8th Annual

Capitol Graduate Research Summit

Abstracts
February 17, 2011

Featuring Graduate Student Research From:

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The University of Kansas
The University of Kansas Medical Center
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Kansas State University

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NITROUS OXIDE EMISSIONS FROM A COMMERCIAL CATTLE FEEDLOT IN KANSAS

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Nitrous oxide (N_2O) is an important greenhouse gas with a global warming potential of 296 times greater than carbon dioxide. Nitrous oxide is generated from various sources, including soils, livestock and manure management. Nitrous oxide emissions from agricultural soils have been studied extensively; however, limited scientific information is available on emission rates of N_2O from pen surfaces in open beef cattle feedlots. The main objective of this preliminary study was to quantify the N_2O emission rate from a pen surface in a commercial beef cattle feedlot in Kansas. Air sampling was conducted for 10 days from July to November 2010 on a pen surface in a commercial beef cattle feedlot. Static enclosed chambers with a diameter of 30 cm were placed on various locations in the pen surface. Samples of air were collected from the chamber headspace at 0, 5, 10, 15, 20, and 30 min with syringes and then analyzed with a gas chromatograph to determine the N_2O concentration. From the N_2O concentrations, the N_2O emission rates were determined. Results indicated large spatial variability in measured N_2O emission rates. Details of the measurement protocol and analysis of results will be presented. These preliminary results will be useful in designing a sampling scheme to establish the emission rate for the whole feedlot.

PREFERENCES OF U.S. AND E.U. UNDERGRADUATES FOR CLONING

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The concept of animal cloning was first introduced to the public's attention in 1996 with the birth of "Dolly the Sheep," the first mammal to be cloned. Now, after more than a decade the technology has reached a point of feasibility on a commercial scale. With the publication of the U.S. Food and Drug Administration risk assessment on animal cloning in 2008, a report that concluded that the technology was safe and posed no risk to consumers, the issue has received renewed attention. In 2010, the European Parliament has attempted to ban the technology for human food use which could cause trade descrapancies between Europe and the U.S. Despite the advantages cloning could bring to the Kansas livestock industries and the regulatory assessments by both domestic and international government agencies, there continues to be concern about the marketability of the technology on a consumer level. In this paper, we examine attitudes to the use of cloning in animal food production among samples of U.S. and European college students. We compare expressed levels of concern about cloning to concerns about other food production technologies, issues, and production practices (genetic modification, bacterial contamination, packaging, etc). Furthermore we attempt to correlate attitudes toward cloning and willingness to purchase cloned products to individual characteristics including socio-demographic variables (gender, household income, farming background) and attitudinal variables measuring political disposition (whether the individual tends to lean conservative or liberal on social and economic issues). The data was collected using Survey Monkey.

DIETARY INTAKES OF OMEGA-3 FATTY ACIDS AMONG SOLDIERS DEPLOYING TO COMBAT

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Background: Psychological health problems and human error are leading causes of death and disability among military service members. One theory gaining acceptance is the postulation that omega-3 fatty acids are deficient and that ensuring adequate intakes may mitigate the growing psychological health crises in the US military. Objective: To evaluate dietary intakes of omega-3 fatty acids among soldiers prior to deployment to combat areas. Procedure: Two hundred fifty-four soldiers scheduled for deployment to Iraq completed a food frequency questionnaire designed to measure consumption of foods rich in long-chain omega-3 fatty acids. Soldiers were from Ft. Riley, Kansas (n = 95) and the Texas National Guard (n = 159). Results: Intakes of long-chain omega-3 fatty acids ranged from 0 to 2,320 mg/day with a mean of 297.8 mg/day. Overall, 43.7% (n = 111) consumed seafood at least twice per week, 11.8% (n = 30) reported taking an omega-3 supplement, and 16.5% (n = 42) reported they had eaten an omega-3 enriched food. Frequent seafood consumption was more common among the Texas soldiers, with 49.1% (n = 78) consuming seafood at least twice weekly compared to only 34.7% (n = 33) among the Ft. Riley soldiers; X (1, N = 254) = 4.956, p = .026. Consumption of omega-3 supplements, omega-3 enriched foods, and sushi did not differ by location. Conclusion: Many deploying soldiers are consuming seafood less frequently than recommended. In addition, soldiers from Ft. Riley consumed seafood less frequently than the soldiers from the Texas National Guard.

COUPLING PYRAZOLE TO PYRIDINE: STEPS TO ENGINEERING A BETTER AGRICULTURAL CHEMICAL AND PREDICTING BINDING PREFERENCES THROUGH CO-CRYSTAL SYNTHESIS

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Kansas is a leader in the agricultural industry, harvesting large amounts of very important crops each year. To protect crops from harmful insects and rodents, a chemical insecticide or herbicide is typically applied to the surface of the crop or to the surrounding area. Among recent promising candidates for new insecticides and herbicides, pyrazole- and pyridine-based compounds have emerged as leading candidates. However, there are a few examples of species that have both components. Thus, understanding where other molecules found in nature, such as potential carboxylic acids, preferentially bind is paramount to understanding the inherent selectivity and chemistry occurring in these agrochemicals. To potentially control and modulate the physical properties of various pyrazole/pyridine based agricultural chemicals, we have chosen two initial steps. First is to synthesize and characterize various ditopic compounds with both pyrazole and pyridine functionalities. The second step is to probe the binding preferences of incoming carboxylic acids. To accomplish this, co-crystals of the as-prepared ditopic compounds and various carboxylic acids are synthesized. The resulting crystal structures are then examined to help determine any reliable and predictable interactions between donor (carboxylic acid) and acceptor (pyrazole/pyridine) compound. We believe that this approach will potentially help engineer a better agrochemical candidate.

EFFECTS OF CONTROLLED INTERVENTION STRATEGIES ON THE QUANTITIES OF A CEFTIOFUR RESISTANCE GENE (*bla*$_{CMY-2}$) IN THE FECES OF FEEDLOT CATTLE

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Antibiotics are widely used in animal agriculture. They can favor resistance in bacteria. This resistance may spread to humans and pose public health risks. Efforts should be focused to assess the dynamics of antibiotic resistance and evaluate intervention strategies that may mitigate its dissemination in farms. This study investigates the effects of two intervention strategies (i.e., feeding chlortetracycline (CTC) following ceftiofur treatment and mixing of ceftiofur-treated with untreated steers) on ceftiofur resistance in bacteria. In a controlled field trial, 176 steers were randomly allocated to 16 pens of 11 steers each. Ceftiofur was given on day 0 to all steers in 8 pens and only 1 steer in another 8 pens; 4 among each 8 pens received three 5-day regimens of CTC in their feed starting at day 4. Fecal samples were collected every other day to 26 days. Community DNA from 200mg feces was extracted via the Qiagen Stool Kit. The ceftiofur resistance *bla*$_{CMY-2}$ gene copies/µl of DNA was determined using quantitative real time PCR. Total DNA concentration was assayed using Nanodrop®. The relationship between the quantity of *bla*$_{CMY-2}$ gene (ln of the ratio to total DNA) and explanatory variables (CTC and mixing in a full factorial design interacting with period (DAY)) was assessed using multi-level mixed model. CTC increased the gene copies consistently across other factors ($P<0.0001$). Mixing had an inconsistent period-specific effect of decreasing the gene copies. Results (gene copies) normalized to 16s gene for all bacteria or total aerobic bacteria c.f.u. count will be presented.

RELIABLE AND SECURE NETWORKS FOR THE COMMUNICATION OF THE POWER GRID

Sarah Kubler*, *Caterina Scoglio, & Noel Schulz*

Department of Electrical and Computer Engineering, Kansas State University

The need for reliable and quick communication in power grid is growing and becoming very critical. With the Smart Grid initiative, an increasing number of intelligent devices, such as smart meters and new sensors, are being added to the grid. The current communication network architecture needs to be evaluated and improved. In this poster, we present a simulation model to evaluate the communication system. The simulation model is written in c plus plus and models the components of the network. The simulation results provide insight on how to design the network in order for the system to be robust from failures. We are using the simulation model to evaluate the interdependency between the communication network and the power grid. Security of the network is a very important aspect. Without the implementation of security protocols, there is a risk of attacks on the network. Attacks can come from malicious users of the network or from entities outside the network. These attacks may lead to damage to equipment, loss of power to consumers, network overload and loss of data, and loss of privacy. The poster will present some of the major issues related to the security of the communication network.

Kansas State University

DISTRIBUTED SOURCES AND ISLANDING TO MITIGATE CASCADING FAILURES IN POWER GRID NETWORKS

Sakshi Pahwa*, *Caterina Scoglio, & Noel Schulz*
Department of Electrical and Computer Engineering, Kansas State University

Distributed renewable generation includes the application of small generators such as wind turbines, scattered throughout a power system to provide for the electric power needed by the consumers. In general, the term distributed generation refers to all the small electric power generators which are located on the utility system, at the site of a consumer. However, in this work, we deal with distributed generation at the transmission side to enable islanding (intentional splitting) of the transmission grid in the event of critical faults which may lead to a cascading failure. This intentional splitting allows the system to accomodate the overloading because it not only reduces the total load on the main grid but presence of distributed renewable sources also helps to continue powering the different islands of the grid. We perform a topological analysis of the power grid as a complex network and partition the grid using a two-step optimization process, followed by load shedding, if required. The first step uses a quality function called modularity which gives basic optimal islands based on power flow but without differentiating between sources and other nodes. The second step combines islands to form superislands such that atleast one distributed renewable source is present in every island to achieve load balancing. This strategy helps to minimize the number of links that are disconnected to form islands, and at the same time, achieves the purpose of protecting the transmission network by reducing stress on the main grid.

CROP MODELING APPROACH FOR ASSESSING IMPACTS OF CLIMATE CHANGE AND VARIABILITY ON CROP PRODUCTIVITY IN THE OGALLALA AQUIFER REGION

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Future cropping systems depends on how the future climate unfolds. The objectives of this study were: (a) to analyze climate variability and change resulting from greenhouse gas emissions using high resolution regional climate model (RCM); and (b) to determine its impact on the crop production in the Ogallala region. Three RCM's used in this study were Canadian Regional Climate Model (CRCM), Regional Climate Model (RegCM3) and the Hardley Regional Model (HRM3). The A2 climate scenario for historic period (1971-2000) and future (2041-2070) were acquired from North American Regional Climate Change Assessment Program (NARCCAP). Spatial crop modeling was performed in AEGIS/WIN 4.0.2 program available in the DSSAT (Decision Support System for Agrotechnology Transfer) crop simulation model suite. The A2 climate scenario showed variable spatial pattern and magnitude across the Ogallala region with extreme climate conditions during the cropping season. Analyses showed that Ogallala region will experience 4-5°C increase in the maximum temperature for the month of July and August. In addition rainfall distribution will be highly variable with some regions receiving high rainfall during the month of May and very low rainfall during the month of August. Simulation results of future climates predicted a 30% decrease in the yield of grain sorghum. However, a substantial increase in wheat production throughout the region with an average increase of 35% was predicted in future climates. Crop management decision helped improve productivity by decreasing yield losses.

DIELECTROPHORETIC CAPTURE OF *E. COLI* CELLS AT NANOELECTRODE ARRAYS

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Rapid detection of pathogens like bacteria and viruses is of great importance for monitoring water and food quality, the early detection and diagnosis of diseases, countering bioterrorism attacks, and other applications. Successful detection requires the manipulation and capture pathogenic particles for further analysis. In our study we use alternating current (AC) based dielectrophoresis (DEP) and electrochemical impedance spectroscopy (EIS) techniques using a nanoelectrode array (NEA) in a microfluidic chip for bacteria capture. A nano-DEP device was fabricated using photolithography. This device employs a vertically aligned carbon nanofiber (VACNF) NEA vs. a macroelectrode of indium tin oxide (ITO) coated glass in a "points-and-lid" configuration. A high-frequency AC field was applied to generate "positive DEP" (p-DEP) at the tips of exposed CNFs. Enhanced electric field gradient generated at the CNF tips due to reduction in electrode size down to nanometer scale helps to overcome large hydrodynamic drag force on *E. coli* at high flow velocities. A significant number of *E. coli* cells were captured at flow velocity of 1.6 mm/sec. A noticeable change in absolute impedance (|Z|) value at the NEA was observed in EIS experiments. The capturing efficiency is being assessed and optimized for future applications.

AN INVESTIGATION OF WATER USAGE IN CASUAL DINING RESTAURANTS IN KANSAS

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Hospitality operations are considered the heaviest consumers of energy and water per square foot of building space among commercial industries. Water and its processing may make up more than 80% of hospitality operations' utility costs, and will continue to increase due to infrastructure upkeep, higher demand, and climate change effects. Implementing water efficiency in Kansas restaurants could save two billion gallons of water each year. Studying the current water usage in Kansas restaurants may result in decreased costs, increased awareness and more sustainable water use. The purposes of this study are to (1) identify water usage via metrics employing water and sales data from a sample of Kansas' casual dining restaurants (CDR's) and (2) determine whether the antecedents of behavioral intent can predict owner intent to reduce water use using the Theory of Planned Behavior (TpB). Objectives include:

1. Establish how much water is currently used across multiple metrics in CDR's.
2. Understand differences of water use metrics in CDR's between location, type of food, type of ownership, kitchen equipment, and revenues.
3. Using TpB, ascertain owner's intent to decrease water usage.

OPTIMAL STIMULUS PARAMETERS FOR MAPPING MUSCLE SYNERGIES & ASSOCIATED MOVEMENTS EVOKED FROM M1 CORTEX WITH REPETITIVE ICMS

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This study explores how the brain activates muscles to accomplish desired voluntary movement. Knowledge of the pathway between brain cells and muscle activation remains incomplete. This pathway is important because it controls all voluntary movement, enabling people to maintain healthy and active lifestyles. Researchers have investigated the pathway between the brain's primary motor cortex (M1) and limb muscles using many methods, including various types of stimulation. Our research is investigating the effects of one type of stimulation (RL-ICMS) applied to M1 in the monkey brain. RL-ICMS allows direct measurement of how M1 controls muscles because it activates muscles at levels that cause arm movement. This allows us to map the section of the brain controlling muscle combinations that cause natural-appearing movements. M1 may simplify muscle control by using muscle synergies, which are fundamental building blocks used to coordinate movements. This study is investigating the relationship between brain stimulation parameters and the resulting muscle activity that causes limb movement. Our results have shown that RL-ICMS moves and holds the limb at a consistent location in space when applied with optimal parameters. Our results suggest a narrow range of stimulus parameters is optimal for RL-ICMS: 60 - 130 Hz, 60 - 130 µA and 750 - 1000 ms, with a mean end-point time of 588 ± 169 msec (n = 400). These results will be used to develop a movement-output map of M1 and to better understand how the brain uses muscle synergies to accomplish voluntary movement, improving future treatment of movement disorders and paralysis.

REDUCING DESIGN COSTS IN MODERN AIRCRAFT THROUGH VIRTUAL SHIELDING MEASUREMENTS

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Modern aircraft are subject to a barrage of high intensity radiated fields (HIRF) from a wide variety of man-made sources. The aluminum skin of traditional aircraft provides significant shielding to the sensitive electronics inside the aircraft. However, the drive to create lighter, more fuel efficient aircraft has created a trend in the aerospace industry away from aluminum, to lighter composite materials. These composite materials do not always provide the same level of shielding as their aluminum counterparts and has created an urgent need to characterize and measure the shielding effectiveness of entire airframes in a timely, cost effective manner. This research project seeks to show the viability of virtual measurements to identify and help correct shielding problems earlier in the design phase of an aircraft than traditional measurements. This can be achieved by showing 1) that current simulation software can accurately model traditional aluminum skinned aircraft and 2) that these models can be extended to include composite aircraft. The project specifically focus on modeling and measuring the shielding effectiveness of three targets, an airframe analog as a proof of concept and to refine measurement techniques, a production aluminum skinned aircraft and an uninhabited air system (UAS) designed and built at the University of Kansas.

SAND DUNES AND MEGADROUGHTS OF KANSAS

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"Megadroughts" were long-duration, prehistoric droughts more severe than historic droughts such as the Dust Bowl droughts of the 1930s. Megadroughts resulted in widespread desimation of vegetation and in the formation and reactivation of dune fields across the Great Plains. Kansas, located in the Central Great Plains, has several dune fields which have recorded these prehistoric megadroughts. This research applies landform analysis and dating methods to the dune fields of Kansas in order to investigate the timing, severity and areal extent of prehistoric megadroughts. In order to reconstruct the history of megadroughts, dunes in two areas of Kansas are being studied: the Hutchinson Dunes in east-central Kansas and the Arkansas River Dunes in western Kansas, along the Arkansas River. In general, both dune fields were stable (vegetated) prior to a global warming event around 1000 AD, but activated in response to one or more megadroughts shortly thereafter. Dune activity slowed towards 1500 AD as climate became wetter, but again intensified due to megadroughts that followed a global cooling event around 1600 AD. Megadroughts continued into the 1800s followed by a short period of stability and, most recently, dunes rectivated in response to the 1930s and 1950s historical droughts. Data gathered from dune fields in Kansas present evidence of past megadroughts and raise the spector that megadroughts will occur in the future, especially given current scenarios under greenhouse warming. Future megadroughts, more severe than those of the 1930s, will have widespread impacts on the agriculture, economy and overall well-being of Kansas citizenry.

WEIGHT-RELATED CRITICISM AND CRITICISM DURING PHYSICAL ACTIVITY AS PREDICTORS OF SEDENTARY BEHAVIOR IN PREADOLESCENT SCHOOL CHILDREN

Emily D. Kessler*, *Leni B. Wilcox, Sonia L. Schwartz, Chad D. Jensen, & Ric G. Steele*
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Pediatric obesity is an increasing problem in today's youth. In addition to the physical risks posed by pediatric overweight and obesity, these children are at greater risk of peer victimization (Hayden-Wade et. al, 2006). Moreover, prior research suggests that higher levels of peer criticism are correlated with lower levels of physical activity (Faith et al., 2002). However, it has been suggested that physical activity and sedentary behavior may be unique constructs and that sedentary behavior may be more strongly correlated with body mass index (BMI; Anderson et al., 2003). This study examines factors that may predict higher sedentary behavior in elementary school children. A sample of 376 fifth- and sixth-grade students from a Kansas elementary school completed surveys assessing perceived weight-related criticism and self-reported sedentary behavior. Hierarchical regression analyses were conducted to determine factors that predict sedentary behavior. Gender, perceived weight-related criticism, and perceived weight-related criticism during physical activity were significant predictors of sedentary behavior. A significant interaction showed that girls who reported more weight-related criticism reported more sedentary behavior. These findings may be useful when developing interventions for pediatric obesity.

University of Kansas

PERFORMANCE AND EMISSION TESTING OF FEEDSTOCK BIODIESELS

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The search is ongoing for a renewable fuel source for internal combustion engines used in the transportation sector. At the School of Engineering in the University of Kansas (KU), sustainable

biodiesel is a focus of research aimed at finding a viable fossil fuel replacement. Creating a sustainable biodiesel requires finding a biodiesel feedstock that meets a given set of standards. Specifically, the fuel source must be economical and feasible to produce, not conflict with other ethical issues such as food production, and have minimal environmental impact. At KU thus far, a collection of six different feedstock-based fuels have been produced and tested to determine each fuel's performance across the entire spectrum from production to exhaust emissions. Soon, algal biodiesel will also be investigated. Students from Chemical and Petroleum Engineering have provided support to ensure accurate diesel production and emission results and a more complete understanding of the entire biodiesel production, refinement, and analysis process. To successfully test the fuels, significant effort went into design, construction, and automation of a single-cylinder diesel test cell. This test cell is outfitted with proper instrumentation to measure and record parameters needed to determine fuel consumption and engine performance in a high-precision manner. Resulting engine exhaust is analyzed to measure critical exhaust gas emission levels. Initial testing has shown positive outcomes for biodiesel production, performance, and emissions. Additional research and improvements to the biodiesel engine test cell and test strategy will lead to improvement of the analysis and feasibility of biofuels.

SELF ASSSEMBLY OF MERCAPTOAZULENES ON METALLIC AU(111) SURFACES

Brad M. Neal*, *Anna M. DeLaRosa, Alexander S. Vorushilov, Mikhail V. Barybin, & Cindy L. Berrie*

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In the race to miniaturize electronics such as computers, cellular phones, etc., there is an ever-growing need to create new nanoscale materials that will eventually replace their macroscopic counterparts. Devices based on such materials would consume only a fraction of energy required to operate conventionally constructed equipment. Azulene is an unusual hydrocarbon (C10H8) that comprises an edge sharing combination of 5- and 7-membered carbon rings. In addition to its long-standing medicinal and pharmaceutical relevance, the azulenic motif constitutes an attractive building block in the design of optoelectronic and conductive materials. This presentation will focus on recent developments in the chemistry of hybrid metal/azulene platforms featuring azulene-based monolayer films anchored to the atomically flat metallic gold surface via thiolate junction ("alligator clip") groups. The nature of the above novel one-molecule thick films was established by means of various state-of-the-art techniques including surface enhanced Fourier Transform infrared spectroscopy and optical ellipsometry.

University of Kansas

AN EFFECTIVE METHODOLOGY FOR ANALYZING THE SPATIAL STRUCTURE OF URBAN AREAS USING SPACE SYNTAX AND GIS TECHNIQUES: THE CASE STUDY OF TOPEKA, KS

Hadi Shateh

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Space Syntax is a set of theories and techniques for analyzing spatial configurations (Hillier and Hanson, 1984). It provides graphical and mathematical representations of an urban structure based on various morphological parameters. These parameters are useful not only for architectural and urban development

but also for predicting social-cultural functions such as crime, transportation, and social segregation. Interestingly, the morhphological parameters of space syntax can easily be integrated with GIS applications. This integration of space syntax with GIS provides a simple methodology to analyze any spatial structure in relation to the GIS datasets that are readily available for many cities in the USA.The proposed study uses this methodological approach to diagnose the urban structure of Topeka, Kansas. This analysis provides quantitative measurements describing accurately the social and cultural functions of the city both at the local and global levels of the city. In essence, this study shows that incorporating space syntax into GIS enhances the capability of GIS for morphological and social-cultural studies; and that the metric generated using this methodology provide a clear description of the built environment in terms of its social and culural functions

VALIDATION AND CALIBRATION OF THE EUTROMOD MODEL FOR KANSAS RESERVOIRS

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The water quality in Kansas reservoirs is closely linked to local land-use, and it is very important to be able to assess the degree to which future changes in land-use might improve or impair human use of these vital water resources. This analysis was designed to test the applicability and suitability of EUTROMOD for quantitative water quality prediction in Kansas reservoirs. EUTROMOD is a spreadsheet model that can be used to predict reservoir water quality from watershed land-use, local soil characteristics, and other key variables. Thirty Kansas reservoirs were modeled using data from the Kansas Department of Health and Environment (KDHE) and the National Resources Conservation Service. Predicted water quality outputs from the model (concentrations of total phosphorus, total nitrogen and chlorophyll a) were then plotted against actual measured values obtained from a long-term water quality database developed by the KDHE. This initial assessment of EUTROMOD's predictive capabilities is a first step towards the larger goal of modifying the EUTROMOD framework to include site-specific nutrient losses from a variety of different agricultural crops (e.g., corn vs. wheat vs. soy). This modified version of EUTROMOD will then be integrated with Geographic Information Systems (GIS) technology and applied as a new predictive tool to model the impacts of farmers' land-use choices on reservoir water quality, for example, as they switch from food production to cultivating biofuel crops, or as they implement new land management practices.

University of Kansas Medical Center

ENZYME CATALYSIS: UNDERSTANDING HOW IT WORKS

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Enzymes increase the rate at which a chemical reaction occurs. How they achieve this rate increase and how this knowledge can be applied to disease treatment has been an area of intense research for many years. Results of multiple studies have shown that motions of individual protein segments (i.e. loops) can play a role in enzyme function. Our enzyme of interest phosphoenolpyruvate carboxykinase (PEPCK), an enzyme involved in creating sugars from stored fat, has a loop that exhibits dynamic motion. This small region of PEPCK, which has the shape of the Greek letter **Ω**, acts like a lid that closes over the active site and has been hypothesized to serve multiple functions during the catalytic cycle. Furthermore, the act of

opening and closing the lid domain is thought to be a delicate free energy balance (the free energy of a system is a value that can determine the spontaneity of a chemical reaction) meaning the lid pays an energetic penalty when it closes which is offset by an energetic contribution from substrate binding. To elucidate the role of the loop two amino acid residues, protein building blocks, were mutated to either increase the energetic penalty of lid closure or decrease the energetic contribution from substrate binding. The resultant mutants were characterized via structure/function experiments. The functional results revealed decreased enzymatic activity compared to the wild-type (Wt; un-mutated) PEPCK and a surprising alternative chemistry not observed in the Wt. The structural characterization allowed a visual inspection of changes in the enzyme at a molecular level; this data showed a shift in the lid orientation from a closed conformation (WT) to a predominantly open conformation in each of the mutant PEPCKs. Taken together, the structure/function data lends support for the mechanism of PEPCK catalysis in which the mobile lid-domain is energetically coupled to substrate binding, it is involved in correctly positioning the substrates in the active site, and is responsible for sequestering and protecting the reaction from the surrounding environment. Overall, a better understanding of how enzymes work in such intimate detail will allow novel methods of chemotherapeutic intervention to be designed for disease treatment.

University of Kansas Medical Center

A NEW METHOD FOR DIAGNOSING HEARING LOSS

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Many new therapeutic techniques for curing hearing loss are currently being explored. This motivates the need for parallel advancement in diagnostic tools to accurately locate the anatomical damage responsible for hearing loss. Outer hair cells are a very common site of damage in the cochlea, which is situated in the inner ear. This damage leads to hearing loss. The cochlear microphonic is a physiologic signal that comes from the outer hair cells and is useful in examining outer hair cell integrity. However, current cochlear microphonic recording procedures are limited to testing outer hair cells in a small portion of the cochlea. Therefore, the purpose of this study is to determine if a new cochlear microphonic recording procedure that utilizes both a low-frequency stimulus and a variable masking technique can elicit responses from outer hair cells along the entire length of the cochlea. This was accomplished by recording

the cochlear microphonic using a low-frequency stimulus embedded in variable masking conditions. Recordings were obtained in Mongolian gerbils before and after inducing noise damage in different regions of the cochlea. Cochlear microphonic amplitudes from each of the masker conditions were recorded and probability density functions were created from the amplitude recordings. These probability density functions quantify the contributions of outer hair cells to the cochlear microphonic at particular locations along the cochlea. After damage, the probability density functions shifted in a manner consistent with the location of induced damage. This suggests that the proposed technique is able to elicit responses from outer hair cells at many locations along the cochlea for more accurate assessment of outer hair cell function.

University of Kansas Medical Center

EVALUATING THE PERFORMANCE OF SEQUENCE/FUNCTION ANALYSIS TOOLS USING THE LACI/GALR PROTEIN FAMILY

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Industry leaders are predicting that, within a few years, new technologies will enable the acquisition of a patient's entire genome for under $1000. While this will provide a wealth of *data*, scientists must now confront the challenge of developing bioinformatics tools to interpret that data into clinically actionable *information*. One basic question is to determine which changes to proteins – the molecular machines inside cells – cause beneficial, deleterious, or neutral effects on protein function and organism health. Recently, a variety of bioinformatics tools have been devised to identify the functionally important parts of proteins. To test the accuracy of these tools, we have used a family of proteins called the LacI/GalR transcription regulators. One of our questions was to determine whether prediction accuracy could be improved by subdividing the family into smaller groups, based on experimental knowledge. Because

proteins are so large, we constrained our experiments to a relatively small region, called the "linker", which is composed of 18 parts, called amino acids. Previous experiments demonstrated that changes to *all* linker amino acid positions change protein function; no positions are neutral. Comparing experimental and bioinformatics results showed that various algorithms identify different subsets of these 18 amino acid positions. In some cases, subdividing the LacI/GalR family (based on other experimental knowledge) increased the accuracy of the tool's predictions. However, two amino acid positions were not reliably identified by computational analyses. Finally, we compared all available experimental data for one natural and three synthetic members of the LacI/GalR family to the set of predictions made by the tools. From this, we estimate that >50% of the proteins' positions are important to function. This suggests that functionally neutral parts of proteins might be easier to detect than functionally important parts. Additionally, this work suggests that the assumptions underlying current bioinformatics tools should be revisited to improve their accuracy when interpreting changes to patients' genomes.

University of Kansas Medical Center

THE DEVELOPMENT OF A COMPREHENSIVE HEALTH CENTER IN A RURAL COMMUNITY:
A QUALITATIVE CASE STUDY

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Objectives: We sought to identify strategies that promoted the development and sustainability of a successful, comprehensive Community Health Center, located in a rural Midwestern state. Since the 1960s, free or reduced fee clinics and CHCs have been providing health care to the most vulnerable populations, including individuals who are underinsured or uninsured. Safety net clinics often rely on funding sources outside of privatized insurance; thus may be fragile organizations providing fragmented care, due to the economic environment within the community.
Methods: We used a qualitative case study methodology, using a purposive sample of fifteen employees and board members of a Community Health Center that serves a rural lower socioeconomic population. Semi-structured interviews were conducted, transcribed, and analyzed for common themes and sub-

themes that would describe the strategies used to develop and sustain this successful Community Health Center.
Results: Leading with Consideration was identified as the dominant theme in the interviews, field notes and archival data. Four sub-themes: Living the Mission, Fostering Individual Growth, Building a Community, and Encouraging Innovation, emerged from the narratives.
Conclusions: Leadership was the most important theme that emerged from the data, resulting in a work force culture that upholds the mission of the Center and leadership that seeks to inspire the growth of both employees and clients. As a result, there is a sense of community and innovative health care endeavors that have created a sustainable holistic health care model. Transformational leadership may be an important concept for safety net clinics to develop to achieve a sustainable primary care program to address multiple primary, secondary, and tertiary prevention programs for individuals who are under or uninsured. Further research is necessary to better understand the relationship between leadership and the economic viability of Community Health Centers.

University of Kansas Medical Center

ANTAGONIZING REPAIR-MEDIATED RESISTANCE IN BREAST AND OVARIAN CANCER

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Human cancers expressing high levels of breast cancer susceptibility gene 1 (BRCA1) are resistant to ionizing radiation, platinum-based chemotherapeutics and poly(ADP-ribose) polymerase (PARP) inhibitors. BRCA1 is a nuclear phosphoprotein critical for resolving double-strand DNA breaks (DSBs), thus its overexpression in malignant cells diminishes the efficacy of therapeutic agents that induce this form of damage. *In vitro, in vivo* and human clinical data have demonstrated that BRCA1-deficient cancers are profoundly sensitive to alkylative chemotherapeutic agents, are amenable to synthetic lethal approaches which exploit defects in DSB repair (e.g., PARP inhibitors), and are generally associated with improved overall survival. Conversely, high expression of wild-type BRCA1 in breast, ovarian and non-small cell lung cancer and frame-restoring intragenic mutations in *BRCA1* mutant ovarian cancers are

associated with therapeutic resistance and poor prognosis. Therefore, there has been much interest in identifying agents that interfere with BRCA1-dependent DNA damage repair to restore or enhance sensitivity to cancer therapeutics. We demonstrate that the heat shock protein 90 (Hsp90) inhibitor 17-allylamino-17-demethoxygeldanamycin (17-AAG/Tanespimycin), which is currently in Phase II/III clinical evaluation, induces BRCA1 ubiquitination and proteasomal degradation, resulting in compromised repair of ionizing radiation-induced DNA damage and increased damage-associated growth arrest. Additionally, we demonstrate that loss of Hsp90 function completely abolishes both homologous recombination and non-homologous end joining of DSBs, which are required for repair of platinum- and radiation-induced damage, respectively. Importantly, we also demonstrate that the ability of 17-AAG to sensitize cells to ionizing radiation is dependent upon BRCA1 destabilization, arguing for a central role of BRCA1 in the sensitivity phenotype induced by Hsp90 inhibitors. In summary, we document a novel upstream Hsp90-dependent regulatory point in the Fanconi anemia/BRCA DSB repair pathway and specifically identify BRCA1 as a novel clinically relevant Hsp90-dependent target for enhancing radio- and chemosensitivity in refractory and/or resistant malignancies.

Wichita State University

NANOMONITORS: A MINIATURE ELECTRONIC BIOSENSOR FOR EARLY DISEASE DIAGNOSIS

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Heart disease more specifically vulnerable coronary plaque rupture, which is the cause of acute coronary syndromes stroke, peripheral vascular limb ischemia, and other end-organ ischemic diseases, is one of the leading causes of death in Kansas. Approximately 50% of Kansas population lives in rural areas and 13% of Kansas population are above 65 years, an age group where ACI (Acute Coronary Insufficiency) is one of the major causes of death. More importantly approximately 13% of Kansas population does not have health insurance. Hence, it becomes essential to develop technologies, which enable rapid and cost effective diagnosis of ACI in a pre-symptomatic state.

The primary purpose of this research is to develop an inexpensive and user friendly 'point- of- care' (POC) device for pre-symptomatic diagnosis of ACI through the detection of two proteins that have been identified as biomarkers for this disease.

Inflammation and thrombosis are key mediators of vulnerable coronary plaque and NT-BNP and Troponin-T are two proteins which are biomarkers of this condition.

We have utilized nanoporous alumina membranes to generate high surface area to volume structures for trapping protein biomolecules. We employ the protein specific capacitance measurement method as the basis for protein biomarker detection. We demonstrate device performance parameters for protein biomarker detection in purified and spiked serum samples to be comparable to the current gold standard: ELISA.

COMPETITION AND ALLELOPATHY IN INVASIVE *LESPEDEZA CUNEATA*

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The introduction of non-native species can have a profoundly detrimental effect on native ecosystems composition. This is being seen in the tallgrass prairies of Kansas as a result of the introduction of *Lespedeza cuneata* (sericea). This plant is able to form dense monocultures that greatly reduce native species cover where it invades. One proposed explanation for this invasive success is that sericea produces allelopathic chemicals that suppress native species. We tested this hypothesis in a greenhouse experiment in which a native plant, *Sorghastrum nutans* (Indian grass), was grown with sericea and alone. Three different treatments were factored among the pots. Field soil with a history of either sericea or native plants was collected. This was done to determine if sericea alters the soil through microorganisms or through an accumulation of chemicals. In half of the pots, this soil was autoclaved to eliminate microorganisms. Microorganisms affect the nutrient acquisition and disease in plants, so an alteration in that community could affect growth. Additionally, an extract was made from mature sericea, and applied to half of the treatments. The extract may contain an allelopathic chemical, and if present, may alter biomass of native plants. After twelve weeks plants were collected, dried and biomass recorded. Preliminary analysis indicates that the soil history and microorganisms have
an effect on Indian grass. This suggests that sericea may be able to change the soil microbial communities over time, leading to long-term negative effects on the native plants of Kansas.

Wichita State University

ENERGY USE IN HEALTHCARE SERVICES: RADIOGRAPHY PROCEDURES

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In 2010 the U.S. healthcare sector rose to comprise 18% of the nation's GDP. During that year $8.8 billion was on energy to meet patient needs. As the percent of GDP spent on healthcare rises over the next several years, there will be an associated rise in energy consumed by healthcare services. The majority of information on energy consumption and improvements in healthcare are at the macro level. Instead, this research explores energy use based upon the principles of life cycle analysis at the healthcare service level. The goal is to achieve a substantial increase in knowledge of healthcare services with the aim of improved sustainability.
In this presentation the energy consumption during the delivery of x-ray and CT services are reported. The setting for data collection is the Veteran's Administration (VA) Hospital in Wichita, Kansas. The results reveal that a large portion of the energy consumption is due to the idle time which can be reduced operationally. Thus, it is shown that improvements of energy use in health care should not be restricted to

heating, ventilating, air conditioning and lighting since these are largely fixed after installation. The importance of idle energy leads to possible improvements by hospitals in patient scheduling or by manufacturers to lower standby power demands. Energy savings in the radiology department through the application of operations research tools are discussed.
Keywords: Energy, Healthcare, Hospital, Radiography, Radiology, Environment.

EMERGENT LANGUAGE AND LITERACY SKILLS IN BILINGUAL PRESCHOOL CHILDREN

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The purpose was to determine if a child's proficiency in vocabulary skills in their native language was related to and/or predictive of their proficiency in language and literacy skills in their emerging language. The sample consisted of 115 bilingual (English/Spanish) participants between ages 3 and 5 from Wichita-area Head Starts. The children were tested utilizing standardized formal measures. Tests were administered individually in a counter-balanced order in both languages by trained bilingual research assistants in 2-3 sessions. Results indicated that proficiency in native language vocabulary (Spanish) was not correlated to proficiency in the emerging language vocabulary (English); however, English and Spanish vocabulary skills were statistically correlated with literacy skills. Executive control was correlated with English vocabulary skills but not Spanish, and correlated with literacy skills. To determine if English language/literacy skills were predictive of Spanish vocabulary, a simultaneous multiple regression analysis was computed. The overall model was significant; $F(3, 112) = 13.85$, $p<.000$. Executive control and the literacy skills measure both contributed unique variance to English vocabulary, but Spanish vocabulary did not. The findings provide interesting insight into the relations among native language skills and emerging language skills. This has instructional implications for teachers and policy makers.

Wichita State University

COMPARATIVE ANALYSIS OF KANSAS COMMERCIAL WIND ENERGY PROJECTS AND WIZELIUS' EUROPEAN WIND PROJECT DEVELOPMENT MODEL

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Kansas ranks 2nd in wind-producing potential in the United States, yet in 2009 wind energy contributed only 5.2% of the State's electricity supply. In August 2010, Kansas had 9 operational commercial wind energy projects with a total installed capacity of 1,026 megawatts (MW). With National goals to generate at least 20% of electricity from wind by 2030 and Kansas' renewable portfolio standard (RPS) requirements that utilities acquire 20% of their energy from renewable sources by 2020, Kansas wind energy project development and installed capacity must increase. If Kansas is to meet both National and State goals, between 6,000–10,000 MW of installed capacity will be required by 2030. If approved, proposed wind energy projects would generate over 6,200 MW of wind energy for the State in the next few years. This study analyzes 9 operational and 1 unsuccessful Kansas projects. Insights from these analyses are compared with a European model of wind project development. Researchers collected public documents relevant to the 10 projects. Documents were thematically analyzed using inductive, data-driven and deductive, prior-research driven approaches. In addition to the inductive process, prior research identified 4 critical components of wind project development: project timeline, key contributors, support and opposition, and project trajectory. Data were compared across projects to

develop a trajectory for existing Kansas wind projects. This trajectory was contrasted with Wizelius' European model to identify strengths, weaknesses and opportunities for Kansas wind energy development. This comparative analysis resulted in proposed Kansas "best practices" guidelines for wind project development.

IDENTIFICATION AND IMPROVEMENT OF MEDICAL CARE INEFFICIENCIES AT A RESIDENT PEDIATRIC CLINIC

Brittany Huffman* *& Mehmet B. Yildirim*
Department of Industrial and Manufacturing Engineering, Wichita State University

Health care access and effectiveness is at the forefront of the current national debate and the importance of policy decisions can be seen locally in Kansas. It is a bipartisan agreement that effective and comprehensive health care should be provided to children regardless of parental status. In collaboration with the University Of Kansas School Of Medicine, the Wichita State University Industrial and Manufacturing Engineering healthcare research team have identified a local pediatric teaching facility that serves mostly low income and Medicaid patients. Our goal is to improve the effectiveness of care throughout the clinic using industrial engineering system improvement tools. The Wesley Resident Pediatric Clinic is unique to other local health care clinics because it serves dual purposes. First it serves as a site for pediatric care; second, it is a teaching center for resident physicians to gain clinical experience while being advised by faculty of the local school of medicine. Currently, about 300 patients are seen by residents in the clinic per week. However, waiting times and appointment retention at this clinic are suffering. Observations have been done over a six week period to collect data on the clinical process and analyses will be provided to support recommendations to improve the clinic effectiveness and overall care that is provided. Most importantly, these analyses will have direct applications to other local health care facilities.

Wichita State University

DOPAMINERGIC TOXICITY OF 1-METHYL-4-PHENYLPYRIDINIUM (MPP^+): MODEL FOR PARKINSON'S DISEASE

Viet Le* *& Kandatege Wimalasena*
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Parkinson's disease (PD) is among the most common neurodegenerative diseases. Approximately 60,000 Americans are diagnosed with this disease every year. The cause or cure for PD remains unknown. MPP^+ is a dopaminergic neurotoxin that induces symptoms similar to PD and commonly used as a good model to study the molecular causes of PD. The specific dopaminergic toxicity of MPP^+ is proposed to be due to the uptake through dopamine transporter (DAT) followed by the inhibition of complex I of the electron transport chain leading to cellular energy starvation. However, this proposal has not been conclusively established. We investigated the mechanism of MPP^+ toxicity using MN9D (neuronal) and HepG2 (non-neuronal) cell models. Our studies show that both cells take-up substantial levels of MPP^+ under similar experimental conditions, while only MN9D cells are susceptible to MPP^+toxicity. MPP^+ toxicity is independent of DAT in MN9D cells. Extracellular Ca^{2+}decreases MPP^+ uptake into MN9D cells, but has no effect on the toxicity. Voltage-gated Ca^{2+} channel blockers decrease the MPP+ uptake into MN9D cells, but again do not protect the MN9D cell from MPP^+ toxicity. These and other findings suggest a novel mechanism in which MPP+ perturb intracellular Ca^{2+} leading to neuronal cell death. The understanding of the causes of PD at the molecular level could lead to the development of therapeutic and preventive measures.

MIXED INTEGER NON-LINEAR PROGRAMMING (MINLP) FORMULATION OF ENERGY-EFFICIENT LOCATION ROUTING PROBLEM FOR ELECTRIC-POWERED VEHICLES

Shokoufeh Mirzaei* *& Krishna Krishnan*
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Electric vehicles (EVs) in the robotic context and in the future of logistics networks will play an important role as a sustainable and emission-free tool of transportation. The recent development of EVs such as Nissan LEAF and Chevrolet Volt is a turning point in the modification of transportation networks. Aligned with this green movement, the first EV Charging Station for the State of Kansas has been installed on December, 2010. It happened five months after unveiling the first EV charging station in USA, and within a week of the release of the above mentioned EVs. These actions show the potential promise in the use of EVs in the state. Although there are obvious benefits to the use of EVs, one of their main restrictions is the limited stored energy. Thus, energy-efficient Location-Routing Problem (LRP) becomes an important problem which has not been investigated vastly in literature. This paper provides a novel formulation of LRP which finds the best location-allocation and routing plan of EVs with the objective of minimizing the total energy cost. The vehicle weight and travelled distance are the major contributing factors in the energy consumption. Each vehicle energy limit is enforced in the model so that the vehicle does not get discharged before its travel completion. This research helps to use EVs in the most energy-efficient way. The proposed model can also be applied to situations when there is a mixed-fleet (hybrid, gas, or electric powered). A case study is presented to explain the model.

Wichita State University

STUDY AND ANALYSIS OF COGNITIVE RADIO CHANNEL SCANNING TECHNOLOGY FOR WI-FI NETWORKS

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Wi-Fi has become such a ubiquitous wireless technology in a relatively short period that it is not surprising; we are in the midst of at least one Wi-Fi network no matter wherever we are. Each one of us has a Laptop/Smartphone/Netbook competing against each other for the Wi-Fi bandwidth and thus has to compromise on data speeds in order to share the limited Wi-Fi spectrum. Contrary to this Wi-Fi crowding phenomenon which is yet to worsen with the ongoing explosive growth of wireless devices, studies show that 90% of the time, spectrum designated to legacy technologies like the TV spectrum was found unoccupied and not every channel was in use always. Cognitive Radio Technology is the riposte to this paradoxical situation. Cognitive Radios (CR) are envisioned to solve the challenge of spectrum scarcity when communication technologies have increasingly started relying on the wireless medium. CR is an intelligent radio which scans the radio spectrum for free channels and uses them to its own advantage. Though CR technology definitely sounds a promising candidate to deal with this crowding Wi-Fi spectrum, not much is known on how energy efficient these CRs and their Spectrum Scanning processes

are. Our work is to study and analyze these energy-intensive Spectrum Scanning processes and further propose techniques to make them more energy efficient, thereby making battery constrained portable devices operate for longer durations. Our work also increases the reliability and availability of wireless networks in rural areas of Kansas where opportunity of recharging batteries is limited.

MULTI-SENSOR HEALTH DIAGNOSIS USING DEEP BELIEF NETWORK BASED STATE CLASSIFICATION

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Kansas is one of the headquarters of major aircraft manufacturing industries. Due to large human life risks involved in flight journey, safety and operational reliability of aircraft is more critical. This research proposes a novel multi sensor health monitoring and failure diagnosis for Kansas industries to manufacture most reliable and failure preventive aircrafts to the world. Aircraft reliability depends on continuous monitoring of current system health status and health state detection is a key factor for prevention of performance degradation at different stages of damage. Due to nature of observed data and the available knowledge, health diagnostic methods are often a combination of statistical inference and machine learning. A novel artificial intelligent technique, Deep Belief Networks (DBN), has been quite effective in some applications such as image recognition and audio classification with promised advantages such as fast inference, fast learning, and the ability to encode higher order networks. This paper proposes the use of DBN for structural health monitoring applications of aircraft and develops multi-sensor health diagnosis method. DBN works based on Restricted Boltzmann machine and it learns layer by layer considering priors and network posteriors. Enhanced diagnostic system can be structured in three stages: first, collection of data from different sensors and preprocessing of the data; second, development of DBN classifier model based on nature of the system; third, training of DBN with data for different possible health states of the system. Classification effectiveness of this network is evaluated using experimental data for various real time practical conditions.

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This event is supported by Kansas State University, The University of Kansas, The University of Kansas Medical Center, and Wichita State University.

Award funding is provided by KansasBio and Tom and Jill Docking.