

9th Annual
Capitol Graduate Research
Summit

February 16, 2012

Featuring Graduate Student Research from:

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

The Graduate Deans and Graduate Students of KU, KUMC, KSU and WSU wish to gratefully acknowledge the support and co-sponsorship of the Capitol Graduate Research Summit from the Kansas Bioscience Organization and its President and CEO, Angela Kreps.

Presenters and Poster Titles

University of Kansas

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Dennis Eck	TOWARDS AN ENHANCED UNDERSTANDING OF PREFERENTIAL SOIL WATER FLOW
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A.J. Mellott	APPROACHING INNER EAR HAIR CELL REGENERATION THROUGH NON-VIRAL GENE THERAPY
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**N₂O-N EMISSIONS AND THE RELATIONSHIP WITH DENITRIFYING
ENZYME ACTIVITY IN CORN UNDER DIFFERENT MANAGEMENT
STRATEGIES**

Miguel Arango, Charles Rice, and Amy Vu
Department of Agronomy

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 N₂O-N emission under no-tillage (NT) and tilled (T) agricultural systems, (2) determine the





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

Stephanie Shishido and Annelise Nguyen

Department of Diagnostic Medicine & Pathobiology, Kansas State University

Cisplatin treatment has an overall 19% response rate in animal models with malignant tumors. A new class



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

Kyle S. Steele¹, Melissa J. Weber², Elizabeth A.E. Boyle¹, Melvin C. Hunt¹, April S. Lobaton-Sulabo¹, Curtis Cundith², Yoelit H. Hiebert³, Karen A. Abrolat³, Joel M. Attey³, Sherri D. Clark³, Dallas Johnson¹, and Tawnya L. Roenbaugh¹

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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.

LIVING TOOLS: TREE USE IN THE NINETEENTH CENTURY

Theresa Young

Department of History, Kansas State University

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

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

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

Human perceptions of the true prairie environment were forever altered by the Forestry

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.



**LEADING KANSAS? DETERMINANTS OF HUMAN TRAFFICKING POLICY
VARIATION IN THE UNITED STATES AND KANSAS**

Laura Dean

Department of



TOWARDS A CARBON DIOXIDE-FREE, SUSTAINABLE, ETHYLENE OXIDE TECHNOLOGY

Madhav Ghanta, Hyun Jin Lee, Daryle H Busch, Darryl Fahey, and Bala Subramaniam

Department of Chemical and Petroleum Engineering, University of Kansas

Ethylene oxide (EO) is, a large volume chemical building block used to make a variety of consumer products, such as plastic bottles, detergents, and paints. Current EO production methods emit ~3.4 million tonnes of carbon dioxide per year globally, making the process the second largest emitter of this greenhouse gas of all chemical processes. Carbon dioxide results as byproduct from the burning of a portion of the starting material (ethylene) and EO product. The goal of this research is to develop an alternative process that eliminates this wasteful burning. This goal has been achieved. The new technology offers economic and environmental advantages. For example, by conserving feedstock, an economic analysis shows that the process could save \$2 billion per year globally. An environmental analysis shows that the process also reduces carbon dioxide emissions by 23%. This process has received national recognition by winning the 2010 Kenneth G. Hancock Memorial Award for its novelty and greenness. It has also garnered significant interest from Fortune 500 companies. Further, this project has attracted both federal and industrial R&D funding. The EO technology process can be adapted for broader applications, including making other chemical building blocks from biomass instead of petroleum. If successful, Kansas would be an ideal location for manufacturing these chemicals because it is 4th in the U.S. in biomass availability. Capturing as little as 1% of the current U.S. chemicals market would represent a \$7.2 billion/year industry with significant employment opportunities in rural Kansas communities.

EFFECTS OF NEGATIVE PRESSURE TO INDUCE BONE GROWTH INTO POROUS TITANIUM IMPLANTS

Jeff Lamping and Terence McIff

Department of Bioengineering, University of Kansas

Extremity War Injuries (EWI) with peri-articular defects constitute a high volume and high morbidity challenge for the military trauma management system. Among military injury specialists it is agreed the development of an internal fixation device to be used earlier in the reconstructive process is needed. This research combines Negative Pressure Wound Therapy (NPWT), known to promote granulation tissue growth, and porous metal implants, having similar mechanical properties to bone, in order to develop an internal fixation device to be used in EWI reconstruction. A caprine model was used to examine the effectiveness of NPWT applied across a porous titanium implant to promote tissue ingrowth. Bilateral surgery was performed on 6 goats, attaching one large porous titanium implant to the lateral side of each femur using bi-cortical screws. One leg of each animal was sutured closed to serve as the control while the other side was treated with NPWT at either 125 mmHg or 200 mmHg. Tissue ingrowth for each negative pressure was examined at 6, 9, and 12 days. In 5 of 6 animals, gross examination showed improved tissue adhesion to the implant treated with NPWT when compared to the implant not treated with NPWT. This study shows promise that a device combining NPWT and porous titanium could be used in repairing large injuries with defects in both bone and soft tissue such as people suffering EWIs, bone cancer, or other traumatic injury.



**BIOMECHANICAL ANALYSIS OF POSTURAL INSTABILITY IN
PARKINSON'S DISEASE**

Molly McVey

Department of Mechanical Engineering, University of Kansas

cause of falling, fractures, and nursing home placement for persons with PD. Interventions to lower fall risk are effective, but are costly and time consuming for both the patient and the clinician, so it is not practical to prescribe a fall intervention unless a significant fall risk is determined by the physician. Currently there are no good clinical tests that reliably predict a future fall besides a history of falls. Therefore, fall interventions are usually not prescribed until after multiple falls have occurred. To improve care for the person with PD, we need a reliable method to assess fall risk based on the level of postural instability so that the appropriate fall risk intervention can be used to reduce fall risk before falls occur. Reducing fall risk in PD would not only delay the pain, suffering, and medical costs associated with an injurious fall, but also the loss of independence, psychological consequences, and expenses associated with long term care.

**APPROACHING INNER EAR HAIR CELL REGENERATION THROUGH
NON-VIRAL GENE THERAPY**

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PRESERVING THE PAST: TOPEKA'S JAYHAWK THEATRE

Juli Pitzer

Department of Film and Media Studies, University of Kansas



OUABAIN IS A MODIFIABLE FACTOR



TARGETING CANCER STEM CELLS; OVERCOMING MULTIDRUG RESISTANCE IN COLON CANCER

Anand Venugopal, Deep Kwatra, and Shrikant Anant

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It is believed that tumors contain a small population of cancer stem cells. These slowly dividing cells have been implicated in multidrug resistance (MDR) which provides resistance to a wide range of chemotherapeutic drugs. Often chemotherapy treatment will eliminate the vast majority of the cancer cells; however, the small population of cancer stem cells remains viable and gives rise to cancer relapse. Therefore, it is important to identify the molecules that play a role in regulating cancer stem cell biology. Here we demonstrate that the protooncogene RNA binding motif 3 (RBM3) is capable of increasing the cancer stem cell population in colorectal cancer by inducing Notch activity, a crucial signaling cascade for managing stem cell behavior. Furthermore, cells overexpressing RBM3 display significantly less cell death when treated with the chemotherapeutic agents doxorubicin and paclitaxel. These cells demonstrate an increased capacity to survive until they are killed when treated with an increase in the expression of the multidrug efflux pumps, multidrug resistance protein 2 (MRP2), and phosphoglycoprotein (Pgp). Importantly, RBM3 overexpressing cells treated with DAPT, a compound that inhibits Notch signaling, showed significant cell death implying that inhibiting Notch signaling in RBM3 overexpressing tumors would have favorable outcomes compared to treatment with classical chemotherapies. In summary, we have elucidated a new role for the protooncogene RBM3 in promoting the cancer stem cell population in colorectal cancer cells and increasing MDR. We have also determined that chemotherapeutic inhibition of the Notch signaling pathway can provide a potential approach in overcoming RBM3 mediated MDR.

SHOULDER INSTABILITY MAY DEPEND ON LABRAL AND CAPSULAR PROPERTIES

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**IMPACT ON CO₂ EMISSION DUE TO ELECTRIC VEHICLE CHARGING
AND DISTRIBUTED WIND GENERATION**

Sachin Argade

Department of



A CONCEPTUAL STUDY OF AIRFOIL PERFORMANCE ENHANCEMENTS USING CFD

Armin Ghoddoussi

Department of Aerospace Engineering, Wichita State University

A conceptual study of performance enhancing devices for an airfoil is performed using Computational Fluid Dynamics. Three simple, passive devices are examined to explore alternate methods for stall control and lift-to-drag improvement. The motivation behind this research is to study effective techniques to improve performance with fewer drawbacks than previously existing methods. An evaluation scheme is presented to compute airfoil lift, drag and pitching moment for a range of angles-of-attack up to stall. NACA 64₁-212 single-element and slatted airfoil CFD results are compared with experimental data to validate the computational model. Evaluations on the first conceptual design (Stall vane) show elimination of the separation at 15 degrees of angle-of-attack where the flow reversal normally starts at 86% - chord. A total drag increase of 22% is detected because of the sharp leading-edge of the device, but the main element drag has a reduction of 43%. The maximum lift coefficient does not show a significant change on the same model. The second device (Cylinder) has a negative effect, initiating flow separation and causing a significant decrease in lift-to-drag ratio at a given lift coefficient. The third device (Dimples) demonstrates the potential of lift-to-drag ratio improvement at the higher angle-of-attack.

USE OF ARTIFICIAL NEURAL NETWORKS TO DETECT DAMAGE IN COMPOSITE LAMINATES

Zachary Kral

Department of Aeronautical Engineering, Wichita State University

Maintenance has remained an important issue in the aerospace structures and materials field. As technologies have improved, composites have begun to replace increasingly more structural



**UNPACKING THE INVISIBLE PROBLEM OF CAMPUS HUNGER: THE
HUNGER AWARENESS INITIATIVE AT WSU**

Katie Thanh Le and Jack Brand

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that they have become clichés. How much truth lies behind these phrases? Existing data on hunger and food insecurity does not effectively address these issues. Ironically, despite the fact that research is conducted on university campuses, there is still significant need for such research. The present study reports phase 1 results of an on-going community-based, participatory initiative to enhance understanding of hunger issues on one campus, the Wichita State University (WSU) Hunger Awareness Initiative. Data were collected through surveys made available online through a social media campaign directed toward the WSU community, during a food-packaging event, and through focus group discussions. Data from 44 individual survey respondents to the prompt: *us your hunger* and the information shared by 50 participants in focus groups held during a campus-inductive thematic analysis. Results indicated that while hunger stories varied widely among participants, several themes were found within participant groups. Stories offered by international and graduate students indicated that food insecurity was an issue for them. Indicating the complexity of this issue, three consistent themes found in the focus groups were that students feel reluctant to admit they are food insecure due to the stigma of asking for help, or the need to be self sufficient; students eat low-budget meals regardless of nutrition or taste due to lack of resources; and finally, there are opportunities to help hungry students now, and that preventative measures can be taken. The WSU Hunger Awareness initiative is the first step in a coordinated effort to understand hunger and food security awareness on college campuses.



IMPROVING READING:



LORENZO D. LEWELLING AND KANSAS' 'CIVIL' WAR

Jordan A. Poland

Department of History, Wichita State University

research, will examine one of the most obscure periods in Kansas political history, the early 1890s. The paper will explore the rise of Populism, a grassroots third-party movement, that upset the long-standing Republican majority in Kansas and show how this movement brought Kansans to the brink of all out war on the Capitol grounds.

Wichitan Lorenzo D. Lewelling, and show how his action, and inaction, in office changed reform politics in Kansas for the next twenty five years. Drawing on primary source documents, a look

reforms that helped to shape Kansas into the state we see today. Blamed largely for his role in



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