RESEARCH AND THE STATE

GRADUATE STUDENT POSTER SESSION

OCTOBER 31, 2011
K-STATE STUDENT UNION, WEST BALLROOM

Sponsored by:
Graduate Student Council
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Program Schedule

FIRST ROUND OF POSTER JUDGING 9:00 AM to 11:00 AM

Research posters will be presented by 32 graduate students representing 21 academic disciplines at K-State. The top 16 presenters will be selected to compete in the second round of judging.

SECOND ROUND OF POSTER JUDGING 1:00 PM to 3:30 PM

The top 10 of 16 graduate student poster presenters will receive awards and will be selected to represent K-State by presenting their posters at the 9th annual Capitol Graduate Research Summit (CGRS) at the State Docking Building in Topeka on Thursday, February 16, 2012.

The CGRS is an annual showcase of research conducted by graduate students from Kansas State University, Wichita State University, the University of Kansas, and the University of Kansas Medical Center. Participants have the opportunity to present their research posters to state legislators, the governor, and the Board of Regents. Awards will be presented to the top two presenters from each institution.

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Poster Abstracts

N_2O-N EMISSIONS AND THE RELATIONSHIP WITH DENITRIFYING ENZYME ACTIVITY IN CORN UNDER DIFFERENT MANAGEMENT STRATEGIES

Miguel Arango, Charles Rice, Amy Vu
Department of Agronomy, College of Agriculture

Management strategies for N fertilization and tillage are necessary for enhancing N use efficiency and reducing the negative impacts of N to the environment. The objectives of this research were to (1) quantify N_2O-N emission under no-tillage (NT) and tilled (T) agricultural systems, (2) determine the effect of different N source (Manure (M) and Urea (U)) on N_2O-N emissions, and (3) evaluate Denitrifying Enzyme Activity (DEA) under no-tillage systems. Nitrous oxide emissions and DEA were evaluated during the summer of 2011 on a Kennebec silt loam. The results were statistically analyzed using SAS 9.2 (SAS Institute, 2010). The N_2O emissions were significantly different with regard N source and tillage. M presented higher emissions which accounted for 8.2 kg N_2O-N ha^{-1} during the growing season whereas U had 3.4 kg N_2O-N ha^{-1}. The high emissions from M affected the overall emissions in NT systems. The cumulative value of NT and T systems were 7.8 and 3.8 kg N_2O-N ha^{-1}, respectively. DEA was higher in M than U treatment under both, T and NT systems. Under NT the DEA values were 1.05 and 0.18 µg N_2O-N g^{-1} hr^{-1} for M and U, respectively. Under T the DEA values were 0.67 and 0.18 µg N_2O-N g^{-1} hr^{-1} for M and U, respectively. The C:N ratio of the manure played a key role in the biochemical activities that enhance the N_2O production such as DEA. Results from previous years at the same location had lower emissions with M presumably due to changes in C:N ratio of the organic fertilizer.

Relevance of Research to State-Related Topic(s)

Nitrogen is critical for plant growth and is a major cost of inputs in production agriculture. Too much N is also an environmental concern, among others due to the N_2O emissions. Strategies to reduce N emissions should result in improved efficiency thus lowering input cost and producer profitability.

NITROUS OXIDE EMISSIONS IN DIFFERENT BIOFUEL CROPPING SYSTEMS

Andrew McGowan[1], James Inouye[2], Charles Rice[1]
[1]Department of Agronomy, College of Agriculture; [2]Department of Engineering, Seattle Pacific University

The 2007 Energy Independence Security Act mandates the production of 80 billion liters per year of advanced biofuel, including cellulosic ethanol, by 2022. These biofuels are required to have Life Cycle Analysis (LCA) emissions 50% below those of gasoline/diesel. Therefore, it is important to identify crops for biofuel feedstock that provide maximum biomass with minimal greenhouse gas emissions. Nitrous oxide (N_2O) is a potent greenhouse gas (GHG), having a global warming potential 298 times that of carbon dioxide. The IPCC estimates agriculture contributes 65-80% of total anthropogenic N_2O emissions. Much of this N_2O is produced by microorganisms in the soil. Therefore, accurate estimates of N_2O emissions from soils under different biofuel crops are essential in evaluating the GHG balance of biofuel produced from different feedstocks. This project monitored annual soil N_2O emissions from four biofuel crops using a chamber-based technique during the 2011 growing season in Manhattan, KS. After 108 days, the cumulative flux was 3.56, 2.96, 2.71 and 1.62 kg N_2O-N/ha for photoperiod sensitive sorghum, corn, switchgrass and miscanthus, respectively. A significant interaction was found between mean daily N_2O flux, crop type and sampling date. The highest mean daily fluxes for all crops occurred after a series of large precipitation events in early June when soil moisture, soil temperature and soil inorganic nitrogen concentration were all relatively high. Future work will compare these findings to model simulations and examine how the observed N_2O fluxes affect LCA emissions of biofuel produced from the studied crops.

Relevance of Research to State-Related Topic(s)

To help meet the mandates in the 2007 Energy Security Act, the Department of Energy is contributing funding to the construction of several cellulosic ethanol plants throughout the United States, including the Abengoa Bioenergy Plant in Hugoton, Kansas. Farmers who sign contracts to provide biomass to cellulosic plants will be looking at growing a variety of crops to fulfill their contracts. In Kansas, corn, photoperiod sensitive sorghum, switchgrass and miscanthus are four crops being promoted as potential sources of cellulosic feedstock. However, the impacts these four crops have on GHG emissions, especially nitrous oxide, from soils could vary greatly and could have implications on the effectiveness of biofuel in mitigating GHG emissions. This study aims to measure nitrous oxide emissions from soils grown in corn, photoperiod sensitive sorghum, switchgrass and miscanthus. These measurements will be essential for developing accurate estimations of GHG emissions for these crops in Central Kansas.

3

WITHIN-PLANT DISTRIBUTION IMPACTS CABBAGE APHID (*BREVICORYNE BRASSICAE)* REPRODUCTIVE POTENTIAL ON WINTER CANOLA

Ximena Cibils Stewart and Brian P. McCornack
Department of Entomology, Collage of Agriculture

The cabbage aphid (*Brevicoryne brassicae*) is a perennial pest that specializes on plants of the Brassicaceae family. Feeding damage observed in winter canola (*Brassica napus*) can result in seedling death, curling, yellowing, stunting, or virus transmission; all of which can alter seed quality and reduce yield up to 33%. The cabbage aphid attacks canola before and during flowering, typically colonizing the new growth areas of the plant or the upper flowering canopy. This colonizing behavior can be induced by intrinsic characteristics of the host plant (bottom-up effects) such as nutritional value, secondary compounds, morphology, or plant architecture. However these considerations and their relationship to cabbage aphid population dynamics need further study. Therefore, our goal was to evaluate how within-plant distribution impacts cabbage aphid reproductive potential on different canola plant structures. Specifically, we restricted aphid localization using two types of exclusion cages. Cages enclosed either the flowering raceme, or a single leaf in the lower canopy. Each cage was inoculated with two, newly-reproductive adult cabbage aphids. This study was replicated in the field at Ashland Bottoms Research Farm near Manhattan, KS and in plants grown under controlled greenhouse conditions. Aphid populations remained in all exclusion cages for 3 weeks before they were removed; plant material was bagged and aphid densities were recorded in the laboratory. Preliminary results suggest that within-plant distribution of the cabbage aphid directly affects aphid population density with higher growth rates observed on reproductive canola structures. Direct implications for pest management and sampling plans will be discussed.

Relevance of Research to State-Related Topic(s)

Winter canola is a profitable first generation biodiesel crop (yields >40% oil) that yields up to 1600 lbs/acre (price ranging from 11-27 cents per pound) and is suitable to use in rotation with winter wheat. This crop contains the lowest levels of saturated fat and the highest levels of omega-3 fat among cooking. Because of its promising economic, health, and rotation potential, canola acreage has increased to over 40,500 hectares in the south-central US in the past decade. However, since the introduction of winter canola to the region, producers have battled with severe aphid infestations, that can account for as much as a 33% reduction in yield. Due to the lack of information on canola aphids, producers are reliant on chemical control to avoid yield loses. This study addresses the biology of the pest in KS canola, which is essential in the development of appropriate management strategies.

4

GARDENING ON ARSENIC AND LEAD-CONTAMINATED BROWNFIELDS: IS IT SAFE?

Phillip Defoe[1], Ganga Hettiarachchi[1], Chris Benedict[2], Chammi Attanayake[1], Sabine Martin[3]
[1]Department of Agronomy, College of Agriculture; [2]Washington State University Extension, Washington State University; [3]Center for Hazardous Substance Research, College of Engineering

Increased food prices have led to the transformation of brownfields located in older industrialized cities of the US to some productive use despite being challenged by environmental contaminants. Gardening on raised beds has been a popular but expensive approach. In 2010, we established a test plot on a moderately acidic loamy sand soil containing elevated levels of lead (Pb) and arsenic (As) in Tacoma, WA. The main objectives were to conduct site-specific research on food-chain transfer of soil contaminants, and provide technical assistance for community gardening initiatives in different geographic areas of the country. Specific objectives were to evaluate plant uptake of As and Pb by three different vegetable crops, and the effectiveness of soil amendments on reducing plant availability and bioaccessibility of these contaminants. The experimental design was a randomized complete block with split plot arrangement. The main plot factor was Tagro mix (a blend of biosolids, sawdust and screened sand) applied at 2 levels (zero/control and ~ 1/3 of Tagro: soil mix). Lettuce, carrots, and tomatoes grown and harvested upon maturity, were tested for total Pb and As concentrations following "kitchen-style washing" and a laboratory cleaning procedure. Average soil Pb and As concentrations for control plots ranged from 166-172 mg/kg and 82-86 mg/kg, while Tagro added plots ranged from 160-204 mg/kg and 58-88 mg/kg, respectively. Lead concentrations in all three crops with/without Tagro treatment ranged from 0.5 to 45.8 mg/kg while As concentrations were below 0.2 mg/kg(dry weight basis).

Relevance of Research to State-Related Topic(s)

The presence of blighted sites across the Kansas City and metropolitan areas has increased significantly due to the severe economic downturn. Minority groups (~33% of Kansas City residents) suffer with high unemployment (>50%) and increased food prices. Gardening on vacant brownfields for subsistence use is on the rise. Many of these brownfields have elevated levels of common soil contaminants that have the potential of becoming bioavailable if best management practices are not followed. Our research provides urban gardeners of Kansas and beyond with pertinent and cost effective treatment measures, cleaning protocols and other best management practices. The potential for food-chain transfer of these contaminants via sensitive crop types is also assessed to ensure that produce meet food quality and safety standards.

5

MOISTURE AND OIL UPTAKE DURING PROCESSING OF SOY-BASED EXTRUDED SNACKS

Swathi sree Kodavali, Sajid Alavi
Department of Grain Science and Industry, College of Agriculture

Oil or lipids comprise 20-40% of the weight of most savory snack products. These products also usually have high amounts of refined carbohydrates and low protein content. This study focused on a novel high protein soy-wheat based composite snack produced using extrusion followed by a combination of soaking and frying. The primary hypothesis was that water and oil transfer during processing was impacted by the presence of soy proteins and additives in the extruded matrix. The overall objective was to optimize soaking and frying conditions using experimental methods and to develop healthier, novel soy based savory snack. Extruded soy-wheat pellets were produced using twin screw extrusion with different ratios of soy to wheat flours (25:75, 50:50, 75:25). Monoglycerides, added at levels of 0.375 and 0.75% were evaluated. Sodium bicarbonate at 0.5% was also tested. Optimum soaking times of 60-75min and frying times of 2.5-3.5min were determined. Water holding capacity (WHC) and oil uptake of composite snacks were decreased by 0.05-5.6% and 17.2-21.9% respectively, with the increase in monoglycerides from 0.375 to 0.75%. WHC and oil uptake decreased by 16.7% and 23.1-30.6% respectively, with increase in soy from 25 to 75%. Oil uptake data was verified with the crude fat measurements. Consumer acceptance study was conducted to test acceptability of these extruded snacks. Mechanism of oil uptake was explained based on water absorption capacity and starch protein composition. Incorporation of high levels of soy in extruded pellets helped to produce savory snack that are rich in protein and low in fat.

Relevance of Research to State-Related Topic(s)

Savory snacks are most widely consumed in United States and are of high oil and caloric content. With the increase in health related issues (obesity, diabetes, chronic diseases) and growing consumer demands for nutritious and wholesome foods there is a need to develop healthier snacks. Most research and development efforts are focused towards products that are low in refined carbohydrates, fat and high in protein and/ or fiber. This study is a step in the same direction and focuses on the development of a soy-based high protein savory snack product. This research project is funded by Kansas Soybean Commission and will benefit soybean farmers and producers in Kansas. International market development for these nutritious and value added products will increase the focus on utilizing Kansas soybeans.

6

DEFINING AND CHARACTERIZING THE "NUTTY" ATTRIBUTE ACROSS FOOD CATEGORIES

Ashley E. Miller[1], Alicia Jenkins[1], Edgar Chambers IV[1], Delores H. Chambers[1], and Jeehyun Lee[2]
[1]Department of Human Nutrition, College of Human Ecology; [2]Hospitality Management, Culinary Arts, and Food Science, Drexel University

The term, "nutty," has been used to describe an array of foods including many outside the realm of nuts. However, it is not clear if "nutty" is a single term or if it takes various forms, depending on the type of product. The objective of this study was to determine whether a single nutty term could be used to describe nuttiness in all food products or if additional terms were needed. More than 200 products with potential nutty flavor, including nuts, spreads, grains/cereals, seeds, beans/legumes, oils, cheeses, fish, and beverages, were studied. Five "nutty" concepts were found and described with terms, definitions (with references), and intensity ratings: Overall Nutty, Nutty-Beany, Nutty-Buttery, Nutty-Grain-like, and Nutty-Woody. These attributes are single concept attributes that described subgroups of nuttiness. Terms, such as peanut or almond, that describe a certain type of nut but are separate from the "nutty" character were excluded intentionally. A second descriptive panel was used to review the lexicon. This panel used this lexicon to describe a set of 10 products (nuts, grains, beans, seeds, cheeses) to determine if any additional attributes were needed to describe nuttiness. All of the products displayed varying intensities of the nutty attributes, and the panel found no additional terms for the "nutty" component were needed. The development and verification of the lexicon can assist in product development and quality assurance when describing foods with a "nutty" attribute. These terms can be applied across all food categories and is not exclusive to characterizing nuts.

Relevance of Research to State-Related Topic(s)

Consumers eat specific foods due to their palatability and unique sensory properties. This lexicon can be used as a tool by researchers, breeders, food industry workers, manufacturers, and marketers to better market and sell their products. Kansas has many native crops such as wheat, corn, sunflower seeds, black walnuts, pecans, and sorghum that all have nutty characteristics. As a result of better characterizing these food crops, Kansas breeders and manufacturers can identify which cultivars have the potential to perform well in the marketplace and bring more profit to their farm or business. Also, by more accurately describing the foods' sensory properties, the appeal of these products for end-users can be enhanced, thus leading to greater consumption and improved health, both physically and economically, for the people and state of Kansas.

7

HIGH QUALITY SEED AS A MAIN FEATURE FOR AGRICULTURAL IMPROVMENT

Rodrigo Pedrozo and Christopher R. Little
Department of Plant Pathology, College of Agriculture

The mechanisms of infection, transmission and precise methods for diagnosis of important soybean seed pathogens, such as *Fusarium* spp. and *Phomopsis longicolla* require further study. The objectives of this work were to determine the identity of seedborne pathogens of soybeans in Kansas. Eight locations and 7 varieties from Kansas were sampled and as a result a total of 78 fungal isolates, including both pathogens, were isolated from soybean seeds. The multi-location screening efforts showed that most *Fusarium* spp. were isolated from soybean seed produced in Cherokee county (southeast Kansas), followed by seed from sites in Pottawatamie, Republic, Reno, and Franklin counties. The soybean variety, KAES 4607, had the highest infection of *Fusarium* spp. and *Phomopsis longicolla*. This variety yielded 11% *Fusarium* spp. on potato dextrose agar and 26% on pentachoronitrobenzene media, whereas *Phomopsis longicolla* was recovered at a rate of 4 and 2.5% on the same media, respectively. *F. proliferatum*, *F. oxysporum*, and *F. fujikuroi* have been identified based upon morphological characters and DNA-based molecular detection methods. The next step of the work is to test and score isolates regarding their pathogenicity and virulence. Additional material is being collected from this year's harvest (2011) to broaden isolate sampling. In future studies, these isolates will be used to elucidate the mechanisms of infection and transmissibility of *Fusarium* spp. and *P. longicolla*, use reporter markers (GFP, RdRFP) to trace pathogens through the plant, and develop a precise molecular diagnostic tool for identification of soybean seed pathogens for seed health testing.

Relevance of Research to State-Related Topic(s)

Soybean is one of the most important crops grown in United States. In Kansas, soybean is one of the most important commodities with a receipt of 1.5 billion dollars last year. Although production has increased over time, the improvement of soybean productivity is not only related with the total area used or planted but it is also related with some important agricultural features such as the usage of high quality seeds. One of the most relevant reasons for that is mostly due the fact that the major part of plant pathogens found on this cash crop can be and actually are transmitted by seeds. However, some essential knowledge regarding the interaction between these pathogens and seeds, such as the mechanisms of infection, transmissibility and identity of these pathogens is not clear, which makes this project unique and indispensable for state agricultural development

8

AGRICULTURAL PRODUCERS' ACREAGE AND YIELD RESPONSES USING VARIOUS EXPECTATIONS

David Boussios, Andrew Barkley
Department of Agricultural Economics, College of Agriculture

This research identifies and quantifies the impact of biophysical and economic variables on Kansas crop acreage and yields for the period 1977- 2007. Due to long production times, agricultural producers must make vital decisions with imperfect information, based on expectations of future agronomic and economic conditions. This research analyzes the impact of prices, climate, and yield expectations on crop acreage allocations and yield responses for the four major commodities produced in Kansas: corn, soybeans, what, and grain sorghum (milo). By modeling and analyzing both biophysical and economic variables, total supply response can be estimated for potential future changes in prices, yields, climate, and weather outcomes. The analysis of both biophysical and economic conditions allows for the estimation of supply response in the short and long run. The results provide updated, more precise results than previous research which has often separated acreage and yield functions, despite the interrelationship between the two.

Relevance of Research to State-Related Topic(s)

This research is important for the State of Kansas, since it provides insight into the response of agricultural production of the four major commodities to both climate/weather and economic changes. Accurate estimates of the response of crop production to these conditions are crucial to predict and understand the impact of government policies and programs, including taxes and subsidies, on the Kansas agricultural sector. This is of particular importance in recent years due to a large investment in the ethanol industry, and increasing weather volatility. Expanding crop acres and changes in crop mix have important implications on rural incomes and local environments.

9

VALIDATING THE FUNG DOUBLE TUBE FOR USE WITH BROILER CHICKEN INTESTINAL CONTENTS

Miguel A. Barrios, Jasdeep Saini, Chris M. Rude, R. Scott Beyer, Daniel Y.C. Fung
Department of Animal Sciences & Industry, College of Agriculture

Clostridium perfringens is an anaerobic, spore-forming bacterium, which causes necrotic enteritis, resulting in decreased feed efficiency and increased mortality in chickens. It is estimated that *C. perfringens* infects nearly one million people in the US every year. The purpose of this study was to validate the Fung Double Tube (FDT) method to detect and enumerate *C. perfringens* in chicken intestinal contents. Eighteen broilers were selected and euthanized at 21 and 42 days of age. The jejunum and ileum were harvested and inoculated into two methods and three different media arranged in a 2 x 3 factorial for a total of six treatments. The two methods were FDT and petri plates, and the three media consisted of: Shahidi Ferguson Perfringens (SFP) with egg supplement, polymyxin B (p), and kanamycin (k) (E); SFP with p and k (P); and SFP with cycloserine (C). At 21 days of age, counts using media C with FDT (4.51 log colony-forming units, CFU/g) and plates (1.58 log CFU/g) were higher ($P<0.05$) than using media E or P. At 42 days of age, there were no differences among plate treatments and media E had the highest counts (0.75 log CFU/g). Out of all the FDT, media C (5.35 log CFU/g) had the highest counts, followed by media P (3.54 log CFU/g). The FDT has been shown to detect *C. perfringens* at similar and higher levels than petri plates; therefore, this method should be implemented and further explored by laboratories around the world.

Relevance of Research to State-Related Topic(s)

Clostridium perfringens is ubiquitous. Outbreaks are most commonly found when food, especially meat products, is prepared and served in large quantities. Institutions like school cafeterias, nursing homes, and hospitals are at particular risk because of their need to feed hundreds of people at a time. These venues not only target large groups of people, but also the more vulnerable demographics. Poultry houses diagnosed with necrotic enteritis, caused by *C. perfringens*, experience poor growth performance. This disease has been estimated to cost $2.6 billion every year worldwide. Necrotic enteritis also afflicts bovine cattle causing increased mortality. This research could be applied to other species, and has the potential to aid veterinarians in identifying *C. perfringens*. The Fung Double Tube method is effective, inexpensive, rapid, and selective providing a novel instrument to detect and enumerate *C. perfringens*.

10

SHELF LIFE OF FIVE MEAT PRODUCTS DISPLAYED UNDER LIGHT EMITTING DIODE OR FLUORESCENT LIGHTING

Kyle S. Steele[1], Melissa J. Weber[2], Elizabeth A.E. Boyle[1], Melvin C. Hunt[1], April S. Lobaton-Sulabo[1], Curtis Cundith[2], Yoelit H. Hiebert[3], Karen A. Abrolat[3], Joel M. Attey[3], Sherri D. Clark[3], Dallas Johnson[1], and Tawnya L. Roenbaugh[1]

[1]Department of Animal Sciences and Industry, College of Agriculture; [2]Cargill, Wichita, KS; [3]Hussmann Corporation, Bridgeton, MO

Light Emitting Diode (LED) lighting used in retail display cases offers economical savings in energy use and generates less heat compared with fluorescent (FLS) lighting. A total of 144 beef, pork, and poultry products displayed in two retail display cases set up with the same temperature profiles were evaluated for visual color, instrumental color, aerobic plate counts (APC), *Enterobacteriaceae* counts (EB), display case and internal product temperatures and thiobarbituric acid reactive substances (TBARS). Visual color scores of the five meat products indicated color deterioration increased as display time increased. Beef *longissimus dorsi* steaks, ground beef, and the superficial portion of beef *semimembranosus* steaks had less ($P<0.05$) visual discoloration under LED lighting than FLS. Pork loin chops under LED lighting had higher ($P<0.05$) L* values. The superficial and deep portions of beef *semimembranosus* steaks were slightly ($P<0.05$) more intense red under LED lighting. Lighting type had no effect ($P>0.05$) on APC or EB populations. For most products, microbial populations increased over time. All internal product temperatures, except beef *longissimus dorsi* steaks, were lower ($P<0.05$) in the LED case. Compared with the LED case, FLS case temperatures were higher ($P<0.05$) by 0.56 to 1.11 °C over the duration of the study. Pork loin chops, ground turkey, and beef *semimembranosus* steaks had higher ($P<0.05$) TBARS values under LED lighting. Retail display case LED lighting results in lower case and, for most products, internal product temperatures and extended color life; however, lipid oxidation was increased in some cuts under LED lighting.

Relevance of Research to State-Related Topic(s)

Meat retailers in Kansas display products in self service retail cases under different lighting types. Lighting sources can influence the rate of meat discoloration on display. When discoloration of the meat products reaches a certain point, customers will no longer pay the full price for the product. Discolored products must either be reduced in price or discarded completely resulting in losses for the retailer. Light emitting diode (LED) lighting holds the potential for extending fresh meat color through benefits in operating conditions. Fresh meat color and other shelf life properties were evaluated on pork loin chops, beef loin steaks, ground beef, ground turkey, and beef inside round steaks. Results of this study provide meat retailers knowledge and technology to maximize fresh meat color stability and reduce any financial losses. Conclusions suggest retailers display fresh beef products under LED lighting to extend product color life.

11

GLYPHOSATE-RESISTANT KOCHIA IN KANSAS

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Glyphosate is the most widely-used herbicide in the world and is the major component of chemical weed control in fallow and Roundup Ready corn, cotton, and soybean crops in Kansas. Complaints of poor kochia (*Kochia scoparia*) control with glyphosate in western Kansas have increased in recent years. We visually surveyed and determined the level of kochia infestation, control practice employed by farmers, and herbicidal control effectiveness in nearly 1600 wheat stubble fields in the western half of Kansas in 2011. By the first week of August, 49% of wheat stubble fields had been sprayed with herbicides and 30% of the fields had been tilled. Nothing had been done in 21% of the fields post-harvest. A high proportion of the non-controlled fields had been sprayed with herbicide by the end of August, whereas the proportion of the tilled fields remained nearly the same. Of the sprayed fields, 4% were heavily infested, 52% were moderately infested, and 44% were lightly infested with kochia. Control of kochia in 1, 28, and 71% of infested fields was rated poor, fair, and good or excellent, respectively. A shikimate accumulation assay to determine resistance to glyphosate was performed on excised leaf discs of kochia plants from 44 randomly sampled fields. One-fourth of the populations showed moderately-high to high levels of resistance to glyphosate. This confirms the suspected wide-spread presence of glyphosate-resistant kochia throughout western Kansas and reinforces the need for growers to adopt alternative control strategies to mediate the problem.

Relevance of Research to State-related Topic(s)

Kansas is an important agricultural state and ranks seventh among states for total U.S. agricultural production. Herbicidal weed management has been a common practice in Kansas agriculture for decades. In recent years, famers increasingly have experienced difficulty in controlling kochia using common weed management practices centered around glyphosate. Kochia is adaptive to dry condition and its presence in western Kansas is significant. Confirmation of wide-spread presence of glyphosate-resistant kochia highlights the need for growers to adopt alternative weed management strategies to mediate the threat to farm sustainability and gains in soil and water conservation achieved over the past decade.

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GENETIC DIVERSITY IN *FUSARIUM THAPSINUM* ISOLATES FROM KANSAS

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Fusarium thapsinum, the causative agent of grain mold and stalk rot of sorghum (*Sorghum bicolor*) is characterized by the production of yellow pigments on lab media. However, pigmentation is variable in *F. thapsinum* strains, with some strains producing no pigment or violet pigments in the agar. Thus morphological variability in this species may reflect genetic and pathogenicity variation. The objective of this study was to evaluate genetic diversity in strains of *F. thapsinum* and to evaluate how this variability reflects on pathogenicity to sorghum seedlings. Amplified fragment polymorphisms (AFLP) analysis using *EcoR1*-TT and *Mse1*-AC was used to evaluate genetic diversity in 200 *F. thapsinum* strains isolated from different sites within Kansas. Preliminary results suggest a limited genetic variation in isolates of *F. thapsinum* from Kansas. Furthermore, isolates fell into different phylogenetic clades irrespective of their site of origin. This could be explained by the low sexual recombination that occurs in *F. thapsinum* field populations. Low female fertility in this species plays a role in the low rate of sexual recombination in field populations. In addition, we predict that there will be a difference in pathogenicity to sorghum seedlings by yellow-pigmented (YP) vs. non-pigmented (NP) strains of *F. thapsinum*. This may suggest that pigment production has a pathogenicity advantage in *F. thapsinum* strains. The results from this study suggest that any genetic variation or variability in pigmentation formation has the potential of allowing sub-populations within *F. thapsinum* to overcome currently deployed resistance towards grain mold and stalk rot of sorghum.

Relevance of Research to State-Related Topic(s)

Grain sorghum is one of the most important crops in Kansas making the state the top producer of grain sorghum in the United States. Not only is grain sorghum important as livestock feed, but its market is expanding as an alternative energy source (ethanol production). Diseases such as grain mold and stalk rot caused by *F. thapsinum* greatly affect sorghum yield. Therefore, our research aims to better understand the biology of this pathogen and its interactions with the host-plant. In the end, our results will contribute not only to the scientific knowledge of the biology of *F. thapsinum*, but also in understanding the disease management and control strategies that can be implemented to improve sorghum yield.

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EFFECT OF SUBSTITUTED QUINOLINE, PQ1, ON INDUCTION OF APOPTOTIC SIGNALING PATHWAY IN BREAST CANCER CELLS

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Cancer is a serious disease which is in part caused by gene mutation and cell homeostasis disruption, leading to deficiency in apoptosis (a programmed cell death) and uncontrollable cell growth. Activation of apoptotic signaling pathway is a widely accepted effective approach to treat cancers as well as a target for drug development. Substituted quinoline PQ1, a gap junction enhancer, is reported to have a significant antitumor effect on human breast cancer cells. Previous studies showed that PQ1 increased caspase-3, a pro-apoptotic protein, in T47D breast cancer cells, suggesting a possible involvement of PQ1 in apoptotic signaling pathway. However, how PQ1 mediates apoptotic pathway is still unclear. In this research, both of the apoptotic pathways (intrinsic and extrinsic) in T47D breast cancer cells were studied. Our results demonstrated that both extrinsic pathway reporter caspase-8 and intrinsic pathway checkpoint protein caspase-9 were increased by PQ1 treatment, indicating the function of PQ1 on induction of the two pathways. Studies of the Bcl-2 family proteins in mitochondrial pathway (intrinsic) showed that PQ1 enhanced the expression of Bax, a pro-apoptotic protein. However, PQ1 had no effect on the expression of Bcl-2, a pro-survival protein. These results further implied possible function of PQ1 on cytochrome c release from mitochondrion. Combined with previous animal studies showing that PQ1 significantly reduced 70% tumor growth in xenograft tumor of T47D cells, current study provides a greater understanding of the mechanism of PQ1 in apoptotic pathways in breast cancer cells.

Relevance of Research to State-Related Topic(s)

Breast cancer is a very serious disease that threatens the health of women. It is the second leading cause of cancer death among women in the US also in Kansas State. From 2003 to 2007, the age-adjusted incidence and death rates for breast cancer in Kansas are 476.0 and 182.7 per 100,000 population respectively, which are higher than the average rates in the US. Out of 14,070 new cancer cases estimated in 2011 for Kansas, 1890 cases are breast cancer, among which 370 people are estimated to die. Thus, development of new drugs to treat breast cancer is needed to improve women health in Kansas. Our research provides a promising molecule for drug development. Compared with other anti-cancer drugs that only trigger one pathway of apoptosis, PQ1 can trigger both intrinsic and extrinsic pathways, which makes PQ1 a very effective anti-breast cancer candidate.

14

GOING GLOBAL: A TALE TOLD BY TWO GRASSLAND BIRD SPECIES

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Reduced quality of nesting habitat and facilitated spread of infectious diseases, due to anthropogenic changes in the North American tall-grass prairie, have had negative effects on grassland dependent species (Greater Prairie-chicken, Upland Sandpiper). Avian malaria is caused by *Plasmodium*, a protozoan blood parasites that is transmitted via mosquitoes. Using molecular detection tests, we confirmed the presence of avian malaria in Greater Prairie-chickens and Upland Sandpipers that nest sympatrically in the Flint Hills of Kansas. While both exhibit different ecologies (one is migratory, one is not), a shared habitat during the breeding season creates potential for disease transmission. During migration Upland Sandpipers encounter different habitats, including the tropics, which have been associated with higher levels of pathogens than regions in higher latitudes. As a result we expected the Upland Sandpiper to exhibit a higher prevalence and diversity of blood borne pathogens than the Greater Prairie-Chicken. In addition, since both species nest sympatrically, we predicted that vector-borne pathogens would be exchanged among species. We screened a total of n=1225 Prairie-chickens and n=605 Sandpipers for avian malaria using polymerase chain reaction to amplify DNA of blood-borne pathogens. Positive samples were sequenced. We found that the majority of *Plasmodium* infections were haplotypes unique to each species, but we also found haplotypes shared between the two avian species suggesting transmission of *Plasmodium* has occurred in the Flint Hills. Furthermore, a comparison between these birds indicated that Upland Sandpipers did in fact have a higher prevalence and genetic diversity of *Plasmodium* than did the Greater Prairie-chicken.

Relevance of Research to State-Related Topic(s)

Declines in grasslands worldwide have lead to an increased loss in biodiversity, catapulting this ecosystem at the forefront of conservation ecology. In North America grasslands have largely been converted to agricultural lands and/or fragmented by human activities. Kansas with its large remaining patches of grassland has been considered the stronghold of obligate grassland species such as the Greater Prairie-chicken. Native as well as migratory species utilize our grassland ecosystems, making it a 'global' melting pot. However, increasing fragmentation, may have given rise to increased vector abundance and spread of infectious diseases in our grassland. Monitoring the spread of these diseases, for example avian malaria, is an integral aspect of conservation, which not only has an impact on the native fauna but has potential implications on a global level.

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EFFECT OF ALFERON N INJECTION (INTERFERON ALPHA) ON INFLUENZA A VIRUS REPLICATION *IN VITRO*

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Influenza A virus is an important respiratory pathogen which can affect public health, especially during pandemic episodes. Current strategies to combat influenza are vaccination and anti-viral drugs. Since influenza viruses change constantly via antigenic drift and antigenic shift, vaccines might be not protective and resistance to antiviral drugs can be easily achieved. Interferon alpha (INF- α) plays an important role as a first line of innate anti-viral immunity. To investigate the anti-viral potency of exogenous applied INF- α on the replication of various influenza A viruses, 3 subtypes of influenza A virus, i.e. H3N2, pandemic H1N1, H9N2 were chosen to study their replication kinetics in the presence of Alferon N injection (Human Interferon alpha) on human epithelium (A549) cells and swine testis (ST) cells. We found that the replication ability of all 3 viruses is inhibited when ST cells were pretreated with Alferon for 4 hours before infection. The ability of Alferon to inhibit influenza replication is dose-dependent. Similar results were obtained when A549 cells were used, and pretreatment of A549 cells with Alferon for more than 16 hours was necessary before infection. In summary, these results demonstrated that Alferon has the ability to inhibit replication of different strains of influenza A viruses *in vitro*. Our study build the basis for future in vivo study on using exogenous INF- α treatment as an alternative strategy to combat influenza A virus infection especially in patients infected with influenza strains which are resistant to common anti-viral drugs.

Relevance of Research to State-Related Topic(s)

Influenza is a globally important respiratory pathogen causing annual epidemics and the occasional pandemic. Over the centuries there have been several influenza pandemics resulting in loss of human lives. The famous "Spanish flu" killed 12,000 alone in Kansas and more than 20 million worldwide. The next influenza pandemics are inevitable and estimated to cause 4,600 to 10,700 hospitalizations and 1,100 and 2,500 deaths in Kansas alone according to WHO and CDC. So it is very crucial to find out effective ways to treat the patients who are infected and to protect the welfare of the people in Kansas and worldwide. With emergence of influenza virus strains resistant to existing antiviral drugs there is an urgent need to develop alternative ways to treat these infections. Results of our study provide promising direction for future *in vivo* studies to find out alternative strategies to cope with influenza infection.

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GAP JUNCTION ENHANCER INCREASES EFFICACY OF CISPLATIN TO ATTENUATE MAMMARY TUMOR GROWTH

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Cisplatin treatment has an overall 19% response rate in animal models with malignant tumors. A new class of substituted quinolines (PQ) possesses inhibitory activities against breast cancer cells through the enhancement of gap junctional intercellular communication. Restoring cell communication is linked to drug sensitivity and reduction of tumorigenicity. The objective of this study was to examine the effect of a combinational treatment of PQ and cisplatin in an animal model to show an increase in efficacy via the enhancement of gap junctions. Mice were implanted with estradiol-17ß (1.7 mg/pellet) before the injection of 1 x 10^7 T47D human breast cancer cells subcutaneously into the inguinal region of mammary fat pad. Animals were treated intraperitoneally with DMSO (control), Cisplatin, PQ, or a combining treatment of Cisplatin and PQ. Cisplatin alone decreased mammary tumor growth by 34% while combinational treatment of Cisplatin and PQ showed a 60% reduction after 7 treatments at every 2 days. There was a significant increase of gap junction proteins in PQ-treated tissues compared to control or cisplatin alone, indicating an increase in gap junction intercellular communication. There was also evidence of highly stained apoptotic proteins, specifically caspase 3, in tumors of combinational treatment compared to cisplatin alone, suggesting PQ increases tumor cell death. We have showed for the first time an increase in the efficacy of antineoplastic drugs via the enhancement of gap junctions with PQs, a specific class of gap junction enhancers. This provides evidence for a new combinational treatment for breast cancer using cisplatin at a reduced dose to prevent renal toxicity.

Relevance of Research to State-Related Topic(s)

A total of 1,596,670 new cancer cases and 571,950 deaths from cancer are projected to occur in the United States in 2011. In Kansas that is 14,070 cancer cases, where 1,890 cases and 370 deaths are due to breast cancer.

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DIELECTROPHORETIC CAPTURE AND DETECTION OF THE *E.COLI AND T4R* VIRUSES AT MICROPATTERNED NANOELECTRODE ARRAYS

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This study focuses on electronic manipulation and detection of bioparticles. An alternating current (AC) based dielectrophoresis (DEP) and electrochemical impedance spectroscopy (EIS) is employed. DEP is a method to manipulate the motion of polarizable particles due to the interaction of induced dipole moment in the particle with a nonuniform electric field. We constructed a micro fluidic DEP device using UV-photolithography to define a nanoelctrode array (NEA) vs. a macroelectrode in a "points-and-lid" configuration for capture and detection of bacterial cells and virus particles. The force of DEP is proportional to the volume of the particle and the square of the electric field gradient (∇E^2). Small bacterial cells and virus particles experience less DEP force hence it becomes a challenge to capture them. To overcome this challenge, a nanoelectrode is used so that the ∇E^2 is largely enhanced to balance the loss due to smaller sizes. This principle has been demonstrated in capture of *E. coli* cells (~1-2 μm) and is extended to capture T4r viruses (~200 nm in size). *E. coli* capture experiments were performed with DI water as a suspending medium and the optimum AC frequency for effective capture was found to be 100 kHz. Effective capture of *E. coli* cells were demonstrated even at a high flow velocity of 1.6 mm/sec. Accordingly, a prominent change (~58%) in absolute impedance (|Z|) value at the NEA was observed in EIS experiments. The recent results on DEP capture of virus particles will also be presented.

Relevance if Research to the State related Topic:

Detection of pathogen has become important in industries ranging from monitoring of water and food contamination to early detection of biological warfare agents. One of the sectors of food industry has a huge responsibility to assure that food provided to the consumer is safe in order to prevent them from transmission of communicable disease in the pathogen outbreak. To address this critical problem towards public health, steps must be taken to develop fast and accurate methods to detect food- and water-borne contaminants like bacteria and viruses. Dielectrophoresis capture of pathogens provides a microfluidic sample preparation method that helps to concentrate and sort microbes in the raw sample, which can be easily integrated with other on-chip identification method for further analysis. This fits the needs of meat processing industries and agricultural production in Kansas. It is also crucial for the well-being of people lived in Kansas.

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ANILINE CAPPED AU COLLOIDS BY SOLVATED METAL ATOM DISPERSION METHOD

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Thoils were found to be very efficient ligands for the digestive-ripening process, during which a colloidal suspension in a solvent is refluxed at the solvent boiling temperature in the presence of a capping ligand to convert a highly polydisperse colloid into a nearly monodisperse one. Lots of work has been done by our group using thiols as the capping ligands to form stable monodisperse gold colloids. Apart from thiols, we are also interested in using amines, which were also found to have similar efficiency for this purpose. We want to differentiate between thiols and amines as the ligands in gold colloids. Our method is based on the solvated metal atom dispersion technique (SMAD), which is very suitable for preparation of large amounts of metal colloidal solutions. We prepared aniline capped Au colloids in butanone using our SMAD method and these colloids were characterized using electron microscopy and spectroscopic techniques such as UV-visible, NMR, FT-IR etc. We also tried to see what happens to these colloids under digestive ripening conditions. The details about our findings towards aniline capped Au colloids would be discussed in the poster.

Relevance of Research to State-Related Topic(s)

The motivation for the preparation of gold nanoparticles include their potential utility in sensors, nanoelectronics, and the vast basic knowledge we can gain from these novel materials. Colloids of gold nanoparticles are also one of the most stable and easiest to manipulate. We have already gained enough evidence to get monodisperse gold particles by using alkylthiols as the capping agent, so if we can accomplish monodisperse gold particles on a useful synthetic scale by using another stabilizing ligand, particularly Aniline, that would be very significant.

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CO_2 SEQUESTRATION IN KANSAS: MINERALOGY AND HYDROGEOCHEMISTRY OF ARBUCKLE AQUIFER IN SOUTH CENTRAL KANSAS

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With increasing concerns over the impact of CO_2 on global climate change, scientists have proposed one possible storage mechanism for CO_2 within saline aquifers. The deep saline aquifer within the Arbuckle formation in south-central Kansas has been proposed as a potential site for geologic storage for CO_2 in a project funded by the US Department of Energy – National Energy Technology Laboratory (NETL). Two wells (KGS 1-32 and 1-28) have been drilled to the basement rock to provide data for a site specific determination of the storage potential of the Arbuckle. The Arbuckle formation (~4100-5100 ft) was cored to provide core plugs for mineralogical analysis and water was collected from 9 depths to define the chemistry of the aquifer brine. Extensive heterogeneity found in the core plug samples necessitate careful examination and description of the mineralogy of the core for accurate geochemical modeling linking them to evaluate the storage permanence of the aquifer. The dominant mineralogy within the proposed CO_2 injection zone is dolomitic limestone with dispersed cherty nodules. Thin section, XRD mineralogy, SEM and CT scan microtopography data have provided concrete mineral assemblages within core plugs. A depth profile of aquifer brine has shown changing chemistry of water with depth. Initial chemical analyses of the water show a saline brine (50,000 to 190,000 TDS) dominated by Cl, Na and Ca. Mineralogical description of the formation rocks and geochemical evaluation of the water throughout the depth of the aquifer will constrain geochemical models of a CO_2 injection scenario.

Relevance of Research to State-Related Topic(s)

Arbuckle saline aquifer is part of the Ozark Plateau Aquifer System, which includes the hydro-economically important Ogallala aquifer. Injecting CO_2 initiates reactions that dissolve minerals and mobilize elements, including heavy metals. By researching the hydrogeochemistry of the aquifer and mineralogy of formation rocks we can predict which elements may mobilize and how they could affect freshwater sources. Notable oil fields lie above Arbuckle in southern Kansas that are simultaneously being evaluated to use CO_2 to enhance oil recovery, providing economic benefit to the sequestration process and lowering the carbon footprint of oil that is produced. By examining the potential of the Arbuckle aquifer to store CO_2 through extensive characterization of reservoir properties this project will be on the forefront of an emerging science. Collaboration between Kansas academic institutions, government laboratories and local industry have enabled this project to be on the leading edge of CO_2 sequestration research in the USA.

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--WITHDREW--

GEOCELLULAR CONFINEMENT SYSTEMS IN LOW-VOLUME APVED ROADS

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Geocellular confinement systems (geocells) are 3-dimensional honeycomb-like structures filled with an in-fill of some available materials that vastly improve shear strength of in-fill materials. Geocells have the possibility of being a viable solution for the challenges of low-volume paved road reconstruction. The objective of this study was to test geocell designs with different in-fill materials and a thin hot-mix asphalt (HMA) overlay under real world traffic. To achieve this study objective, four pavement test sections were constructed at the Civil Infrastructure System Laboratory of Kansas State University. Three out of these four lanes had geocell-reinforced bases with three different in-fill materials; crushed limestone; quarry by-products; and Reclaimed Asphalt Pavement. The fourth test lane was the control section consisting of crushed stone base. All sections were heavily instrumented. Repeated loads (80-kN single axle) were applied using an accelerated pavement testing machine. The sections with 50-mm HMA layer reached the failure criteria of 12.5-mm rut depth after 10,000 passes due to excessive stress in the subgrade. The redesigned sections with 100-mm HMA layer carried 1,000,000 passes with less than 12.5-mm rut depth. The geocells with marginal materials as in-fills appear to be viable in low-volume paved road applications.

Relevance of Research to State-Related Topic(s)

A majority of roads in Kansas are low-volume roads. These roads service the farmers, who bring their crops and cattle to the market. However, with dwindling budgets, maintenance has been pushed back. Quite a few of farm- to- market roads are in need of major renovation. High quality aggregates are in short supply especially in western Kansas. Geocells could allow for a cheaper rehabilitation by limiting the amount of infill needed to be hauled in and also by allowing the use of lower quality in-fill materials. Geocells are a viable alternative that state and county road crews could use to build stronger roads.

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COAXIAL SILICON COATING ON VERTICALLY ALIGNED CARBON NANOFIBERS FOR HIGH-PERFORMANCE LITHIUM-ION BATTERIES

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Improving the energy capacity, charging/discharging speed, and lifetime of lithium-ion batteries is critical for their broader applications in portable electronics and hybrid electrical vehicles. We report a study on the development of a three-dimensional core-shell nanowire architecture anode for high-performance lithium-ion batteries. This unique anode comprises of amorphous silicon coaxially coated on a forest-like nanostructure of vertically aligned carbon nanofibers (VACNFs) that is grown on a substrate of 0.0033 in thick copper foil. The highly conductive VACNFs are firmly attached to the substrate and provide a good electron-conducting pathway while mechanically supporting the silicon coating upon charge/discharging cycling. The freedom in radial expansion also accommodates silicon's large volume expansion upon lithiation (up to 300%) and thus improves the cycle stability. This nanostructured anode was characterized against a lithium metal electrode with cyclic voltammetry and galvanostatic charging/discharging measurements to determine energy storage capacity, capacity retention, coulombic efficiency, and cycle lifetime. Our results demonstrated that the silicon coating with the nominal thickness of 500 nm and 1500 nm presents a lithium storage capacity of ~3,000 to 3,500 mAh/g at C/2 power rate, close to the theoretical capacity of 4,200 mAh/g, and greater than 96% coulombic efficiency. This capacity is about an order of magnitude larger than that of commercial graphite anodes (~370 mAh/g). Besides the loss at initial cycling owing to the formation of solid electrolyte interface, the capacity remains relatively stable in following charging/discharging processes. The silicon thickness and carbon nanofiber length are currently being optimized to improve cell performance.

Relevance of Research to State-Related Topic(s)

The advancement of lithium ion storage capabilities is advantageous for Kansas to meet future energy demands of its communities and citizens. Renewable energy sources like wind and solar are intermittent sources, meaning energy cannot be produced constantly throughout the day; however, extra energy not utilized can be stored for service when conditions are less favorable. Lithium ion batteries are well positioned for this task with their ability to store large quantities of energy, and provide a long operational life. Nevertheless, the infrastructure required to store this energy are still vastly too large, demanding valuable materials and resulting high costs. The development of our electrodes to have larger capacities per unit mass, better performance and use abundant silicon materials marks our research as innovative and environmentally driven.

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DESIGN OF A MYCOBACTERIAL PORIN BASED DYE SENSITIZED SOLAR CELL

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A prototype of a nano solar cell containing the Mycobacterial channel protein MspA, as the matrix for vectorial electron transport has been successfully achieved. MspA is an octameric trans-membrane channel protein (i.e. porin) produced by *Mycobacterium smegmatis* and is one of the most stable porins known so far. Wild type MspA has been successfully isolated, analyzed and purified in high yield to obtain crystals. A novel Ruthenium-phenanthroline-viologen-maleimide dye which is a fast vectorial electron transporter, has been synthesized, purified and successfully bound to the terminal end of wild type MspA, via the cysteine-maleimide bond. The dye-protein complex has then been adsorbed onto TiO_2 plates and subjected to incident sunlight. The protein appeared to be stable under the incident wavelength and a steady current is observed. A 1% incident photon conversion efficiency of sunlight into current by the MspA-dye complex has been achieved so far. This finding marks the first ever evidence of incorporating a biodegradable material such as a protein in a solar cell, leading up to a greener generation of solar cell technology.

Relevance of Research to State-Related Topic(s)

Alternate, sustainable energy sources are gaining increased attention from chemists, physicists and engineers, as mankind realizes the limited availability and adverse environmental impacts of burning fossil fuels. Solar cells have great potential to be used as a sustainable and green energy source for the future. For States such as Kansas which have abundant sunlight for a significant period of time of the year, solar energy is an efficient alternate energy source. Also a greener solar cell with a biodegradable matrix is a much desired advancement. Funding provided by State of Kansas through Kansas Technology Enterprise Corporation and Kansas Bioresearch Authority for this project is greatly appreciated.

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FEASIBILITY OF USING LIGNIN- A PLANT DERIVED MATERIAL FOR INCREASED SUSTAINABILITY OF RURAL TRANSPORTATION LIFELINES

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The feasibility of using lignin, a co-product of wood pulping and bio-fuel production, for stabilization of unpaved roads is being investigated. The objective of this research is to increase the performance, economy and sustainability of unpaved roads, which often serve as single transportation lifelines in rural communities. A calcium lignosulfonate (CL) powder, also known as lignin, is usually obtained by chemical processing softwood. Lignotech, U.S.A. donated the lignin used in this research. Dry uniformly graded masonry sand is first thoroughly mixed with lignin powder at several different gravimetric lignin contents ranging from 0% to 14%. Next, different amounts of water are added to initiate the cementation process thereby binding otherwise loose sand particles. In addition to the sieve analysis and Atterberg limits, the laboratory experiments include compaction and direct shear tests. The first phase of the research provides experimental data for characterization of early age compaction and strength behaviors, whereby the samples are tested immediately upon mixing sand, lignin and water. These early age strengths, which exhibit cohesion gain, will serve as the reference values for assessment of strength development with time due to air drying, which comprises the second phase of laboratory testing. The sand-lignin samples are presently being dried under laboratory conditions to assess their water loss and establish the optimal times for the next series of direct shear tests, which will provide a basis for characterization of strength development with time.

Relevance of Research to State-Related Topic(s)

Finding alternative uses for lignin is beneficial to Kansas because it has the potential to improve performance and reduce the maintenance cost of unpaved roads, which are prevalent throughout the state. Lignin is nontoxic and poses no threat to the environment unlike other co-products such as fly ash which can leach heavy metals into the ground. A larger market demand for lignin is also likely to lower the costs of environmentally friendly bio-fuels.

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REAL-TIME ELECTROCHEMICAL MONITORING OF CANCEROUS PROTEASE (LEGUMAIN) ACTIVITY USING NANOELECTRODE ARRAY

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Legumain (also known as asparaginyl endopeptidase) is a lysosomal cysteine protease which is found highly expressed in a majority of tumors including carcinomas of the breast, colon and prostate. However, overexpression is not found in normal cells, which makes it a potential cancer biomarker. Ferrocene (Fc) labeled peptides (NH_2-$(CH_2)_5$-Ala-Ala-Asn-Leu-Fc) are end-grafted onto embedded vertically aligned carbon nanofiber (VACNF) nanoelectrode array (NEA) via a C5 linker, and their ability to act as substrates for legumain is investigated by real-time alternating current voltammetry (ACV). Fc is used as an electroactive reporter and the peptide as a recognition and cleavage site of legumain. The cleavage results in the release of Fc moieties from the electrode to the bulk solution, thus leading to a decrease of the ACV signal whose rate depends on the activity of legumain. The optimization on ACV conditions for legumain detection was carried out by careful investigation of electron transfer rates (ETRs) with ACV in comparison with direct current voltammetry (DCV) on Fc-functionalized CNF NEAs. Unique conical graphitic stacking of the CNFs was found to play a critical role in facilitating a new capacitive pathway in high-frequency ACV measurements, leading to 100 times higher ETRs than that measured by DCV. This indicates that the intrinsic limit of nanoelectrode materials can be solved by selecting an appropriate electrochemical technique. Particularly, high-frequency ACV detection using CNF NEAs can provide high-performance nano-biosensors for ultrasensitive detection of legumain activities in various cancerous cell lines with a simple portable electrochemical system.

Relevance of Research to State-Related Topic(s)

In recent years, more than 5,000 Kansasians died each year from cancer, accounting for approximately 22 percent of all deaths. Cancer has been the second leading cause of the death in Kansas. Thus, early diagnosis plays a critical role in preventing these deaths. It is well known that over expression of certain enzymes such as kinases and proteases causes cancer. Legumain is a lysosomal cysteine protease which is found highly expressed in a majority of tumors including carcinomas of the breast, colon and prostate. However, over expression is not found in normal cells, which makes it a potential cancer biomarker. Our research focuses on the development of a simple portable electrochemical system for ultrasensitive detection of legumain activities in various cancerous cell lines. This work may greatly facilitate the early cancerous diagnosis and the monitoring of cancer therapeutic treatments, which will release the cancer threat to people's live.

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FACTORS INFLUENCING FINANCIAL SATISFACTION

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The purpose of this study was to add to the current body of literature, which shows that income perception is paramount to being financially satisfied. Financial satisfaction is defined as a respondent's feeling towards his or her current overall financial situation. This research was analyzed using ordinary least-squares (OLS) regression in SPSS 20.0. The primary conclusion of the research showed that income in and of itself does not help an individual feel more financially satisfied. This research showed that as respondents perceived themselves as able to meet financial needs, regardless of income, they were more financially satisfied. Key findings included the following: (a) those with a larger household size felt less financially satisfied; (b) those with a higher tolerance for financial risk were more satisfied with their financial situation; (c) individuals become more financially satisfied with age; (d) the more years of formal education an individual has, the less financially satisfied he or she is; and (e) those with higher levels of financial education report greater financial satisfaction. The results suggest that a strong argument can be made that income in and of itself does not help an individual feel more financially satisfied. To be more financially satisfied, individuals do not necessarily need more general education, but they must have more financial education. These findings support continued education for helping individuals and families better understand the components associated with meeting daily financial needs using their available resources.

Relevance of Research to State-Related Topic(s)

Some topics of focus in Kansas are education outcomes and family stability. These findings support an increase in financial education to help Kansas residents and families better understand the aspects associated with meeting their daily financial needs with available resources. As can be seen from the key findings, those who have more financial education feel more financially satisfied. Therefore, this study further emphasizes the need for financial education to help individuals feel more financially satisfied. Based on the findings of this and previous studies, Kansas policy makers and educators need to specifically target financial education to increase income perception, financial risk tolerance, and overall financial satisfaction. Current legislative requirements have begun to pave the way for financial education to be taught in schools and the workplace, yet much more work is needed to enhance the quality and level of financial education for Kansas residents and students.

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A REVIEW OF CURRENT FOOD SAFETY VIOLATIONS IN SCHOOL FOODSERVICE OPERATIONS

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The purpose of this descriptive qualitative study is to ascertain the prevalence of specific food safety violations in school nutrition operations. This study will identify the gaps in practice and potential gaps in food safety training among school food service employees. A random sample of 21 states, three states from each of the United States Department of Agriculture's seven regions was selected. Inspection reports were requested for every school in each state. The average response rate from each state was 91%. Since food codes vary among states, frequencies of each violation will be recorded at the state-level first, then each state will be combined into a master file. A statistical analysis will be conducted using the Statistical Package for Social Science to determine the most common violations across the sample. Once data entry is completed, a calculation to determine the average number of critical and non-critical violations per school will be conducted. Inspection reports are currently revealing several critical violations frequently occur. These include holding and cooling potentially hazardous food to appropriate temperatures and employee hand washing. Non-critical violations that are frequently occurring pertain to food storage techniques and facility cleanliness. Understanding common violations in schools is essential to protecting the health of public and private school students and increasing food safety awareness. This study will help drive future research in school nutrition operations. Health inspectors, registered dietitians, and other food safety educators can utilize this data when conducting training for food service directors, managers, and employees.

Relevance of Research to State-Related Topic(s)

This study will help schools in the state of Kansas enhance food safety practices. School inspection reports are revealing difficulty with holding and cooling potentially hazardous food to appropriate temperatures, employee hand washing, correct food storage techniques, and facility cleanliness. Understanding the extent to which these problems affect school nutrition operations can help educators and directors within the Kansas School Lunch Program to ensure a variety of better practices for school nutrition programs, employees, and health inspectors. Providing a safer school nutrition environment for school-aged children can enhance students' academic performance, health, and overall well-being.

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PERCEIVED NEIGHBORHOOD ENVIRONMENT INFLUENCES THE RELATIONSHIP BETWEEN TRANSTHEORETICAL MODEL CONSTRUCTS AND STAGE OF CHANGE FOR PHYSICAL ACTIVITY

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The positive effects of physical activity on morbidity and all-cause mortality are well documented, yet most people do not get enough physical activity to receive health benefits. Past research has focused on intra-individual aspects of behavior change using the Transtheoretical Model (TTM). The purpose of this study is to explore the potential mechanisms by which a Social Ecological Model construct (perceived neighborhood environment) influences intra-individual TTM constructs (stage of change, temptation, decisional balance, processes of change and self-efficacy). Perceived neighborhood environment and all five TTM constructs were assessed in an online survey (N = 1530). The majority of participants were recruited from universities, colleges and public schools. As such, most participants report having at least a four-year degree, higher socioeconomic status and being married. A series of regressions assessed (1) the univariate association of perceived neighborhood environment and TTM constructs and (2) whether perceived neighborhood environment moderated the proposed relationships between the TTM constructs. Perceived neighborhood environment accounted for a significant amount of variance in several TTM constructs across the stages of change (F's = 3.28 – 5.85, p's < .05). Few moderating relationships were identified. Thus, this study shows that perceived neighborhood environment is associated with TTM constructs, but does not moderate the relationship between TTM constructs. Future research will benefit from exploring which neighborhood attributes are most influential for physical activity behavior change and exploring possible mediating effects of perceived neighborhood environment on physical activity.

Relevance of Research to State-Related Topic(s)

According to the Kansas Department of Health and Environment (KDHE), the leading causes of death in Kansas in 2009 were heart disease, cancer and cardiovascular disease. The link between physical activity and chronic disease has been well established. To combat these chronic diseases, KDHE has developed and implemented physical activity interventions based on the Transtheoretical Model and Social Ecological Model. This research is a novel approach that explores how these theories of behavior modification link together synergistically to better understand and explain physical activity behavior change. The findings will inform our basic understanding of physical activity behavior change, thereby creating a foundation for more effective interventions for the prevention of chronic disease.

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CIVIL CONSEQUENCES? THE SOCIETAL RISKS OF INCARCERATING WOMEN WITHOUT OPPORTUNITIES FOR EFFECTIVE TREATMENT

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The feminist perspective of criminology focuses on women as offenders and victims, where women's pathways to crime are often linked to their surviving abuse and substance abuse. U.S. society has responded to women as offenders through a no-tolerance, tough on crime approach, in which incarceration is often the first step rather than a last resort. States, including Kansas, have not responded in equal measure to these women as victims, both ideologically (failing to acknowledge contributing factors) and practically (failing to provide therapeutic support). Through semi-structured interviews, this study identified and evaluated the therapeutic programs provided at Topeka Correctional Facility in Kansas, as well as the women's facilities in contiguous states, to determine whether programming exists that focuses specifically on issues of victimization, abuse, and substance abuse. Findings reveal drastic cuts in programming budgets, which have left women in the State of Kansas with no state funded support to overcome issues that resulted in their incarceration. Future longitudinal studies are imperative for understanding the long-term costs – financially and socially – surrounding the absence of therapeutic programming for women incarcerated in the State of Kansas.

Relevance of Research to State-Related Topic(s)

The mission statement for Kansas Department of Corrections concludes with the goal of "actively encouraging and assisting offenders to become law abiding citizens." Recent cuts in the State General Fund resulted in a 95% reduction in correctional programming, leaving approximately 60% of the state's incarcerated women to struggle with substance abuse issues without effective therapeutic programming. In turn, these women are returning to their communities without the tools necessary to overcome their addiction. Not surprisingly, Kansas communities suffer. Successful reintegration, already a challenge, is threatened even more as women are returned to face addiction issues while trying to maintain secure housing and employment. What is even more sobering, as many as 80% of these women have dependent children. As long as Kansas maintains a no-tolerance sentencing structure, improved efforts need to be made to ensure adequate prison programming for inmates. Only then, can these women inmates become law abiding citizens.

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HOW TO DRAW THE PRAIRIE: AESTHETICS AND EMPTY LANDSCAPES

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With their undulating windswept ridges and wide wind-rent skies, prairies don't fit conventional definitions of beautiful scenery. If evaluated according to principles of design, they look like simple voids; analyzed according to psychoevolutionary theory, they read like alienating exposures. Most importantly, if approached with expectations for the bucolic or the sublime, they seem flat and dull, like worthless empty space. This research contemplates prairies from a phenomenological perspective, using first-hand experience and systematic self-reflection to ask: how can people counter pejoratives and champion the prairie aesthetic? What *is* the prairie aesthetic? In creating images that depict subtle attributes and moments of splendor and narratives that evoke annual rhythms and moments of delight, it asserts new perspectives—new ways of looking at, thinking about, and, above all, experiencing the unique aesthetic of wild, open, beautiful prairie landscapes.

Relevance of Research to State-Related Topic(s)

Kansas is not known for its striking landscapes. Although residents of rural communities know that prairies and plains have a rhythm, elegance, and power all their own—sunrises! Wildflowers! Sweeping storms and the songs of meadowlarks!,—it is difficult to convince travelers whizzing along I-70 that the state is anything but flat and dull. If Kansans are to successfully celebrate and articulate the beauty of their natural heritage, they need to understand traditional expectations for pretty scenery and envision new ways to appreciate the experience of open space. Doing so can help residents deepen and maintain a sense of place, engender local pride, and promote tourism in rural communities.

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I CAN DO IT TOO! COMPARING CHILDREN'S WORKING MEMORY TO ADULTS USING A MODIFIED VERSION OF THE BROWN-PETERSON TASK

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Several studies have observed memory interference in children as well as general working-memory functioning in adults and even children but few have compared performance in children and adults when using an equivalent type of task (such as the well-established Brown-Peterson task) in order to assess how well children are able to remember over a short period of time, even when a distracter task is present. Since the task itself does not use context (such as words), which can cause variability in the differences in performance of children and adults (due to differences in children's executive functions) the Brown-Peterson task modified to use the pledge of allegiance is appropriate for children as it not only provides an equivalent distracter as adults, but also because by using the Brown-Peterson task one may still be able to gain insight into the WM abilities of children in the midst of distraction. As such, this task was used to allow for a direct comparison in working-memory in children and adults. Children showed steeper decay curves on BP task than adults when distracter was present. With no distracter present, children performed with equal accuracy when prompted to rehearse, but significantly less well with no prompting. These tests suggest that the Brown-Peterson task is one that can be used to effectively test memory abilities of differing age groups while maintaining similar level of difficulty for both groups. Further it shows that children can indeed remember as well as adults on simple tasks when explicitly told to rehearse.

Relevance of Research to State-Related Topic(s)

According to the Kansas Department of Education, there are currently eight assessment measures to evaluate educational progress in children. Of all these assessments, one of the underlying abilities being measured is that of memory, may it be a few seconds to much longer periods of time. That being said, the current study enables educators to use another tool to assess memory abilities in very young children (pre-school and kindergarten) without compromising performance due to inability to use context. This is important for two reasons: first, it provides further evidence that children can indeed remember as well as adults (and older children) on simple tasks when explicitly told to rehearse, and secondly, it allows for a direct measure between different age groups, and even allows for longitudinal studies in which the progress of a single student can be assessed overtime using the same method to allow for greater reliability.

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IN WHAT WAYS DO SOCIOCULTURAL FACTORS INFLUENCE THE SUCCESS OF NON-TRADITIONAL HISPANIC, PRE-SERVICE TEACHERS IN A REQUIRED ONLINE INSTRUCTIONAL TECHNOLOGY COURSE?

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Latinos are the fasted growing ethnic/racial group in the United States. As the number of school age children who are culturally and linguistically diverse increases, so must the number of teachers of multi-ethnic backgrounds to meet the educational, social and cultural needs of these children. The purpose of this study is to identify sociocultural factors that influence the success of non-traditional Latina pre-service teachers from Southwest Kansas in a required online instructional media and technology course. In prior studies, researchers found that factors such as education and economics have been shown to affect the use and ownership of computers, particularly in the Latino population. Yet, as the cost of computer equipment decreases and availability of Internet access increases; U.S. Latinos remain less likely than other racial, ethnic groups to own a home computer and have Internet access. Using purposeful sampling in a naturalistic, case study research design; study investigated the ways in which culture plays a role in the use of computers and Internet access for eight Latino pre-service teachers as they completed requirements for elementary education certification through distance education.

Relevance of Research to State-Related Topic(s)

Latinos are the fasted growing ethnic/racial group in the United States. As the number of school age children who are culturally and linguistically diverse increases, so must the number of teachers of multi-ethnic backgrounds to meet the educational, social and cultural needs of these children. In an effort to increase the number of multicultural teachers, K-State partnered with the Kansas Board of Regents to offer financial aid to students enrolled in the *AccessUS* program, designed to increase minority student enrollment in post-secondary education. Due to the rural nature of the location of the participants, distance education in the form of video conferencing, e-mail and KSOL tools were used to give place-bound students opportunity and access to higher education.

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LIVING TOOLS: TREE USE IN THE NINETEENTH CENTURY

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Despite vast research on the nineteenth-century settlement period and westward expansion, little is written on the Afforestation movement and the Timber Culture Act, both of which altered human perceptions of the open prairies. The subject surfaces briefly in discussions of the ill-fated "Rain Follows the Plow" theory; however, the actual climate altering ideas centered upon trees and thus the resulting ecological changes in Kansas are largely overlooked. The plow has been discussed in terms of reclamation and as technology by historians Emmons, Miner, Fite, and Webb, but trees have not been. This study discovers from newsprint, settlers' diaries, railroad publications and governmental reports that trees and their supposed powers of reclamation were a topic of discussion nationwide. Rain Follows the Plow was not the only erroneous climate theory that emerged in the nineteenth century. Afforestation efforts encouraged first by the railroads and then the Department of Agriculture far out lived their successor. Richard Smith Elliott, of the Kansas Pacific Railroad, was the first to experiment with these theories on the open prairie. Due to his efforts, trees increasingly became viewed as a tool that could improve Kansas' ecology. Human perceptions of the true prairie environment were forever altered by the Forestry Division's public support of tree planting as a way to ameliorate the climate. The goal of this paper is to highlight historical events that carry contemporary importance in environmental conversations. The history of Kansas can be thus broadened by looking at the past from the perspective of trees and their uses.

Relevance of Research to State-Related Topic(s)

The face of Kansas has changed since 1861; the relatively treeless expanses that dominated three-fourths of the state are gone. Boosted by the Morrill Land-Grant Act of 1862, Kansas State University began agricultural experimentation and developed technological tree farms throughout the state. New farming models emerged including the use of trees for ameliorative efforts. Kansas was the leading state concerning tree research and implementation of tree planting, but this topic is widely overlooked even though the influences on the ecology and economy can still be seen today. What was developed in the nineteenth–century was a working knowledge used by people with economic interests and it provided the frame work for soil conservation attempts in the New Deal era of shelterbelt planting. Looking at the cultural relationships humans developed with trees in the early days of Kansas, this paper reveals the changing ecology and economy of the state.

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