹, Ryan Strasser¹, Ignacio Ciampitti², and Keith Cockerline³

*¹Department of Biological and Agricultural Engineering, Kansas State University; ²Department of Agronomy,
Kansas State University; ³United Soybeans Board*

Seed lubricants play a crucial role in proper seed singulation by ensuring the seeds flow smoothly through the metering unit. However, the harmful chemicals inadvertently expelled along with the air during the seed metering process have raised concerns regarding the negative effects of these lubricants to the environment. An alternative has been developed from soy-

**LIQUID BIOPSY: THE SIMPLEST TECHNIQUE FOR PANCREATITIS
AND PANCREATIC CANCER DETECTION**

**Obdulia Covarrubias-Zambrano¹, Madumali Kalubowilage¹, Sebastian O. Wendel², Deryl L. Troyer²,
Anup Kasi³, and Stefan H. Bossmann¹**

Kansas State University

We will generate F₂ progeny that will be used to determine the genetic basis as well as map the genes controlling tolerance. We

Kansas State University

Controls included complete feed (positive and negative controls) and a stock virus positive control (virus only, no feed matrix). Briefly, 5g of each ingredient were inoculated with 10^5 TCID₅₀ of the contemporary strain, ASFV Georgia/07. The PCR data showed consistent inoculation and nucleic acid stability across all inoculated feed ingredients during the 30-day transboundary model. Viable ASFV was detected by VI at 30 days post-inoculation (DPI) in 8 tested ingredients as well as both positive controls, with mean titers between 10^2 and 10^3 TCID₅₀. Both VI and swine bioassay failed to demonstrate infectivity of ASFV in 3 ingredients, including dried distillers' grains, lysine and vitamin D. Our data shows that ASFV maintains viability in varying environmental conditions, even in the absence of a protective feed matrix. This study provides additional information supporting the hypothesis that feed ingredients may play a role in the transboundary movement of foreign animal diseases, such as ASFV.

SOY PROTEIN IS AN EFFICACIOUS ALTERNATIVE TO WHEY PROTEIN IN FORTIFIED BLENDED FOODS

Erin Ward¹, Hafiz A. R. Suleria¹, Michael Joseph², Sajid Alavi², and Brian L. Lindshield¹

¹*Department of Food, Nutrition, Dietetics and Health, Kansas State University;*

²*Department of Grain Science and Industry, Kansas State University*

Previously we found that extruded sorghum-soy blend (SSB) and corn-soy blend (CSB) fortified blended foods (FBFs) containing whey protein concentrate (WPC) are equally nutritious food aid products. WPC is commonly added to FBFs as a high-quality protein source, however, it is the most expensive component of FBFs. The primary objective of this study was to determine if soy protein may serve as an alternative to WPC in FBFs. Nine extruded FBFs were formulated; one SSB and one CSB both containing 9.5% WPC and 15% sugar served as comparison FBFs. Four additional SSBs and three CSBs were developed containing no WPC with increased soy flour to meet protein requirements and sugar content from 0 to 15%. Male, weanling Sprague Dawley rats were individually housed and divided into ten diet groups (n = 10) which consumed either AIN-93G, standardized rat diet, or one of the FBFs for 28 days. Results were analyzed using one-way ANOVA with Tukey's test. There were no significant differences in food intake or final body weights. CSB-WPC group had significantly lower food intake compared to SSB-0% and AIN-93G groups. CSB-5% group had significantly lower body weight compared to the SSB-0% group. There were no significant differences in hemoglobin concentrations; liver iron concentrations were significantly higher in all FBF groups compared to the AIN-93G group and CSB-5% group was significantly higher than the SSB-15% group. Our results suggest that extruded SSB and CSB FBFs with soy protein are an efficacious and cost-effective alternative to WPC-containing FBFs.



MAPPING FLOODS ANYWHERE IN KANSAS USING THE NATIONAL WATER MODEL

James Coll¹ and Mike Johnson²

¹*Department of Geography and Atmospheric Science, University of Kansas;* ²*Department of Geography, University of California, Santa Barbra*

When the National Water Model went operational in 2016, for the first time in the modern computational era the nation went from a lumped basin parameterization to a fully distributed, coupled hydrologic/hydraulic representation of the water cycle. Not only does this implementation represent an almost 21,000-fold increase in our predictive potential of river discharge, its modular nature ensures that future efforts to improve individual aspects of the model are immediately integrated into the lifecycle of a hydrologic event. However, the methods of accessing these efforts for those not intimately familiar with the model or data science conventions are limited, and the means of consuming these within the emergency management realm are currently nonexistent. To rectify these shortcomings, a graphical user interface built on Free and Open Source tools is demonstrated whose ideal users include hydrologists, first responders, and decision makers. These intuitive and accessible tools presented enable virtually anyone with a modern computer to access, interact with, and make decisions based on, National Water Model forecasts effectively bridging the gap between federal scale efforts to guide and inform, and the local scale where actions are made.

CHLAMYDIA OF PIGS AND HUMANS: A COMPARATIVE GENOMIC ANALYSIS

Zoe E. Dimond and P. Scott Hefty

Department of Molecular Biosciences, University of Kansas

Chlamydiae are unique pathogenic bacteria associated with a range of diseases affecting most mammalian species. *Chlamydia suis*, a common pathogen of pigs, causes chlamydiosis which is associated with diseases including spontaneous abortion, causing loss of entire litters, gastrointestinal issues, conjunctivitis, an eye disorder that can lead to blindness, and respiratory diseases like pneumonia. Importantly, there are several reports indicating that *Chlamydia suis* has been detected in pig farmers and has the potential for zoonotic transmission to humans. Even more concerning, *C. suis* often encodes for tetracycline antibiotic resistance which is a primary treatment antibiotic, meaning that these diseases cannot be treated in pigs, nor would they be treatable in humans. Additionally, recombination in the lab between *C. suis* and human chlamydia has shown that this antibiotic resistance can be transferred between species. Because of this emerging threat, and to gain a better understanding of the basic biology, a comprehensive analysis of the *Chlamydia suis* genome was completed to understand the genes that might be contributing to its ability to cause disease, both in pigs and humans. This report constitutes the first fully assembled and independently annotated genome for *C. suis* with complete comparison with other Chlamydiae, including human pathogen *Chlamydia trachomatis*. The 986 genes that make up the *C. suis* chromosome are closely related to other Chlamydiae, though several unique aspects of this bacteria come to light. This and future studies will enable focused efforts on discovering key species-specificity and host-adaptation factors that are attributed to chlamydial infections, including humans.

GROWING 3D CARTILAGE TO TREAT OSTEOARTHRITIS

Pamela Johnson¹, Anna Trofimoff², Justin Lehtinen², and Jennifer Robinson^{1,2}

¹*Bioengineering Program, University of Kansas;*

²*Department of Chemical and Petroleum Engineering, University of Kansas*

Osteoarthritis (OA) is a major public health issue affecting approximately 31 million Americans. This disease affects joints and symptoms include pain, stiffness, and decreased mobility and is characterized by the degeneration of articular cartilage that lines



**MENTAL HEALTH OUTCOMES IN FOSTER YOUTH: PROMOTING COHESION AND CONFLICT
RESOLUTION IN FOSTER FAMILIES**

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GENE EXPRESSION PROFILING USE IS ASSOCIATED WITH REDUCTION IN MODERATE TO SEVERE TRICUSPID REGURGITATION AFTER HEART TRANSPLANT

Kaitlyn Carl, A. Michael Borkon, MD, Andrew Kao, Samantha Beauchamp, Philip Jones



th
MPUT: ($r=0.73$ and 0.63 , respectively, $p<0.001$). Precision was significantly and positively correlated with JTHFT ($r=0.45$, $p=0.006$). Accuracy was not significantly associated with JTHFT ($r=0.33$, $p=0.054$). Conclusion: Our results showed moderate to strong correlations between pinch proprioception and hand dexterity measures (i.e., less accuracy and precision in pinch proprioception is associated with longer time to perform dexterity tasks). The current findings could be an important component for hand dexterity screening and following up with treatment plans focusing on hand rehabilitation. Pinch proprioception can be used for subjects with neuropathy as well as for other patients with orthopedic and neurological conditions that affect hand dexterity such as hand osteoarthritis, hand tendon repair, stroke, and multiple sclerosis. Funding Source: No funding was provided for this study and the authors report no conflict of interest.

ELEVATED O-GLCNAC EXACERBATES PRO-INFLAMMATORY CYTOKINE SECRETION FROM CD4+ T CELLS

Miranda Machacek; Pat Fields, PhD; and Chad Slawson, PhD
University of Kansas Medical Center, School of Medicine

Chronic inflammation is a feature of obesity and enhances the risk of atherosclerosis, cancer, diabetes, and autoimmunity. Specifically, pro-inflammatory Th17 CD4+ effector T cells are increased in metabolic diseases. However, a clear molecular mechanism linking metabolic changes with pro-inflammatory T cells is lacking. We hypothesize that elevated levels of O-linked -N-acetylglucosamine (O-GlcNAc), a post-translational modification of nuclear and cytoplasmic proteins, promotes pro-inflammatory CD4+ T cell function. Since production of O-GlcNAc involves input from carbohydrate, amino acid, fatty acid, e of O-GlcNAc in a setting of metabolic disease, we analyzed O-GlcNAc levels in CD4+ T cells from mice fed a high fat and -GlcNAc levels compared to cells from mice fed standard chow. When polarized to a Th17 lineage, cells from obese mice secrete more IL-17A, the eponymous Th17 cytokine. Importantly, when naïve CD4+ T cells from lean and obese mice are polarized to a Th17 lineage in the presence of Thiamet-G (TMG, an inhibitor of the enzyme that removes O-GlcNAc (O-GlcNAcase, OGA)) the cells from lean mice secrete levels of IL-17 comparable to those from obese mice and IL-17 secretion was exacerbated in cells from obese mice. Transcript levels of IL-17 are similarly elevated in both lean and obese mice Th17 cell -related orphan receptor gamma) acts as the Th17 master transcription factor, orchestrating the Th17 differentiation program. TMG -17 locus. Uniquely among the CD4+ effector T cell master transcription factors, limiting enzyme in fatty acid synthesis, is known to enhance generation of Th17 cells by producing ligands that increase the -GlcNAcylated. Furthermore, lipidomics analysis identified increased levels of sterols and saturated fatty acids IL-17 promoter. Collectively, our data suggest that elevated O-GlcNAc levels increase pro-inflammatory IL-17 secretion from Th17 cells through alteration of the lipidome. Further study into the molecular mechanism of how O-



**PRODUCED WATER TREATMENT FOR AGRICULTURAL USE IN KANSAS OIL, AND GAS
PRODUCTION FIELDS**

Sattar Ali and Eylem Asmatulu



INNOVATIVE GENETIC APPROACH MAY GIVE CROPS RESISTANCE TO CHARCOAL ROT DISEASE

Heather Forster and Bin Shuai

Department of Biological Sciences, Wichita State University

Macrophomina phaseolina, causative agent of the plant disease charcoal rot, impacts over 500 plant species, causing devastating crop failures worldwide. In Kansas, it is the biggest cause of soybean crop loss, and disease epidemics are increasingly frequent. Charcoal rot attacks primarily through fungus-infested soil, leading to yellowing and death of plant leaves. Traditional pathogen control means, such as natural resistance, crop rotation, and fungicides, have been ineffective or problematic. This study aims to evaluate the effectiveness of host-delivered RNA interference (HD-RNAi) to manage charcoal rot. HD-RNAi exploits the natural process of RNA interference to target essential genes for *M. phaseolina*. In this process, small interfering RNAs (siRNAs) are designed and engineered into plant genomes. Upon infection, siRNAs expressed in plant cells can enter invading fungus and prevent expression of genes necessary for successful infection. HD-RNAi has been successful against some nematodes, insects, and other fungi. In this preliminary work, we have manufactured siRNAs to interfere with genes used in the production of *M. phaseolina* cell wall compounds. We hypothesize that without these compounds, the fungus will be unable to grow and infect plants. To test

growth between siRNA-treated and untreated fungus. We are working on optimizing testing conditions and developing an assay to evaluate the efficiency of siRNAs. Our work gives insights into RNA interference in *M. phaseolina* and provides a framework for future siRNA testing.

NON-INVASIVE DETECTION OF INTRACRANIAL FLUID VOLUME SHIFTS USING WEARABLE HEADBAND

Jacob Griffith, Brandon Eckerman, Ben Loflin, Subash Bhandari, Ryan Becker, Noor Mohammed, and Kim Cluff

Department of Biomedical Engineering, Wichita State University

Pathological increases in cerebral blood or cerebrospinal fluid volume have been linked to neurological complications and even death in patients who have had hemorrhagic strokes, traumatic brain injury, or have undergone neurosurgical or neurological treatments. The development of non-invasive techniques to measure and monitor shifts in intracranial volume have included the use of ultrasound, magnetic resonance imaging (MRI), and computed tomography (CT). However, these methods require expensive, specialized equipment and personnel that may not be available in many rural communities across rural Kansas. This -of-care, wearable headband capable of non-invasively detecting shifts in intracranial fluid volume in limited resource settings. The sensor consists of a single baseline component configured into a rectangular planar spiral with a self-resonant frequency response when impinged upon by external radio frequency sweeps. Preliminary human tests, approved by the Institutional Review Board (IRB) of Wichita State University, were performed to determine the feasibility of detecting fluid volume shifts. Participants were placed in a 15° head down tilt for approximately 30 minutes to induce an increase in intracranial fluid volume. During this induced bio-fluid shift, the sensor was applied to the forehead and data was collected. Validation of the increase in intracranial fluid volume was performed through non-invasive ultrasound measurements of the optic nerve. This study establishes the foundation for future work to optimize the sensor capabilities to monitor shifts in fluid volume and assist with medical scenarios including stroke, cerebral hemorrhage, or traumatic brain injury in limited resource environments.

ECONOMIC DEVELOPMENT AND JOB CREATION BY APPLYING OPTIMIZATION METHODS FOR SCHEDULING PROBLEM IN JOB SHOPS

Parsa Kianpour and Deepak Gupta

Department of Industrial, Systems, and Manufacturing Engineering, Wichita State University

The manufacturing sector earned one of the top spots in 2017 Kansas economy adding over 1,000 jobs. This developing direction is predicted to continue with 0.5% growth in 2019. Within the manufacturing sector, aviation is ranked fourth in Kansas with over 30,000 workers. 44% of Kansans work for small businesses (less than 50 employees) and this percentage is projected to increase since the annual growth of small businesses in Kansas is projected as 6%. Therefore, this research aims to study typical operations in one of these small businesses in the aviation sector. The study evaluates the scheduling problem with the objective of minimizing total earliness/tardiness cost. A new model is proposed that considers the effects of maximum allowable tardiness. In addition, the existing model in the literature is simplified to reduce computational time and enable corporate scheduling staff to use the model

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THE IMMIGRANTS WHO BUILT KANSAS: ONE SPIKE AT A TIME

Jenny Masias

Department of Modern and Classical Languages and Literatures, Wichita State University

The prevalent link in the position of Latino neighborhoods in cities throughout Kansas is the railroad. Whether it is Newton, Wichita, Topeka, Emporia or even larger cities like Los Angeles and Chicago, the proximity of Latino neighborhoods to the train tracks is no coincidence. The recruitment of Mexican Immigrant labor during the late 19th and 20th century expanded the railway and allowed for the economic growth of Newton, and many similar cities in Kansas. These workers who endured harsh working and living conditions managed, through solidarity, to forge tight-knit communities, all the while weathering the waves of anti-immigrant political sentiment at the county, state, and national level. Newton, Kansas has been a crucial geographical location where the railway traffic not only bridges east to west, north to south but internationally from Canada to Mexico creating a bullseye through existing documents and pictures that remain at the Kansas Historical Society, Harvey County Historical Society, and local church records. History has often been used as an instrument to advance the narrative of those in positions of power molding a one-dimensional historical memory. However, history can also be a tool to correct the silencing of the past. It is only through a complex analysis of this narrative that it is possible to fully understand the value of the contributions Mexican immigrants have made not only to Newton but to the State of Kansas and beyond.

ORGAN MOTION PREDICTION IN MR-GUIDED RADIOTHERAPY

Seyed Ali Mirzapour¹, Thomas Mazur², Gregory Sharp³, and Ehsan Salari¹

¹Department of Industrial, Systems, and Manufacturing Engineering, Wichita State University; ²Washington University in St. Louis, St. Louis, MO; ³Massachusetts General Hospital, Boston, MA

According to the American Cancer Society, it is estimated that around 15,000 cancer cases will be newly diagnosed in the state of Kansas in 2019, from which around 4500 will be lung and abdominal cancers. Radiotherapy is a major treatment modality for cancer with more than half of all cancer patients receiving radiotherapy as part of their treatment. The goal of radiotherapy is to deliver a therapeutic dose of radiation to the clinical target volume while sparing the surrounding healthy tissue to the largest extent possible. However, internal organ motion during radiation delivery may lead to under dosing of the target volume or overdosing of the normal tissue, potentially causing treatment failure or normal-tissue toxicity. Organ motion is of particular concern in the treatment of lung and abdominal cancers, where breathing induces large tumor displacement and organ deformation. A new generation of radiotherapy devices is equipped with on-board MRI scanners to acquire a real-time my during radiation delivery. The goal of this research is to develop, calibrate, and test motion predictive models that employ real-time MRI images to predict the short-term trajectory of anatomical motion during radiation delivery. These motion predictive models have direct applications in motion-intervention strategies to control and correct for any dose discrepancy that may occur as a result of organ motion during the radiation delivery process.

GUIDECALL: A SYSTEM FOR REMOTE VIDEO CALL ASSISTANCE FOR BLIND AND VISUALLY IMPAIRED PEOPLE

Naveen Mukundan Ravindran,

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For more information, please contact:

Emporia State University

Jerald Spotswood, Emporia State University,
1 Kellogg Circle, Emporia, KS 66801
(620) 341-5403 <https://www.emporia.edu/grad/>

Fort Hays State University

Jennifer Bonds-Raacke, Fort Hays State University,
600 Park Street, Hays, KS 67601.
(785) 628-4236 <http://www.fhsu.edu/gradschl/>

Kansas State University

Carol Shanklin, Kansas State University,
103 Fairchild Hall, Manhattan, KS,
(785) 532-6191 <http://www.ksu.edu/grad>

Pittsburg State University

Pawan Kahol, Pittsburg State University,
112 Russ Hall, 1701 South 0009ou0 G[()] TJ te87 TJ t7424237BA5 Uni