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INVESTIGATING THE EFFECTS OF NUCLEAR RADIATION ON ADDITIVELY MANUFACTURED PARTS

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The growing interest in developing safe modular nuclear reactors has resulted in a need for advanced materials/parts that can tolerate intense radiation while in service. Manufacturing of such advanced materials via traditional machining processes present several challenges. Recently, Additive Manufacturing (AM), or 3D printing, has shown capability of fabricating complex-shaped nuclear components. AM offers a unique opportunity to print parts on demand with a reduced need to rely on external suppliers. The aim of this research is to compare the mechanical properties of metal samples fabricated using conventional machining and AM methods before and after nuclear radiation. This research will help engineers design next-generation, radiation-resistant nuclear reactor components using AM processes. Inconel 625 (a nickel-based superalloy) was fabricated using the laser powder bed fusion (L-PBF) AM process. The samples were placed inside a nuclear reactor for 2 weeks. The mechanical properties of these samples were examined by measuring hardness before and after nuclear radiation. The hardness values of the AM samples were compared to traditional machined samples**.** Results indicate that AM specimens are less prone to radiation hardening defects relative to their wrought counterparts. As-printed AM specimens showed an increase in hardness by 1.2% hardening. The wrought samples displayed an increase in hardness by 5.25%. Results provide insight into how one can minimize radiation hardening in nuclear materials for their safe and reliable use. Results should increase confidence levels for adopting AM for building nuclear reactor components which perform the same or better than conventionally manufactured components.

TO TALK OR NOT TO TALK: AN ANALYSIS OF PARENTS' INTENTIONS TO TALK WITH CHILDREN ABOUT DIFFERENT SEXUAL TOPICS USING THE THEORY OF PLANNED BEHAVIOR

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Parent-child sexual communication (PCSC) has positive outcomes for children's sexual health, but parents' intentions to educate children about sexuality are largely understudied. Based on the theory of planned behavior, this study aimed to explore what factors are associated with intentions to talk with children about different sexual topics. A sample of 561 parents of an oldest child ages 6-11 were recruited to complete a survey through Prolific.co. Results of a path analysis showed that having positive attitudes about PCSC, believing others would approve of them talking with kids about sex (subjective norms), and feeling that they had the ability to engage in PCSC (self-efficacy) were significantly associated with parents' intentions to talk to their children about at least three of the five categories of sexual topics ("the basics," "pleasure," "sex in relationships," "gender identity/sexual orientation," and the "religious meaning of sex"). Of these components, self-efficacy was most consistently and strongly associated with increased intentions to discuss all topics, followed by the attitude of believing sex education was the parents' responsibility. These findings suggest that building self-efficacy and helping parents feel responsible for educating their children about sex would be most important in attempting to increase parental intentions to engage in PCSC on a wide variety of topics. Funding for parent-targeted programming should be allocated to increase parent intentions to engage in PCSC. This programming should focus on helping parents develop self-efficacy and a sense of responsibility for educating children about multiple sexual topics.

UTILIZING COMPARATIVE TRANSCRIPTOMICS TO UNDERSTAND THE EFFECTS OF VESICULAR STOMATITIS VIRUS INFECTION ON NEURO-SENSORY FUNCTION IN CULICOIDES MIDGES

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Culicoides midges are important vectors of many livestock pathogens, including orbiviruses and rhabdoviruses. These viruses heavily infect the insect's eyes and other sensory organs as the infection disseminates. Previous midge infection studies with the orbivirus epizootic hemorrhagic disease virus (EHDV) have shown that many genes associated with vision, memory and other behaviors were downregulated, while a few genes associated with olfaction were upregulated. Because vision is important for midges to navigate their environment and is key for vector surveillance via light trapping, virus alteration of these traits has significant implications on host seeking and disease risk assessment. We hypothesized that the reported effects of orbivirus infection on gene expression in midges would also be observed in rhabdovirus-infected midges. In this study, we used RNAseq to determine differential expression (DE) of genes in female *Culicoides sonorensis* infected with the rhabdoviral livestock pathogen, vesicular stomatitis virus (VSV). Midges were fed either blood meals spiked with media containing VSV or virus-free media (controls) and were collected 8 days post-ingestion. RNA was extracted and sequenced from pools of midges in 5 replicates. Overall, 65 genes were significantly (FDR > 0.05) differentially expressed between virus infected and uninfected midges. Many of these genes were associated with the innate immune system, as well several genes in association with olfaction, vision and other neuro-sensory functions. This information will give us valuable insight into altered sensory perception and neurological function of midges, which can inform behavioral phenotypic studies and ultimately better management methods.

CAN VIRTUAL REALITY BE USED TO TEST OLDER ADULTS ON DAILY ACTIVITIES PERFORMANCE?

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The number of people affected by cognitive disorders will increase in the next decades as the US population ages. Researchers need to find effective ways to test, train, and screen individuals affected by normal and abnormal aging processes. Virtual Reality (VR) technology could facilitate screenings by making tests real-life based and more accessible. The purpose of this research is to find out if VR can be used for daily activity testing and will compare real-life performance with VR performance. In this case study, a sorting task was replicated in a virtual environment to compare these two different settings in terms of task load, time, and effectiveness. Twenty college students participated in the study, and results showed a significant difference in time between conditions, with the VR condition taking significantly more time and having significantly higher variability than the real-life condition. The task was effectively completed by participants in both settings, but there were differences in time, strategy, and perceived task load when the two conditions were compared - even when considering learning effects. Participants considerably improved their VR times by the third trial with an average 24.1% improvement. Task load was reported to be higher for the VR task when compared to the real-life task. High levels of immersion and low levels of cybersickness were also reported. This research supports the important considerations when developing VR simulations for common daily tasks. Future research will evaluate differences between younger and older adults when performing VR tasks.

AGE-ASSOCIATED MICROBIAL STABILITY AND VOLATILITY SHAPE THE GUT MICROBIOME IN A HEALTHY PIG MODEL

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The gastrointestinal microbiome plays a critical role in swine health with implications on the sustainability and competitiveness of Kansas swine production. Microbes harbored in the gastrointestinal system are crucial for metabolizing dietary nutrients into utilizable sources for the host while also limiting pathogen invasion leading to disease. This study demonstrated how the swine gut microbiome, specifically bacteria and fungi, develop over a pig's life. Fecal samples from ten pigs were collected during three age-dependent stages: preweaning (0-3 weeks of age), nursery (3-11 weeks), and finishing (11-22 weeks). We performed bacterial 16S rRNA amplicon sequencing to determine diversity and identify taxonomy of distinct bacteria between growth stages, and qPCR for a swine fungus of interest (*Kazachstania slooffiae*). Our results indicated that the preweaning microbiome was relatively more different among the pig hosts as compared to the nursery and finishing aged swine. *Kazachstania slooffiae* abundance was highest immediately following weaning but decreased to a plateau during the middle of the nursery stage. Both the plateau of *Kazachstania slooffiae* abundance and bacterial convergence occurred in the middle of the nursery stage which indicated an interplay between bacterial and fungal establishment within the gut. Our study provided the foundation for future research to evaluate how bacteria and fungi interact with the swine host for diet metabolism, and maintenance of a healthy gut environment. This knowledge can be utilized to improve swine growth and pork production, such as through altered diets and therapeutics, for Kansas agriculture.

ACUTE ANAPLASMOSIS REDUCES BREEDING SOUNDNESS IN EXPERIMENTALLY INFECTED BEEF BULLS

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The causative agent of bovine anaplasmosis, *Anaplasma marginale*, costs the U.S. cattle industry an estimated $300 million annually. Anemia and fever during clinical anaplasmosis may reduce bull breeding soundness. The study objective was to evaluate breeding soundness outcomes and clinical changes in beef bulls during clinical anaplasmosis and after recovery. Six healthy, *Anaplasma*-negative, mature, Angus bulls of satisfactory breeding status were included. Blood from an infected donor cow was used to challenge three bulls, the other three remaining unchallenged controls. Fever, anemia (via packed cell volume, PCV), pallor, and icterus were monitored weekly in all bulls. Infection progression was evaluated via quantitative PCR and percent parasitized erythrocytes (PPE). Seroconversion was monitored by cELISA. Oxytetracycline was given to bulls with PCVs <15% or temperatures >105°F. Weekly breeding soundness examinations were performed on all bulls for 16 weeks. Breeding soundness parameters included sperm morphology and motility, external and internal genitalia, and physical exam. All *A. marginale*-challenged bulls were PCR-positive, seropositive, and clinical by 3-, 17-, and 24-days post-challenge, respectively. Clinical signs included weight loss, pallor, icterus and fever ($\geq$104.3°F). Anemia in all challenged bulls reached PCV nadirs $\leq$18% and peak PPEs $\geq$50%. Breeding soundness reductions were observed days after clinical onset and continued weeks beyond resolution of clinical anaplasmosis. Bulls in the control group remained negative for *A. marginale* by PCR and cELISA, and maintained consistent breeding soundness outcomes. Findings from this study suggest acute anaplasmosis is a driver of reduced breeding soundness in beef bulls.

KANSAS SOIL HEALTH PARTNERSHIP

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Soil health is proven to have wide-ranging benefits and is of increasing interest to farmers and agricultural stakeholders. Although no-till adoption has been growing, there is still relatively low adoption of cover crops. As soil health practices become more common, data on on-farm soil health metrics changes are needed to target middle and late adopters. The objective of this study is to measure and communicate the environmental benefits of cover crops. The Kansas Soil Health Partnership is a five-year project and currently involves four farms across the State of Kansas: (1) Solomon, (2) Bucyrus, (3) Beloit, and (4) Glen Elder. For this abstract, we will focus on results from site 1. Site 1 is located at the Knopf Farms and is in year three of five. The experimental design was four randomized and replicated strips (RCBD) of the farmer standard practice (no cover crop) and the improved practice (cover crop). Soil samples were taken on a GPS coordinated grid at 0-5 and 0-15 cm soil depth at the first (2019 - benchmark) and third (2021) year of the study. The soil health indicators measured were: β-glucosidase activity (βG), microbial biomass (MB), and arbuscular mycorrhizal fungi (AMF). We observed that cover crops increased all soil health indicators at 0-15 cm when comparing 2019 and 2021. The increments in βG, MB, and AMF were even higher at 0-5 cm. Cover crops have demonstrated a great potential for improving soil health across Kansas.

APPLICATION OF FLUORESCENCE SPECTROSCOPIC CHARACTERIZATION OF AN ALGAL BLOOM EVENT IN THE MILFORD GATHERING POND

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An increase in the frequency and geographic distribution of algal and cyanobacterial blooms has been observed over the last two decades, threatening marine and freshwater ecosystems. In situ fluorometers have been proposed for their potential to provide early warning of bloom development through the analysis of fluorescence signatures of the water. Despite the potential of the technology, there has been no in-depth analysis studying the fluorescence and 3-D excitation emission matrixes (EEMs) of an algal bloom in a waterbody experiencing an algal bloom with intensive monitoring. The Milford Gathering Pond in Geary County, KS experiences annual algal blooms that cause public access closures and affects the Kansas Department of Wildlife and Parks fish hatchery. An algal bloom at the pond was intensively monitored from April 2021 to November 2021. Various water quality parameters such as pH, turbidity, orthophosphate, total nitrogen, and total carbon were tracked and the 3D fluorescent EEM spectroscopy was analyzed. Preliminary findings have shown EEM intensity changes in the T1 and C1 fluorophores, which represent the Protein-like and Humic-like components respectively. Although subtle, early changes in the EEMs correspond with the onset of the bloom and the EEMs continued to change with the progression and increase in severity of the bloom. The findings show promise for a proactive and realistic algal monitoring tool which can be used by regulators and scientists alike for greater societal and environmental well-being.

DEVELOPMENT OF DURABLE ANODE ELECTROCATALYSTS FOR DIRECT METHANOL FUEL CELLS

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The increasing energy demand has attracted investigation of alternate energy fuels such as methanol. Methanol when produced from feedstocks is a renewable, carbon neutral fuel. Liquid methanol, as an anode fuel in Direct Methanol Fuel Cells (DMFC) possesses high energy density (6.08 kWh/kg). DMFCs can be deployed in transportation, portable electronics, and as stationary power supply systems. We report a study on the development of efficient, durable PtRu anode electrocatalyst on unique core-shell support architecture for high performance DMFCs. This core-shell support comprises of defective amorphous TiO_2 shell (~10 nm thick) conformally coated on oxygen functionalized nitrogen doped carbon nanotubes (ONCNT). Our electrocatalyst synthesis approach involves the utilization of low-cost microwave heating and post-synthesis thermal annealing in H_2 environment. The as-prepared nanostructured electrocatalyst, denoted as PtRu/TiO_2/ONCNT-400, was characterized using electrochemical voltametric techniques to determine the methanol oxidation activity and long-term stability. Our results revealed that the PtRu/TiO_2/ONCNT-400 demonstrates improved methanol oxidation reaction (MOR) with a mass activity of about 523.5 mA/mg_{Pt}, enhanced CO oxidation reaction kinetics and excellent stability for 500 cycles when compared to the state-of-the-art commercial PtRu/C anode catalyst. **CONCLUSION:** The ultra-thin amorphous TiO_2 shell provides a strong catalyst metal support interaction to offer excellent stability. It also provides surplus hydroxyl species to efficiently oxidize the reaction intermediates such as CO thereby reducing catalyst poisoning and enhancing the mass activity. Various high surface area carbon supports are currently being explored and the thickness of TiO_2 is being optimized to further improve the performance.

DOMINANT PRAIRIE GRASS CROSS-TRANSPLANTED ACROSS THE MIDWEST RAINFALL GRADIENT: RESPONSE TO DROUGHT

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Big bluestem (*Andropogon gerardii*) is a dominant, native, tall grass that is for critical cattle forage, conservation, and restoration. This grass has a wide geographic distribution across the Great Plains rainfall gradient (500-1200 mm rain/yr). Distinct wet and dry ecotypes, each adapted to its local regional climate, have been recognized. The objectives were to observe growth of big bluestem ecotypes that were cross-transplanted into wet and dry climates. We predicted that each ecotype would perform best in their home site, but perform poorly when foreign sites. Reciprocal gardens (cross-transplants) were established in 2010 and growth was monitored over time until 2021 in four garden sites (Colby, Hays and Manhattan, KS to Carbondale IL). To specifically examine the effects of drought, rainfall was reduced by 50% using rainout shelters in three sites. Cover was measured to estimate growth. By 2021, the wet ecotype had 54% less cover than the dry ecotype in Colby but had 43% more cover in Illinois. In contrast, the dry ecotype cover is lower in Illinois but higher western Kansas. These results confirm that wet and dry ecotypes perform best in their home environments. Interestingly, the mesic ecotype had intermediate cover (~40%) in all four sites. Experimental rainfall reduction resulted in increased cover in the dry ecotype in Illinois. These results indicate the prominent role of ecotypes across the natural and experimental rainfall conditions. Thus, restoration should consider the use of climate-adapted ecotypes in anticipation of future droughts.