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PRESENTS THE

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THE DSP DIFFERENCE

A FUTURE OF DIVERSE EXCELLENCE

Developing Scholars Program

ABSTRACT BOOKLET

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Note: For the complete list of collaborators and their credentials, please view the posters.

The Meadow Project

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The prairie and grassland ecosystems are severely unprotected across the globe. Only four percent of the planet's prairie grasslands are protected. The objective of this project is to demonstrate the ecosystem benefits of a small native plants landscape while also educating the local community of the significance of the prairie. A small section of the Kansas State University campus grounds, which consisted of common turf grass, was converted into a one-half acre meadow. Multiple species of native plants were selected and planted on site. Random samples will be taken this growing season to study growing patterns, soil and water quality, biodiversity of plants and insect pollinators, and overall quality of the site. This ongoing experiment allows firsthand research of the designed Meadow site and the interpretation of sustainable, green infrastructure. Not only does the Meadow provide education and environmental awareness, but it may provide ecosystem services. It is anticipated that compared to the turf grass, the native vegetation of the Meadow will show improved local soil and water quality and increased biodiversity. The overall goal of this project is to educate the community on the importance of green infrastructure and protection of grasslands worldwide. The Meadow also provides research opportunities and experimental ground for faculty and students and serves as an example of a low energy, low water, and chemical free campus landscape.

Effect of Unequal and Equal Incentives in Teams

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This project looks at the form in which two entities are willing to work together and share knowledge capital to succeed. The purpose of the research is to determine how incentives contribute to a team's efficiency and individuals' willingness to collaborate. In order to study these variables in a controlled environment, we will be conducting an experiment on various pairs of randomly matched undergraduate students and faculty using a skill-based card game that relies on each individual to work with their counterpart to achieve a common goal. Each pair will go through several rounds of the card game and we will observe their willingness to collaborate as we give each pair either equal or unequal incentives after a certain number of rounds. We hope to see a change in the way that one's counterpart in the pairing shares tactics and information with their partner as we offer unequal incentives. Expected results include an unwillingness to collaborate on the pair's task and therefore a decrease in the effectiveness of the team when unequal incentives are present. Through this experiment, we aspire to gain insight as to different methods for managers of creating open communication and increased collaboration in the work place.

The Effect of Teaching Method and Institutional and Classroom Factors On Student Learning In Introductory Physics

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Institutional factors, classroom factors, and pedagogy all affect student learning in introductory physics courses. These effects are measured with research-based conceptual inventories in a wide range of institutions worldwide. In Mechanics (physics 1), the two most popular concept inventories are the Force Concept Inventory (FCI) and the Force and Motion Conceptual Evaluation (FMCE). In Electricity and Magnetism (physics 2), the two most prominent inventories are the Brief Electricity and Magnetism Assessment (BEMA) and the Conceptual Survey or Electricity and Magnetism (CSEM). We conducted a secondary analysis of peer-reviewed papers published from mostly US colleges and universities to compare institutional, classroom, and pedagogy effects in both Mechanics and Electricity and Magnetism. We ran statistical analysis between classroom data, math level, pedagogy and institutional data from the Carnegie Classifications to see what affects student learning. Last year, we reported on Mechanics data; this year, we report on Electricity and Magnetism data. We found that teaching method is still an important factor in these classes, but it is not the only factor that affects student learning.

Reviving the Democratic Frontier in Kansas

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Republicans have largely dominated state politics in Kansas since 1861. Although Democrats have been competitive in state elections and ten Democratic Governors held office between 1882 and 2002, Democrats are more likely to succeed in Kansas when the Republican Party is split. This was the case during the Populist Era in the 1890s and again between the 1950s and 1980s. In the 1990s, however, some local Democratic offices closed. During the 2014 midterm elections, and despite the Republican incumbent for Governor being widely unpopular in Kansas, Democrats were unable to effectively challenge Republican leadership. How, then, can local Democrats revive the Party where Republican power remains robust and the infrastructure for Democratic organizing has been absent for nearly twenty years? To answer this question, I have been studying a group of local residents who are trying to reinvigorate the Democratic Party in "Prairie City." Their efforts began before the current split in the Republican Party developed, and several leaders of these efforts have participated in a non-partisan Coffee Party movement that emerged in 2010 as a response to the popular Tea Party movement. However, whereas many members of the Coffee Party feel that supporting moderate Republican candidates is the only way they can be included in state politics, leaders of the movement to re-open a Democratic office hope to create a viable Democratic alternative. I examine how they are working to overcome a variety of obstacles to reestablish an effective Democratic challenge to a powerful Republican Party.

Designer Polymers for the Design of Better Mesoporous Silica Particles for Drug Delivery

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The Bossmann and Wang group have developed a new polysilazane-based random copolymer capable of binding to macroscopic and nanoscopic metal, metal oxide and polymer surfaces. My research is concerned with utilizing this novel material in the design of mesoporous silica (nano) materials (MSN). Mesoporous silica nanoparticles (MSNs) have been intensely discussed as drug delivery devices since the turn of the millennium. A history of in-vitro studies have demonstrated that MSNs can be designed to exhibit stimulus-responsive release of drugs, suitable cellular uptake, as well as cell-specific targeting. Furthermore, MSN are able to deliver relatively large payloads of a broad variety of therapeutic agents, ranging from hydrophobic drug molecules to therapeutic peptides and imaging agents. The reason why my research is concerned with the development of novel Hybrid Microspheres for Cell-Mediated Delivery is that in spite of all reported successes, MSNs have not performed exceedingly well in meaningful animal models. This is, in part, because it is difficult to derivatize them with groups facilitating triggered release. Our novel designer polymers are capable of forming nanoscopic or mesoscopic layers on the surface of MSNs. The presence of silicon-hydrogen bonds within the material permits the attachment of a wide variety of "gatekeepers", such as peptides and proteins to the outer shell of the MSNs. At the same time, the non-toxic designer polymers are undergoing a controlled biocorrosion process within the body. This enables their transport either via extravasation or cell-mediated delivery to tumors and metastases, followed by the controlled release of their payload.

The Design and Construction of a Compact Inverted Pendulum Cart

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In 2012, Dr. Warren White and his controls lab team created Kansas State's Inverted Pendulum cart, AKA "Wally." The four-wheeled cart uses an underactuated control system to balance the inverted pendulum. If the pendulum falls in one direction (either forward or backward), the cart will roll in that direction to prevent it from falling, analogous to balancing a broom stick, vertically, in one's hand. The dynamics of the inverted pendulum cart is used in multiple new technologies such as the Segway, the self-balancing unicycle, and the Hoverboard, as well as rocket and missile guidance. The cart currently in use is large, cumbersome, and difficult for a large number of students to use at once. The purpose of our project is to create a smaller version of the inverted pendulum cart so that students will be able to test the dynamics of their controllers on their lab station table tops. The greater number of carts would allow for a more efficient utilization of class time. The new cart, nicknamed "Junior", was drawn using the program SolidWorks with many of the parts 3-D printed or purchased from hobby websites. The on-board control computer is the myRIO from National Instruments. The intended results will be determined by building a controller in LabVIEW and testing the dynamics of the cart using the program MATLAB. The desired outcome is to produce two viable prototypes that can then be reproduced for classroom use after further testing. The goal is to ultimately have nine inverted pendulum carts for classroom use.

The Design and Construction of a Compact Inverted Pendulum Cart

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Food Insecurity in Kansas

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With Kansas being in the "breadbasket of the Midwest," how is hunger still prevalent within its borders? The problem I am researching is food insecurity and hunger in Kansas. Food insecurity occurs when families or individuals are unsure of the availability of sustainable food or have limited access to food. I am collecting data from Feeding America to reflect the number of food insecure people in each county in Kansas. The cost of a meal, according to Feeding America's website, will play a key role in my research. Charts and graphs will demonstrate the cost of meals for each county, the correlation between the cost of a meal and the number of food insecure people in that county, and the number of food insecure people in a county compared to its population. The correlation between the cost of a meal and a county's per capita income will be simulated. I hypothesize that food availability is a much bigger problem in rural areas than in non-rural counties. One would think that being closer to farmers and the crop may help solve this problem, but I think we may find that farmers market their entire crop commercially. By doing this research I hope to learn who to help and later how to help food insecure people by understanding hunger's root causes and educating people about the problem to start a movement.

Spatial Distance and Construal Levels of Consumers' Decision Process

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The purpose of this project is to test persons' decision processes when choosing between businesses that are located close together versus ones separated by distance. The goal of this project is to identify the type of decision processes consumers make when choosing from various retail stores. The outcomes could provide evidence to improve the likelihood of retail store traffic. We are examining consumers' decision processes by using the Construal-Level Theory (CLT), when they choose among businesses with similar product offerings depending on the travel distance. CLT proposes that increasing the reported spatial distance of events leads individuals to represent distant events by their central, abstract, global features (high-level construal) rather than close events by their peripheral, concrete, local features (low-level construal). Prior research has examined consumers decision outcomes, not decision processes. Building on previous research, we hypothesize that consumer's who choose a business located closer will engage in a simplistic, heuristic-type, decision process, whereas, consumers choosing a spatially distant location will engage in a more effortful strategy. The study uses an experimental design to survey participants to describe their decision processes when choosing among businesses varied by location and density.

Expression of cytokines in Wharton's jelly-derived mesenchymal stromal cells

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Wharton's jelly-derived mesenchymal stromal cells (MSCs) are being pursued as an alternative to other forms of multipotent cells for regenerative medicine. In contrast to stem cells gathered from bone marrow, which are painful to procure, or embryonic stem cells, which are controversial, MSCs from Wharton's jelly are collected using a painless procedure from discarded umbilical cord tissue. Currently, we are growing MSCs in cell culture to be studied and tested to characterize them. Results have demonstrated that Wharton's jelly-derived MSCs can be grown in vitro relatively easily and that they can be differentiated into osteocytes, adipocytes, and chondrocytes, as well as other cell types. It has been shown that Wharton's jelly-derived MSCs are a viable source of multipotent cells that may have profound effects in regenerative medicine. Another student researcher and I are testing which cytokines are produced by the cells when subjected to varying stimulants. We hope that we can discern which stimulants produce the most cytokines that result in an immunomodulatory effect.

The Revitalization of the Maternal Bond: An Exploration of the Women's Activity and Learning Center

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The upsurge in incarceration rates within the United States has become a serious issue, especially when considering the impact these rates have on familial relationships. In particular, the increase in incarceration rates have resulted in more children growing up without the presence of a mother, which has been associated with detrimental outcomes such as offender recidivism as well as mental health and social issues for their children. As a means to combat these deleterious effects within the Topeka Correctional Facility for Women, the Women's Activities and Learning Center (WALC) was established. WALC is a program that provides a variety of activities to help incarcerated women stay connected with their children. The purpose of the current project is to explore the specific activities the women engage in with their children and how their relationships with their children have changed as a result. In-depth qualitative interviews with program participants were collected and analyzed for this project.

Girl Scouts Troop Meetings as Health Promotion Opportunities

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Previous research shows that physical activity (PA) and fruit and vegetable (FV) intake decline during adolescence. Girl Scouts (GS) is a program that can offer a viable channel for health promotion and obesity prevention, but research suggests that troop meetings often are missed opportunities for positive contributions to the health and fitness of attending girls. The purpose of the current study was to assess GS meeting environments before and after leader wellness trainings to determine whether trainings led to improvement in meetings' wellness environments. Meetings for nine GS troops were observed at baseline (Jan-Feb) for PA opportunities (via accelerometer) and snack nutrition content (via direct observation). Leaders then received both a group-based and one-on-one wellness training, where they set goals and received resources regarding PA and FV opportunities for upcoming meetings. The same meeting assessments were completed post-intervention (April-May). At baseline, average±SD caloric consumption during a meeting was 191±198 kcals, FV availability was 1.0±1.7 servings, while average moderate-vigorous PA (MVPA) during a meeting was 9.6±5.8 minutes, and the average for steps was 526±239. Neither caloric consumption (-42.6±376.9 kcal) nor FV availability (1.0±3.1 servings) changed over the course of the intervention. However, troops exhibited an increase in average steps (1,468±2,233, $p=0.012$) and MVPA (17.4±21.7 min, $p=0.012$). Results from the current study suggest that GS troop environments have the potential to be improved with regard to PA opportunities and snack nutrition content. Leader wellness training improved PA opportunities, but did not appear to impact FV availability during meetings.

The Effects of Blur/Clarity on Selective Visual Attention

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Preattentive features are processed rapidly, naturally and in parallel without any attention required. Advances in knowledge of preattentive features is important in understanding cognitive abilities used in education, film, photography and advertising. Research involving dual task paradigms suggests that blur is a preattentive feature (Loschky et al., 2014). Eye-tracking studies show that observers naturally attend to unique clear regions before blurred regions (Enns & MacDonald, 2012). Using a rotated L and T visual search task and manipulating the presence of blur and clarity, this eye-tracking study investigates whether blur has a repelling effect on selective visual attention, or if blur is simply ignored. Participants were given the task of finding the T amongst the Ls; the experiment compared their reaction time (RT), and eye-movements. The different conditions consisted of either all of the letters presented clearly or blurred, and either the target or a single distractor presented blurred or clear. To know whether set size had an effect on attention, two different set sizes (4 & 8) were presented. The results show that blurred singleton targets do not have significantly longer RTs than the all-blurred and all-clear conditions, indicating that blur does not repel visual attention. The first eye-fixation-results showed that blur is not capturing selective attention. The consistent RT results through all conditions, along with the first eye-fixation-results in both set sizes suggest that blur is being ignored. These results indicate that further research is needed to understand how blur, if at all, influences selective visual attention.

Improving Social Skills Through Song

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Social stories are short narratives used to teach appropriate social behaviors to people with a variety of developmental disabilities. These narratives can be set to songs which serve as cues for, and as a means of remembering appropriate social behaviors. Current research indicates that school-aged children benefit from social story songs. This research project explores the effectiveness of social story songs to aid adults with intellectual disabilities (IDs). The researchers created a social story song to help cue the participants in a campus drama therapy program to focus their attention on the speaker. Participants were taught the song, instructed in the use of part of the song as a cue to redirect focus on the speaker, and then through staff-feedback its effectiveness was recorded. Through analysis of the responses, the researchers anticipate that social story songs are an effective way to help adults with IDs develop specific pro-social behaviors. A positive result of this study is significant, as it may provide evidence for the effectiveness of this tool when used in a variety of group social situations, thereby transferring the social story cue approach beyond the drama therapy environment.

Poor Diabetic Control is Associated with Chronic Hypertonicity in Cats

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Diabetes in cats results from insulin deficiency and is characterized by increased serum glucose concentration (hyperglycemia) and clinical abnormalities including increased water intake and urine production, weight loss, and dehydration. Tonicity is a serum physiochemical property that is determined by the concentration of effective osmoles. Elevation in serum tonicity (hypertonicity) alters cell function and produces systemic abnormalities, such as neurologic complications. Persistent hyperglycemia is a feature of feline diabetes but the prevalence of hypertonicity is unknown. The study hypothesis is that serum hypertonicity is a frequent complication of chronic feline diabetes. Study groups were diabetic (DC; n=22) and non-diabetic (NDC; n=56) cats that visited the Kansas State University Veterinary Health Center. For each cat, serum sodium, potassium, urea, glucose, and fructosamine (DC only) were recorded and used to calculate total osmolarity (OsmT) and tonicity. A receiver operating curve (ROC) was generated to examine the relationship between tonicity and fructosamine. Clinical data was compared between groups using Student's T-test or Spearman's rho test with significance set at $p<0.05$. DC had elevated glucose, OsmT, and tonicity compared with NDC. Hypertonicity (>330 mOsm) was present in 50% of DC versus ~5% of NDC. In DC with hypertonicity, the additional osmoles were provided by glucose. Correlations between tonicity and electrolytes or glucose were stronger in NDC versus DC. In DC, hypertonicity is a moderate predictor of unacceptable diabetic control based on the fructosamine level. In conclusion, hypertonicity is common in cats with chronic diabetes and is associated with indicators of poor diabetic control.

The Role of Gene CDR20291_1070 in *Peptoclostridium difficile*

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Peptoclostridium difficile is an anaerobic endospore forming bacteria and is the major cause of diarrhea in hospitals. When high risk patients with weakened immune systems, such as the elderly or infants, take antibiotics and the normal microbiota are disturbed, Peptoclostridium difficile is able to establish an infection. Symptoms of this infection can vary from mild diarrhea to life threatening pseudomembranous colitis—inflammation of the colon. To understand the role of gene CDR20201_1070 in the physiology of Peptoclostridium difficile, we constructed a mutant in strain R20291. By comparing the mutant bacteria to the original strain (wild-type), we can observe what effects the mutation has on the cells. Through complementation of the mutant with the original gene, we can confirm the changes were specifically due to the mutation. To complement a bacteria, the complementary gene must be introduced with an inducer which instructs the bacteria to accept and produce the gene. To make sure the changes in the bacteria are again due to the gene, the complemented bacteria will also be compared to a control group of the mutant bacteria with the inducer, but without the gene. In our results, the mutant cells appeared elongated suggesting some defect in cell division or related proteins. Complementation of the mutant gene with the originally functioning gene reversed the growth defect in Ty growth medium. This new information will be an addition to the work dedicated to assigning roles to each gene of Peptoclostridium difficile and their role on the physiology of the bacteria.

Contemporary Architectural Form

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Architectural form types serve as a guiding principal of both formal and spatial decisions, with the goal of creating a cohesive and well composed building. When executed successfully, a form elevates a building beyond its structural confines by establishing a language that is both clear and understandable. A contemporary architectural survey of the last fifteen years within the avant-garde of the field has revealed an establishment of five contemporary forms; the tube, ribbon, peeling, fractal, and shed. These forms beg the question: Within contemporary architecture, does there exist a series of form tenets which can be codified to establish principals from which designers can foundationally apply to their design process.

This research will focus primarily on the tube form, establishing a methodology and logic built for further research of the remaining four types. As the tube form suggests, a building's form follows a spatial construct which reflects a tube or tubes of space. Thus the name suggests its formal nature and logic of spatial organization to be inspected and codified.

Works by various contemporary architects, working within the form type, were chosen for their degree of success, becoming case studies from which a taxonomy of design decisions could be made. The analytical process required diagrammatic perspectives, plans, sections, elevations, and diagrams, entailing an understanding of how a case study dealt with: the ground plane; materiality; openings; spatial relationships; spatial morphology, and how basic infrastructure of the building is functionally organized.
The underlying theory behind this work is to reveal basic principles which each form type is built upon. In doing this taxonomy, designers can use this research to further their understanding of the issues which must be dealt with given a formal style construct within contemporary architecture projects.

Implementation of Thin-film Transducers in Space-suits

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This research focuses on developing thin ultrasound transducers for use in space-suits. The ultrasound imaging provided will help to diagnose shoulder injuries that occur in an astronaut's Neutral Buoyancy Lab (NBL) training exercises. If a sufficiently robust and inexpensive design can be developed then ultrasound imaging may also be viable for general health-care applications where a body-worn system and continuous monitoring is helpful.
The preliminary research included a literature review focused on several aspects of the unit including the imaging array, piezoelectric materials, and flexibility of the structure. This led to the construction of a working prototype probe. Currently the project is in the process of improving the design by increasing the cable length, and lessening the fragility of the device. A new working design is expected to be completed by the end of April 2016 with aspirations of submitting it to the Johnson Space Center for qualification within a space-suit environment as well as writing a paper to be published.

Manhattan Seen Through the Organization of African American Churches

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The primary focus of this project is to inform individuals on the historical significance of the church in the African-American community, particularly in Manhattan, Kansas. People are educated in school about slavery, Martin Luther King, and the Civil War but are rarely educated on black culture. Church was the center of the black community during times when segregation was posted on door signs. A significant amount of time was spent at the church due to the fact that Africans had few other options on locations to gather. The main goal of this project is to elaborate on the effect that the church had on the community.

My research question is: how much did the church influence the lives of Manhattan's African American community prior to the Civil Rights Movement? The answer to this question will be sought by analyzing an oral history that was previously recorded on Linnetta and Deacon Billy Hill. The Hills have been in Manhattan, KS, for many generations and they are one of the last original families who attend Pilgrim Baptist church. Information has been gathered from online resources and scholarly articles, newspapers, books, and K-State's very own special collections to further comprehend the organization of Manhattan's African-American community through the church. The significance of this research is informing the public on parts of Manhattan history that has been forgotten.

Degrading Textile Dyes with Phytoremediation

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Excess textile dyes are being thrown away in the environment which is becoming a major pollution problem because untreated dyes cause chemical and biological changes in our aquatic system. That is why we are trying to get rid of these textile dyes by phytoremediation, which is a bioremediation process that uses plants to eliminate the environmental problem without the need to dispose of it elsewhere. Sunflowers and Arabidopsis have already been used successfully to degrade the dyes so we know that some plants can do it. Dye disposal is mainly a problem in more tropical, and dry areas where the salt cedars are well adapted to grow, which is why we chose them to test. We are growing plants called salt cedars in hydroponic solutions and adding textile dyes to see if the dyes degrade faster and more successfully than throwing them away and damaging our environment. The dyes that we used in our experiments were Methyl Orange and Phenol Red. For our experiment, we had salt cedars in bottles of dyes with either doses of hydrogen peroxide with a mediator called HOBT or just hydrogen peroxide. Our research is not yet complete but we expect that the salt cedars will continue to live and will degrade these dyes efficiently. If our results are true, then this will give a safer and cheaper way to dispose of textile dyes without causing any harm to our environment.

Assessing Southwest Kansas Plots to Determine Potential Wind Turbine Profit

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The purpose of this research is to assess plots in Southwest Kansas to determine if said plots would be viable to sell wind energy. Currently there are financial/regulatory restraints throughout Kansas with the selling of energy. This research would help determine if the selling of wind energy in exchange for pumping less water would make economic sense for all parties associated. I will be analyzing data from met (meteorological) towers located at several locations to calculate the total annual energy expected from wind turbines at 80, 100, and 120 meters at pre-selected potential regions. I will be using the mean wind speed from already existing wind map data combined with shape factor from a Tall Tower wind data analysis already conducted using KDOT antenna towers in six Kansas counties to come up with a wind frequency curve for a given site on the map. Multiplying the wind frequency curve by the power curve for a selected wind turbine we calculate the total annual energy. Total annual energy would help me calculate the amount of profit a person might make by selling wind energy on their plot of land.

Superhydrophobic Polysilazane Designer Polymers

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Although many hospital infections originate from initial colonization at the time of injury, hospital-acquired infections often occur from biofilms on surgical equipment, catheters, etc. Wide-spread multidrug resistance (MDR) is observed in all major bacterial strains occurring in hospitals, which has been facilitated by systematic over-use of broad spectrum antibiotics. Considering the high prevalence of biofilm associated bacterial infections, there is a critical need for the development of bacterial resistant surfaces and interfaces capable of targeting microbial biofilms of multi-drug resistant bacteria. (Super) hydrophobic coatings are ideal for surgical instruments, needles, catheters and short-term implants, because they prevent the adhesion of bacteria. Polysilazane designer polymers will permit strongly adhesive coatings, which are required for clinical use. They can easily be sterilized and are chemically stable. Furthermore, we will be able to integrate antibiotic (lytic) peptides into the chemical framework of the polysilazane polymers to further prevent colonization. These surfaces will be studied in two steps. First, we will determine the physical and chemical properties of the novel coatings (surface hydrophobicity) by measuring the contact angle of water, pH- and heat resistance, resistance to biological (enzymatic) etching processes through contact with blood and tissue samples obtained from mice. Finally, we will then measure the capability of bacteria to colonize these surfaces by incubating M. luteus (BSL level 1) and E. coli (BSL level 2) on these surfaces in 96 well plates. The bacterial growth will be determined via microscopy and by employing the MTT assay.

Novel Electric Field Decoupler for Electrochemical Detection in Microfluidic Devices

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When an ionic current in an aqueous solution is converted to an electrical current at an electrode, water is generally oxidized or reduced producing either oxygen or hydrogen gas at the surface of the electrode. In an enclosed channel the gas quickly supersaturates the solution and produces gas bubbles that can interfere with the electrical circuit. This makes integrating electrophoretic separations with electrochemical detection in microfluidic channels problematic. In order to overcome this limitation, a method needs to be devised to absorb or otherwise get rid of the excess gas. We are trying to use the gas permeability characteristics of poly(dimethylsiloxane) (PDMS) to mitigate bubble formation. A thin membrane of PDMS located above the electrode was fabricated to allow the excess gas to diffuse quickly out of the channel. In order to test this membrane, a variety of experiments were conducted at different electric field strengths and buffer conductivities to assess the ability of the membrane to mitigate bubble formation. Preliminary results have shown that the generation of a partial vacuum across the PDMS membrane has an attenuating effect on bubble formation. Mitigating bubble formation at the electrode will allow the development of in channel electrochemical detection for electrophoretic separations. Future work will examine various parameters to optimize the system.

Insect Cuticle Sclerotization

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Insect cuticle (exoskeleton) has diverse mechanical properties. The exoskeleton of insects can be hard and rigid or soft and flexible. The insect cuticle is inspiring the development of new medical and technological materials. Sclerotization is the hardening of the cuticle and it is hypothesized that the enzyme Laccase-2A is responsible for the cross-linking between proteins in the cuticle which help to make the cuticle more rigid and stable. Our goal is to test this hypothesis by replicating the cross-linking process in the laboratory. In order to test this, we need to produce the cross-linking enzyme and cuticle proteins in sufficient quantity to perform these experiments. The genes for CP30 and CPR27, two main proteins found in the insect cuticle of Tribolium castaneum (red flour beetle) were inserted into bacteria for expression and purification of the proteins. Currently, we are working on the expression of the enzyme Laccase-2A from Tribolium by using a yeast expression system. We found that CP30 and CPR27 can be expressed in high quantities and purified easily using bacteria. We are expecting to get similar yielding results for Laccase-2A using the yeast system. Recombinant DNA technology has proven to be a successful method for producing and purifying the proteins needed for the cross-linking experiments. Once this is completed we will test the hypothesis that CP30 and CPR27 can be cross-linked by Laccase-2A. Ultimately, understanding how these proteins are interacting with one another will help in the development of biomimetic materials.

Nanoparticle Uptake and Toxicity on Neural Stem Cells and Monocyte Cells

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Many treatments and tactics have been developed to increase efficiency of drug delivery methods. One method that has improved drug delivery is the use of nanoparticles. In our studies, we have tested the effects of mesoporous siliconedioxide nanoparticles on tumor homing Neural Stem Cells (NSC) and Monocyte cells (RAW 264.7). The nanoparticles were separated into two groups; Polyethylene glycol(PEG) coated to bypass immune system surveillance, and Biotin labeling to increase loading efficiency. All nanoparticles have non-toxic and biodegradable properties. Each nanoparticle is between 50-100 nm with 2-4 nm pore size which makes it ideal to load drugs inside for targeted cell based therapy. Each of the eight samples were tested on both NSC and RAW cells to test loading efficiency. The samples were loaded at (50µg/1ml) and (100µg/1ml) on both cell types and incubated at 30 minutes and 24 hours before washing and fluorescence imaging. Toxicity was then measured by using varying concentrations from 0 to 100 µg/ml of nanoparticles on these cells after 24 hour exposure through MTT assay.

Localization of Drosophila Importin7 (Dim7) in contractile muscle tissue

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The protein product of the moleskin (msk) gene, named Drosophila Importin-7 (Dim7) is essential in forming the myotendinous junction (MTJ). The MTJ is a specialized site where muscle and tendon cells meet to allow for proper muscle contraction and organismal movement. Drosophila melanogaster, or the fruit fly, is a commonly used model organism for muscle studies as many genes required for invertebrate muscle development are also conserved in human skeletal muscle development. We are using a combination of genetics, immunostaining, and microscopy to determine which region of the Dim7 protein is responsible for proper muscle attachment and formation. In this study we use the binary Drosophila Gal4/UAS system for tissue-specific expression of our gene of interest. Virgin female flies that carry a muscle-specific mef2-Gal4 transgene are crossed to six different 'UAS' male fly stocks that are deleted for various portions of the msk gene. The muscles from third instar larvae are filleted and immunostained to visualize the localization of Dim-7 protein in muscle tissue. Dim-7 normally accumulates in a striated pattern consistent with sarcomere localization, at the distal ends of myofibers at so-called muscle attachment sites, and at low levels in the myonuclei. It is expected that deleting regions of Dim-7 will alter the normal subcellular distribution of this protein and possibly result in phenotypic consequences, such as muscle detachment. Identifying which specific region of the msk gene is responsible for proper muscle attachment and formation will help us understand the molecular basis for muscle-tendon interactions and possibly some types of congenital muscular dystrophies.

Urban Design Governance in Low-Density American Cities: Emerging Institutions in Kansas City, USA

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The project examines recent and halting effort to develop institutions for design governance in sprawling Kansas City. Design governance refers to methods of regulating urban design, development decisions, management and operations of elements. Research on design governance in North America has tended to focus on coastal cities with long traditions of design governance. Less studied are cities in the interior whose size, density, isolation or conservatism limit sustained development interest needed to make effective design governance possible. This project uses the case of Kansas City to examine design governance in this more challenging context. The project draws on content analysis of city plans and semi-structured interviews with public officials, developers, and residents, supplemented by selected morphological analysis. The project identified the mechanisms for design governance established in successive city plans, analyzed how those mechanisms have been implemented within the current development context, and evaluated the successes and failures in attempts to increase the quality of urbanism in the downtown core. After decades of decline Kansas City is experiencing a design moment, making it an opportune time to assess its nascent institutions for design governance. Successive city plans have guided resurgence and have identified mechanisms of design governance to ensure that new developments contribute to sustaining downtown Kansas City's momentum. Nevertheless, context and cultural factors limit the effectiveness of emerging institutions of design governance. The long history of disinvestment in downtown has resulted in a culture of accommodation to developers: recent projects have continued to benefit from a range of public subsidies despite increasing interest and market demand for new downtown development.

The expression of Cytokines in Human Umbilical Cord Mesenchymal Stromal Cells (UC-MSCs) after activation

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The preparation of Human Umbilical Cord Mesenchymal Stromal Cells (UC-MSCs) for clinical applications might be refined through analyzing their cytokine expression. An ELISA assay was used to quantify the release of IDO, PGE2, and other cytokines known to mediate the immunomodulatory effects of UC-MSCs. The expression was measured before and after various experimental manipulations to adjust their potential clinical effect. The lab compared one of five biological replicates of UC-MSC isolates, three male and two female, including two which were frozen and thawed and three which were never frozen, with four stimulants: Lipolysaccharide (LPS), Polyinosnic: polycytidylic acid (Poly (I:C)), Interferon-γ (INF-γ), INF-γ with Tumor Necrosis Factor-α (TNF-α), and a control (no stimulant). After either one hour or twenty-four hours of exposure to stimulation or control medium, the plates are washed and replaced with fresh media. Twenty-four hours later, the medium is collected and the cytokine content measured by ELISA. These results will provide a comparison between differences in stimulation time, sex, and freeze/thaw in UC-MSCs. The data will inform future, more complex and defined ELISA projects, and be evaluated in a preclinical inflammatory bowel disease model for clinical potency.

Importance of Spanish Song Study in Vocal Music Education

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The purpose of this study is to understand how studying Spanish Classical Music enhances vocal music curriculum and to describe effective pedagogy for Spanish classical music. In most high school and college vocal music curricula in the United States, French, Italian, German, and English language classical music comprise the build of the repertoire. This study is important because it will help illuminate the reasons why classical Spanish music is not currently part of the vocal music curriculum at the high school or college levels in the United States. To accomplish this study, I researched three popular Spanish classical music composers, in order to have a better knowledge of Spanish Classical music. After studying the composers, I will observe several students, male and female, ranging from a freshman in college to a junior in college at Kansas State University. The singers include music majors and minors. I will observe how each responds to the music and what his or her weaknesses and strengths are while they are learning the pieces durring their voice lessons. Also, I will be studying the students' perceptions of how the study of Spanish classical music can help their other vocal music studies. Each subject will fill out the same survey describing their experiences with Spanish classical music (past and present) and what their opinions are in regard to the style and how Spanish classical music helped their other vocal music studies. I will also conduct individual interviews with each participant. The results I am expecting are that students will learn that Spanish music is filled with fast paced tempos and rhythms, short melodic lines, challenging piano accompaniment, and passionate poetry. Students will begin to make connections between Spanish classical study and their other vocal music studies. The significance of this study is that vocal students and teachers will develop personal connections to Spanish Classical music they experience and learn unique qualities. Students and teachers can use this study to develop pedagogy that will include Spanish classical music in the vocal music curriculum on an equal footing with French, Italian, German, and English music and not see it as "extra-curricular."

Solving the pentomino puzzle using a computer

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A domino is two squares put together. A pentomino is five squares put together. There are 12 different pentominos. It is possible to fit these 12 pentominos into a 6×10 rectangle. Solving the puzzle by hand is difficult. I will write a computer program that will find a solution to this puzzle. The computer program will model the puzzle using linear systems of equations. The values of the variables must be zero or one. Each variable corresponds to a placement of a pentomino. When the variable equals one the pentomino fits in that spot. Solving a system with such constraints is a problem that is addressed in linear optimization. After the program finds one solution, we can add a constraint so it will not give the same solution again. Using this we can write a program that will find all solutions.

A Case Study of *La Voz Latina*, a Rural Hispanic Newspaper

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This study examines La Voz Latina — a Spanish-language publication published by The Emporia Gazette in Emporia, Kansas — and its influence in the Hispanic community. Hispanic media use and consumption at the rural, community level is a topic that has been largely unexplored by the field of journalism; this case study will provide insight into the efforts and motives of publishers to expand their coverage to Hispanic audiences, as well as insight into the reception of those efforts by the targeted Hispanic communities. This will be accomplished by conducting surveys of a sample of the Hispanic community in Emporia and by interviewing the staff and publishers of The Emporia Gazette and La Voz Latina.

These surveys and interviews are expected to reveal the most effective methods of communicating with the rural Hispanic audience, and we will also look to determine the goals of the publications and what steps they can take to achieve those goals. We also expect to see that the Hispanic community can be better served in their information needs, and we expect to discover a need and want for better communication in the Hispanic community. The information we discover will be valuable to The Emporia Gazette and La Voz Latina, as well as any publishers in communities with a substantial Hispanic presence.

Identifying substrates of a baculovirus sulfhydryl oxidase

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Baculoviruses are enveloped, rod-shaped viruses with circular, double-stranded DNA genomes that infect insects. During replication, baculoviruses produce two virus forms, budded and occlusion-derived virus. The budded virus buds from the cell membrane and spreads infection from cell-to-cell. The occlusion-derived virus has a protein layer that protects the virus outside the host, allowing spread between insects. The baculovirus ac92 gene is a sulfhydryl oxidase expressed in all baculoviruses sequenced to date but uncommon in other viruses. Their conservation suggests that they have an essential function for baculovirus replication. During sulfhydryl oxidation, protein thiol groups are oxidized to form intra- and inter-protein disulfide bridges. Ac92, the product of ac92, is present in the envelope of budded and occlusion-derived viruses; its oxidation substrates may be envelope proteins. Deletion of ac92 affects the phenotype of each virus form: lack of infectious budded virus production and singly-enveloped instead of multiply-enveloped nucleocapsids in the occlusion-derived virus. This project will identify Ac92-interacting viral proteins using co-immunoprecipitations, which is an antibody-based method to determine Ac92 and viral budded or occlusion-derived virus protein interactions. We hypothesize that the virus encodes a sulfhydyl oxidase to carry out this reaction in the nucleus and cytoplasm of infected cells, cellular compartments where sulfhydryl oxidation is unfavorable. We further hypothesize that sulfhydyl oxidation of envelope proteins renders more stable and infectious virions. Identifying the proteins that interact with Ac92 will provide more information regarding virus structure and stability. This information may translate into methods important to design better vaccines and therapeutic agents.

The Design and Construction of a Compact Inverted Pendulum Cart

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In 2012, Dr. Warren White and his controls lab team created Kansas State's Inverted Pendulum cart, AKA "Wally." The four-wheeled cart uses an underactuated control system to balance the inverted pendulum. If the pendulum falls in one direction (either forward or backward), the cart will roll in that direction to prevent it from falling, analogous to balancing a broom stick, vertically, in one's hand. The dynamics of the inverted pendulum cart is used in multiple new technologies such as the Segway, self-balancing unicycle, and the Hoverboard, as well as rocket and missile guidance. The cart currently in use is large, cumbersome, and difficult for a large number of students to use at once. The purpose of our project is to create a smaller version of the inverted pendulum cart so that students will be able to test the dynamics of their controllers on their lab station table tops. The greater number of carts would allow for a more efficient utilization of class time. The new cart, nicknamed "Junior", was drawn using the program SolidWorks with many of the parts 3-D printed or purchased from hobby websites. The on-board control computer is the myRIO from National Instruments. The intended results will be determined by building a controller in LabVIEW and testing the dynamics of the cart using the program MATLAB. The desired outcome is to produce two viable prototypes that can then be reproduced for classroom use after further testing. The goal is to ultimately have nine inverted pendulum carts for classroom use.

Prostaglandins Stimulate Anion Secretion Via Apical Membrane Receptors in Porcine Vas Deferens Epithelial Cells

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Acute exposure to prostaglandin (PG) D2 or PGE2 causes a rapid and sustained increase in short circuit current (Isc), an indicator of anion secretion, across cultured pig vas deferens epithelial cells, an outcome that is consistent with PG-induced increases in adenylyl cyclase activity. Indomethacin, an agent that blocks prostaglandin synthesis, precluded stimulation by bradykinin, which suggests that all components of the prostaglandin synthesis and response pathways are present. However, the molecular identity of the receptor(s), the location(s) of these receptors and second messengers that mediate the responses remain to be determined. Experiments were conducted to localize PG receptors to the mucosal or serosal membranes. These experiments were carried out with primary cultures and immortalized PVD9902 cells using a modified Ussing-style flux chamber. Serosal, but not mucosal exposure of PGE2 produced a rapid increase in Isc, suggesting serosal localization of EP receptors. Similarly, a selective DP receptor agonist, BW 245C, produced an effect following serosal, but not mucosal exposure. However, PGD2 produced inconsistent responses. Further inquiries will be carried out with 1°PVD cells to better test for DP receptor expression and localization. Experiments are planned also to test for cAMP generation in response to PG exposure. The simplest interpretation of data in hand is that both EP and DP receptors are localized to the serosal membrane of vas deferens epithelial cells. Activation of these receptors is tightly linked to anion secretion, which would be expected to increase pH and fluid volume in the male reproductive duct.

Synthesis of Nanobiosensors for Point-of-Care Devices for Asthma Detection

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There is a critical need for smart point-of-care devices (POCDs)/sensing platforms for monitoring a human's biological response to causes of lung inflammation, for instance asthma triggers, pathogens, toxins or environmental irritants. Significant biomarkers of lung inflammation present in biofluid samples can be readily collected for non-invasive on-demand chip-based detection. My research is concerned with the development of nanobiosensors that will be integrated in Point-of-Care Devices (POCD). A smart POCD will open lead to numerous applications in precision medicine for airway diseases and eventually also to personalized treatment strategies for individual patients. This approach has the potential of revolutionizing the standard of care for asthma and chronic obstructive pulmonary disease (COPD) by enabling a rapid and inexpensive diagnosis using liquid biopsies relying on papermicrofluidic devices. In year 1 of this endeavor, I have synthesized the required peptide sequences and fluorescent dyes. As a result, the study will make advances in discovering excellent biomarkers for airway inflammation diseases.

Mesenchymal Stromal Cells in Pepgel

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MSC's, Mesenchymal Stromal Cell's, are stem cells that can be differentiated into connective tissue or tissue that can be used in the lymphatic or circulatory system. MSC's are being studied in Hydrogel Matrix for two reasons: one being how well the MSC's can grow in a 3D environment and what would be the most beneficial hydrogel/media ratio to grow the MSC's in. Hydrogel is a gel in which the liquid component is water. I follow a protocol that is similar to my lab's standard protocol for harvesting and plating the MSC's in hydrogel and each time I passage the cell's I change the hydrogel ratio to see which gives the best results. I have found that certain cell lines prefer different concentrations of the hydrogel so far. My results show that since the MSC's are being grown in a 3D environment, they have more room to grow which is the reason why the cells take longer to reach senescence than cells grown in 2D culture. From this research I have learned that the MSC's take longer to grow in 3D culture than in 2D because of the adherence factor between the Hydrogel Matrix in 3D and the plastic in 2D. This means that the hydrogel does not contain optimal cell signaling properties for the cells to reach out to each other to be able to grow. The findings from this research will contribute to the forward movement of clinical applications for MSC's grown in Hydrogel Matrix.

Comparing the Different Types and Severities of Cyberloafing in the Workplace

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The Internet has perhaps had the largest effect on business than any innovation in the past century and has improved the workplace in many ways by being a new platform for business to operate, for employees to communicate, and for customers to shop. Businesses across the country are finding different ways to use this to their benefit anyway they can. Use of the Internet for non-work related activities in the workplace has become increasingly more common and businesses have expressed concerns about lost productivity due to personal Internet usage (cyberloafing). However, recent research has found that some types of cyberloafing can serve as a 'break' and can actually have a positive impact on employee job performance while other types of cyberloafing are purely detrimental. Studying three different small companies has allowed us to get a better feel on how different businesses use cyberloafing to their advantage. The results are very shocking, and it even makes for a very unique workplace in most cases. This research will explore how employees spend their time online during work and even within their breaks. This study provides evidence regarding the amount of time office workers spend on a number of common types of cyberloafing. The research will explain the benefits of cyberloafing and how you can use them in your workplace as well.

Intimate Partner Violence

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Intimate partner violence (IPV) can be described as physical, sexual, or psychological harm by a current or former partner, or spouse. Factors that contribute to IPV across cultures, especially witnessing IPV in family-of-origin, are not well understood. This study examined the influence of parental use of psychological aggression and physical assault on IPV in relationships among young adults in Malaysia. This is an intergenerational study that looks at the father and the mother and how parental violence is transferred to the adult child's partner-relationships. Some of the factors that we looked at are partner to self-violence or self to partner violence. With these results we can determine if IPV reoccurs in children who witness IPV in their homes, later on in their lives. Through this research we can also see that the violence seen between the mother and father reoccurred in the adult life of their child.

National Immigration Policies and Ethnic Succession in Kansas, 1860-2010

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The project is based on the history of immigrants who have moved to America and how they have affected the state of Kansas. The main focus of the project is to show the change from 1860-2010 of the number of immigrants in Kansas at the county level. As of now we have collected total population numbers from census (1860-2010) for Mexican, German, and English immigrants for each county in Kansas. We have also included the population of people from Sweden, Russia, and Czechoslovakia. The goal of the project is to show the impact that each of these immigrant groups have made in Kansas. These impacts can consist of how they contribute diversity and how they affect the state economy. We have thought of looking for personal stories of immigrants to see how they have adjusted to their new life. We will also be looking at articles that explain immigration laws that have been passed throughout the years, and see their effects on these immigrant groups. As of now I created graphs using the data I have collected to show a visual of the number of immigrants in Kansas for each racial group. The graphs are created using the total number of immigrants migrating to Kansas from 1860-2010. For now we will continue to find articles and point out key immigration laws that will overlap the information that the graphs are showing and try to relate our research to the immigration conflicts happening today.

Study of the effect of pulmonary surfactant on cationic nanoparticle-based gene transfection in lung cancer cells

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The major challenge for effective cancer gene therapy is targeted delivery of therapeutic genes. We have previously demonstrated a highly effective lung cancer gene therapy using a pulmonary aerosol delivery of apoptosis inducer genes by a modified HIV-1 TAT peptide (dTAT) nanoparticle vector (Kawabata et al., 2012). Although the therapeutic efficacy in mice and the material safety have been carefully studied, cancer tissue-targeting mechanism and off-target effect on normal lung epithelium have not been rigorously addressed. Accordingly, the aim of this study was to investigate the effect of pulmonary surfactant on the efficacy of gene transfection in lung cancer cells and normal lung epithelial cells. Green fluorescent protein (GFP) gene was transfected to the cells in the presence of different concentrations of two kinds of surfactants; a bovine pulmonary surfactant and rat lung lavage, which was analyzed to be dipalmitoylphosphatidylcholine (DPPC)-rich pulmonary surfactant. Both pulmonary surfactants dose-dependently inhibited GFP expression by dTAT and polyethylenimine NP vectors in A549 human lung adenocarcinoma and BEAS-2B normal bronchial epithelial cells. Since a large portion of human non-small cell lung cancers do not express surfactant specific proteins, it is suggested that lung cancer cells are not covered by the pulmonary surfactant, whereas normal healthy lung epithelium are thoroughly covered with the surfactant. These results suggest that dTAT NP-based gene delivery passively causes lung cancer-targeted gene transfection of therapeutic genes; whereas normal lung epithelium is protected by the surfactant, thereby maintaining normal lung epithelial structure. The current study suggests that the dTAT NP-based gene delivery is a cancer tissue targeted safe procedure.

Kinetic Study of Fischer-Tropsch Synthesis using Nanocarbon-Supported Catalysts

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The production of liquid hydrocarbons from a renewable source is a major techno-economic challenge. To address this challenge, there is increasing interest in further improving the Fischer-Tropsch synthesis (FTS) process, which involves the conversion of syngas (CO and H2) to liquid fuels. In this study, the Langmuir-Hinshelwood model is used to analyze reaction kinetic data obtained for nanocarbon-supported FTS catalysts. The use of nanocarbon supports have improved the reducibility of the catalysts as revealed by temperature-programmed reduction (TPR) studies. The catalysts have been characterized by electron microscopy and new correlations between the catalyst properties and the kinetic behavior of FTS have been established.

Expression of Recombinant Nucleocapsid (N) and Spike (S1) Proteins of Avian Infectious Bronchitis Virus and Their Assessment as Diagnostic and Subunit Vaccine Antigens

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Infectious Bronchitis Virus (IBV), a positive-stranded RNA virus in the family Coronavirus, genus Gammacoronoavrius, is the cause of an acute disease, Infectious Bronchitis (IB) in chickens. It is one of the major contributors to economic losses in the poultry industry globally. Infection in layers can cause up to 70% drop in production, with eggs characterized by shells that are wrinkled, thin, and soft. IBV encodes nine functional genes, which include the Spike protein (S1), a viral surface glycoprotein shown to induce neutralizing antibody response, and the Nucleocpasid protein (N). The virus poses a persistent threat due to the high rate of emergence of antigenic variants and reassortants strains, making control and vaccine development especially challenging. The N and S1 proteins of IBV have been identified to interact with the host to cause an antiviral immune response. Therefore, this study aimed to assess the utility of the more conserved N protein as a tool for diagnostic development, and the more polymorphic S1 as a potential subunit vaccine. The target genes were amplified by PCR and then cloned into pFastBac plasmid to create donor plasmids, pFastN and pFastS1. The plasmids were used to create recombinant bacmids for rescue of the recombinant baculoviruses in Spodoptera frugiperda, Sf9, insect cells. After recombinant protein purification using Ni-NTA affinity chromatography, specific immunoreactivity was confirmed by western blot using antiserum collected from chickens naturally infected with a local Turkish IBV strain. The N protein based on the sequences of Beaudette strain displayed reactivity against both the antiserum and the monoclonal antibody raised against the Massachusetts IBV strain, indicating a potential broad cross-reactivity. While the S1 protein was reactive against Anti-His (C-Terminal)-HRP antibodies, it failed to react with the Turkish antiserum. The results suggest a strong candidacy of the N protein as a diagnostic antigen for detection IBV infection in chickens; further studies will be performed to examine the reactivity of the S1protein.

Perceptions of Anti-Black and Anti-White Racism: Not Two Sides of the Same Coin

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Racism has traditionally been conceptualized as majority group discrimination toward minority groups, with the traditional prototype of prejudice being Whites discriminating against Blacks (Inman & Baron, 1996). However, a more modern prototype may have emerged in response to Whites perceiving themselves as the victims of reverse discrimination (Norton & Sommers, 2011). In two studies, we investigated how tendencies to perceive anti-Black prejudice interact with manipulated perpetrator/target race pairings to predict attributions to prejudice. Accordingly, we predicted that 1) Whites who believe anti-Black prejudice is prevalent will be more likely to perceive White-on-Black prejudice, and 2) Whites who deny anti-Black prejudice as prevalent will be more likely to perceive Black-on-White prejudice.

In Study 1, participants read a hypothetical news brief in which a homeowner shot and killed an unarmed man approaching the homeowner's house. Race of the perpetrator and victim were manipulated (White-on-Black/ Black-on-White), and perceptions of the perpetrator's racial prejudice were measured. In Study 2, participants read a hypothetical scenario in which a police officer shot at an unarmed man fleeing the scene of a routine traffic stop. We found that Whites are more likely to perceive anti-Black behavior (i.e., traditional prototypes for prejudice) as prejudice than anti-White behavior. More importantly, we found that tendencies to perceive White-on-Black racism were unrelated to tendencies to perceive Black-on-White racism. Thus, the perceptions of anti-Black and anti-White racism as prevalent and problematic in society may be categorically different depending on the target groups' locations in society's status hierarchy.

Nova in vitro approach to measure antibody against adherence of Enterotoxigenic E. coli (ETEC) to human intestinal cell lines

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Escherichia coli (E.coli) strains producing enterotoxins, ETEC, are the most common bacterial causes of children's and travelers' diarrhea2. ETEC cause 280-400 million cases of diarrhea in children < 5 years, and additional 100 million cases in children > 5 years, resulting in 150,000 – 300,000 annual deaths of young children. ETEC also cause 400 million cases of diarrhea in adult travelers3. Currently, there are no effective methods of preventing diarrheal diseases. Vaccines are considered the most effective and most practical against children's diarrhea and traveler's diarrhea4. The goal of this study is to establish an in vitro assay using green fluorescence protein (GFP) to assess vaccine efficacy, particularly efficacy against ETEC colonization. Green fluorescence protein (GFP) is a protein found in bioluminescence Jellyfish, Aequorea victoria1. GFP emits a green fluorescent light when it admits blue light from activated photoproteins or ultraviolet light. GFP is primarily used to mark gene expressions and localize proteins1. In this experiment GFP was introduced to ETEC bacteria, for adherence detection between ETEC and human intestinal cell lines. The cell lines were screened using a florescence microscope to establish a baseline of ETEC adherence to cell lines and to optimize in vitro assays. The selected cell lines in antibody adherence inhibition assays were used to assess antibodies induced by vaccine candidates against ETEC bacterial colonization.

Role of HDAC Inhibition and Environmental Condition in Altering the Reinstatement of Drug-Seeking Behaviors

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Epigenetics is the study of how life experiences alter gene expression and has gained a significant amount of interest as a contributor to several behavioral phenotypes of drug addiction. Research suggests that rearing rats in different environmental conditions can impact drug-taking and drug-seeking behaviors. The differential rearing paradigm has been shown to affect drug responses as well as influence epigenetic markers involved with drug reward. In this study, we investigated the relationship between differential rearing conditions and epigenetic alterations on drug-seeking behavior in an animal model of drug relapse. Rats reared in three different environmental conditions for 30 days: enriched, standard, or isolated. After lever-press training, rats were surgically equipped with indwelling jugular catheters and acquired stable rates of amphetamine self-administration. Following an extinction period in which lever presses led to neither cues nor drug reward, rats underwent both cue- and drug-induced reinstatement tests to measure the relapse of drug-seeking tendencies. During this extinction period rats were administered Trichostatin A (TsA), an HDAC inhibitor, to alter general epigenetic function. All rats exhibited both cue- and drug-induced reinstatement, with TsA administration significantly decreasing cue-induced reinstatement, with more of an attenuation observed in IC rats compared to EC or SC rats. Compared to vehicle control groups, TsA administration did not affect drug-induced reinstatement in any of the environmental conditions. This study furthers our understanding of how differential environmental rearing conditions may alter epigenetic mechanisms that change the likelihood of relapsing when exposed to conditioned contextual cues heavily associated with drug reward.

A Novel Designer Polymer for Application in the Life Sciences

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The Bossmann and Wang group has developed a new designer polymer capable of binding to macroscopic and nano-scopic metal, metal oxide and polymer surfaces. My research is concerned with scaling up the synthesis of a polysilazane copolymer that forms the backbone of the novel polymer material. It can be converted into hydrophilic, hydrophobic (repels water) or superhydrophobic surfaces by nucleophilic exchange reactions. Furthermore, the designer polymer contains silicon-hydrogen bonds, which offer the opportunity to perform unprecedented "click chemistry" with alcohols and amines. This novel and universal "click chemistry" reaction releases hydrogen (H2), thus making the reaction irreversible. It permits the patterning of macroscopic surfaces by using classic 2D inkjet technology. Furthermore, it offers an easy approach to converting fluorescent and magnetic nanomaterials into bioavailable agents that won't be toxic to cells, as long as their coating remains intact. We are in the process of exploring the general applicability of the novel designer polymer in the life sciences.

The Salt Survival and Azo Dye Degradation of Saltcedars

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Azo dyes are a common type of textile dye. They are carcinogenic when introduced into the environment and left to break down on their own. This means degrading them into nontoxic compounds is important to the textile industry because large amounts of dye solutions and salts are discarded into the areas surrounding textile factories in underdeveloped countries. Saltcedars are known for being hardy plants, invading many dry, hot areas of the world as an invasive species. These plants take advantage of any water accessible and can thrive in salt concentrations that would kill other plants. In the lab, we are testing the degrading capabilities of saltcedars in these dye solutions to see if their roots will break down this harmful solution. We grow the plants hydroponically in solutions containing different salts with nutrients. Over time, the plants are weighed to see how much water they are using per hour in order to measure how much they grow. We plan to test several azo dyes to see if these plants can degrade/decolorize the solution and if so, how fast. So far, we have learned that the saltcedars can tolerate high amounts of sodium chloride, sodium sulfate, calcium chloride, and boron. This means that the plants we tested can grow in salty, toxic environments which makes them suitable for planting near textile factory constructed wetlands in order to purify the area. This research can potentially create an ecofriendly solution to pollution and the increase of carcinogens in the environment.

Effects of differential rearing on voluntary ethanol consumption in adolescent rodents

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In 2013, the National Survey on Drug Use and Health found that 8.7 million people aged 12-20 reported drinking in the last month and furthermore, 5.4 million people of the same age engaged in binge drinking behavior. This pattern of use can have significant negative effects and alcohol use during adolescent years can alter brain development and increase the risk for abuse or dependence as an adult. Previous research has demonstrated that the rearing environment during rodent adolescence causes changes in behaviors such as drug seeking and consumption. For example, it has been shown that enriched and standard (SC) housing protects against ethanol use, while isolated (IC) housing increases ethanol use. However, it is not clear if the rearing environment can alter binge drinking during adolescence. We hypothesize that ethanol preference and consumption will escalate more in IC rodents as compared to SC rodents over the extended exposure period time. In experiment one, over a four-week binge exposure period, rodents reared in the IC preferred, and voluntarily consumed, more ethanol than rodents reared in the SC. Furthermore, this preference increased during the later exposure days. In experiment two, rats will be exposed to a longer binge period and we hypothesize that rodents reared in the IC will prefer and consume ethanol more than the SC rodents and that this will escalate over the six- week exposure period. This study can help us to further understand the role the environment plays in adolescent alcohol consumption.

Nutritional Content in Nutritionally Focused vs Standard Menu of the National School Lunch Program for Adolescents in Grades 9-12

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Adequate nutrition is essential for proper growth and development, as well as for learning, cognition, and behavioral functioning in youth. There are several child nutrition programs with nutritional requirements that help guide efforts to provide adequate nutrition to our nation's youth. One of these programs is the National School Lunch Program, which provides meals that are nutritionally balanced, low-cost or free, and available every school day, however, further efforts to improve school meals may be needed to promote the well-being of American youth. The purpose of our study was to determine whether there were significant differences in nutritional quality between a standard school lunch menu and a nutritionally focused lunch menu (both meeting National School Lunch requirements). The nutritionally focused lunch menu was based on the following nutritional priorities: 1) whole grains; 2) whole fruits; 3) fruits and vegetables incorporated into menu items; 4) greater variety of protein foods; 5) minimal added sugar; 6) minimal processing. Nutritionist Pro software was used to analyze 5 days of lunches for each type of menu. Among the major differences in the nutrients of concern were vitamin A (282RE vs. 907RE), folate (139ug vs. 214ug), fiber (10g vs. 16g), Vitamin E (0.23mg vs. 0.45mg), sodium (1118mg vs. 791mg), and magnesium (133mg vs. 187mg). Preliminary results indicate that nutritionally focused lunches could offer substantial improvements in the nutritional quality of child nutrition programs. Future studies should focus on the feasibility of improving school lunches, along with the costs and benefits of doing so.

Comparison of In-Situ Methods to Measure Heat Flow in Building Envelopes

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The thermal resistance of building materials is an important factor in heat flow through building envelopes – walls, floors, and roofs – in turn contributing to the overall energy efficiency of buildings. In a laboratory, thermal resistance and heat flow are measured using small, homogenous test samples and specialized test chambers, but thermal resistance and heat flow can also be measured in-situ (in the field) in the envelopes of actual buildings or large prototypes under actual environmental conditions. This type of testing offers a more realistic characterization of envelope performance and can be used more readily by architects, researchers, and building scientists making design decisions regarding building envelopes. Standard methods for measuring heat flow use a heat flux transducer (aka heat flux sensor), but this equipment is costly and its application can be limiting. As an alternative, surface temperatures of the test subject can be measured using infrared imaging and thermocouples and the heat transfer coefficient on the warm side of the wall can be determined in a separate step. Few studies directly compare methods using heat flux sensors to alternative methods, so this study was initiated to compare the measurement heat transfer coefficients and heat transfer using four different methods: measurement by means of a heat flux transducer, calculation-assisted thermography, calculation-assisted temperature logging, and determination via experiment using a chilled aluminum plate. The expected results can demonstrate the relative accuracy and limitations of the methods tested, informing professionals in the measurement of heat flow and thermal resistance in-situ.

Effects of protein kinase A mediated phosphorylation on surface expression of SLC5A8

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SLC5A8 is an electrogenic, sodium-coupled monocarboxylate transporter expressed on the apical membrane of thyroid, colon, and kidney epithelial cells. SLC5A8 has one consensus site for protein kinase A (PKA)-mediated phosphorylation. We hypothesize PKA-mediated phosphorylation increases SLC5A8 surface expression. Human embryonic kidney (HEK) cells were transfected with extracellularly tagged and intracellularly tagged SLC5A8 plasmid constructs, HA-SLC5A8 and SLC5A8-V5, respectively. Surface expression in response to forskolin treatment was quantified luminometrically and compared to control (DMSO)-treated cells. SLC5A8 expression levels were confirmed by immunoblot analysis using anti-HA and anti-V5 antibodies. Surface expression increased in cells treated with forskolin, indicating that PKA activation can traffic SLC5A8 to the plasma membrane. Cells expressing a phosphorylation-deficient mutant, HA-SLC5A8-ΔPKA, exhibited a diminished response to forskolin, indicating increases observed for wild-type SLC5A8 arose from PKA-mediated phosphorylation and not the indirect result of non-specific membrane turnover. In conclusion, these studies support a model whereby direct PKA-mediated phosphorylation specifically regulates surface presentation of SLC5A8.

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Structure and function analyses of Vibrio cholerae VceA MDR efflux pump protein

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Bacterial antibiotic drug resistance is a serious threat to global public health. Active drug efflux through efflux pumps is one of the major intrinsic mechanisms of multiple drug resistance (MDR) in bacteria. Understanding how MDR efflux pumps function is critical for the development of new therapeutic approaches. One such MDR efflux pump found in Vibrio cholerae, the causative agent of cholera diarrheal disease, is the VceCAB tripartite efflux pump system. VceC is an outer membrane channel protein, VceB is a cytoplasmic membrane transporter and VceA is a periplasmic adaptor protein. All these three membrane proteins are required for a functional efflux pump. While the crystal structure of VceC is available, no such crystal structures are available for VceA or VceB proteins. The aim of this study was to determine the crystal structure of VceA protein. A full length VceA-6His membrane protein (42 kDa) was over expressed in E. coli, purified using Ni-affinity column and obtained a diffractable crystals (at 2.4 Å resolution). Purified VceA protein was further confirmed by anti-VceA antibody and its efflux activity by genetic complementation assays. X-ray diffraction data was used to solve the VceA structure by molecular replacement using various homologs of VceA in the protein database as search models and no clear solution was obtained. This prompted us to attempt to prepare seleno methionine (SeMet) labeled VceA protein in order to solve the structure using anomalous scattering methods. Currently, we are optimizing the crystallization conditions of SeMet-VceA protein to improve their diffraction properties.

Effects of temperature sensitivity of hHela and hFB cells on proliferation and viability rates

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The objective of this project is to study the temperature sensitivity of growth performance of selected cell lines. Human Hela (hHela) and human fiberblast (hFB) cells were used and cultured in 3D environment using PepGel matrix at two temperature conditions: one is regular cell incubation condition and the other is room temperature. Cells were grown at various hour intervals, and cell proliferation and viability were analyzed. hHela were recovered from cryogenic conditions and the cell viability determined through a Cellometer Auto 2000. Six wells were seeded with 1*10^5 cells on six separate 48-well plates. The gel matrix, in which the cells were suspended, was composed of 65% cell solution + DMEM (10% FBS 1% Glutamine 1% Penicillin/Streptomycin) medium, 30% PG Matrix © and 5% PG Works © by volume. Of the six plates cultured, plates 2, 4, and 6 were maintained in an environment at 20° Celsius, whereas plates 1, 3, and 5 were maintained in an environment of 37° Celsius with 95% O2 and 5% CO2 (ref. Table 1). Plates 1, 2 were harvested after 48 hours after inoculation, plates 3, 4 were harvested after 96 hours of inoculation, and lastly, plates 5, 6 were harvested after 144 hours of inoculation. At the time of harvest, the cell proliferation and cell viability for each culture was determined. A second sample set was replicated on Day 2, in which six more cultures were seeded (ref. Table 1). An average of the cell proliferation and viability for each time set was taken from the two sample sets. A second cell line, hFB, was subjected to the same protocol and compared to hHela cells in its ability to survive under the same conditions. Statistical analysis indicates hHela cells have significantly higher proliferation rates under 35° Celsius conditions and reduced mortality rates under 20° Celsius conditions. Results will be presented.

Latino English in the Heartland

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Studies of Latino English have traditionally been centered on major population centers, like Los Angeles and New York City (Fought 2003, Mendoza-Denton 2008, Wolfram 1974), or on long established Latino communities in the Southwest (Schecter & Bayley 1997). However, changes to the meat packing industry created population movements in the 90s that have altered the demographics of numerous small towns throughout the continental US (Kandel & Parrado 2005). As these changes have primarily attracted a Latino workforce, new population centers of Latino English are now emerging across the rural US, creating the opportunity to analyze initial stages of dialect contact. This current analysis contributes to previous research on Latino English in two ways: First, I document general features of the emerging Great Plains variety of Latino English; Second, I consider the role Latino English features play in the construction of adolescent linguistic identity in a community that has transitioned from majority-European American to majority-Latino. This study focuses on Liberal, Kansas, a town where the Latino community has grown from 19.5% of the population to 59.1% of the population over the past twenty four years (US Census). Findings from this study are important as educators in the area will be able to use these findings to predict what language features their students will use.This will allow educators, especially those of English as a Second Language, to structure their classes to better suit the needs of the local population.

Labeling Vesicular Stomatitis Virus Nucleoprotein Using Immunohistochemical Methods

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Vesicular stomatitis disease is a reportable disease of swine, cattle and horses caused by vesicular stomatitis virus, a Rhabdoviridae family member. It is vectored by Culicoides midges. There are current outbreaks of VSV-NJ in the western United States. This project is part of a wider project that is assessing the potential for agricultural spillover of the human VSV-ZEBOV vaccine, an attenuated vesicular stomatitis virus Indiana -vectored Zaire ebola virus glycoprotein vaccine (vax). VSV-IN wild-type (wt) infections will serve as positive controls. We developed an immunohistochemistry (IHC) assay for the vesicular stomatitis virus (VSV) in cattle tongue tissues and midges. IHC uses antibodies (Abs) to visualize the distribution of antigens in tissues, in this case VSV nucleocapsid protein in infected cattle tongue and midges. Two different Abs were tested: Anti-VSV-N [10G4] from Kerafast and anti-VSV-IN mouse ascites fluid from UTMB. We tried antigen retrieval and two different IHC detection methods, avidin-biotin complex and alkaline phosphatase. Uninfected cattle tongue served as our negative control tissue. Additionally, we confirmed our Abs specificity for VSV-IN wild-type and ZEBOV-VSV viruses in Vero cell lysates by Western blot. VSV-IN antibodies were expected to be broadly reactive with VSV-NJ strains and were selected instead of VSV-NJ Abs because the larger project is VSV-IN focused. However, the only available infected tissues at the time of IHC development were infected with VSV-NJ. This assay will be used to assess infection with either wt or vax VSV in animal tissues from pigs, cattle and swine.

Motivations among Men to Volunteer: Persuasive Volunteer Messages

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Attracting men to volunteer for children's organizations can be a challenge. The purpose of this study is to examine the motivations among men to volunteer and how those motivations affect the way they perceive messages from volunteer organizations. In this study, 52 men (M = 23.17 years) completed a 30-item Volunteer Functions Inventory (VFI) differentiating six motivations to volunteer (values, social, career, understanding, protective, and enhancement), followed by six text-based persuasive volunteer messages focused on each motivation. The survey was adapted from Clary et al. (1998). Correlational analyses revealed significant and positive ranking relationships between the "enhancement" message and motivations related to enhancement, protective and understanding as well as negative and significant relationships between the "social" message and the same three motivations. Correlational analyses between ad effectiveness and ad suitability and each of the six motivations, conducted separately for each text-based advertisement, revealed the "career" message was least suitable and least effective. Additionally, men are more attracted to messages centered on enhancement where they perceive they can obtain satisfaction in personal development. Men are drawn away from messages centered around building new social relationships. Thus, in order to attract men to volunteer with children's organizations the recruitment message should be geared towards enhancement of self-esteem, rather than social relationship building or career development.

Effect of the Biocorona Formation on Gold Nanoparticle Size Distribution and Cellular Uptake

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Nanoparticles (NP) upon entry to the bloodstream, instantaneously adsorb proteins and other biomolecules, to form a 'biocorona' over their surface. This alters the NP size, surface charge and stability, affecting their cellular internalization, and biodistribution within the body. The biocorona with its constituent proteins over NP surface determines how the cells or tissues recognize them, which decides their ultimate biological impact and fate in vivo. This study investigated the role of size and surface chemistry on corona formation and the effect on NP size distribution in cell culture media and subsequent cell uptake in human umbilical vein endothelial cells (HUVEC), employing 40 and 80 nm AuNP with branched polyethyleneimine (BPEI), lipoic acid (LA) and polyethylene glycol (PEG) coatings. Physicochemical characterization was done using dynamic light scattering (DLS) technique and transmission electron microscopy (TEM). Surface charge analysis revealed BPEI-AuNP to be cationic, LA-AuNP anionic and PEG-AuNP neutral. However, dispersion of AuNP in HUVEC media (EGM-2), increased the hydrodynamic diameters of all NP and reduced their absolute surface charge. Hard corona protein profiles over individual AuNP incubated in human plasma analyzed using SDS-PAGE showed surface chemistry dependent corona profiles. Time dependent intracellular uptake of bare and plasma corona coated AuNP for 0.25, 0.5, 1, 3, 6, 12, and 24 h using inductively coupled plasma-mass spectrometry (ICP-MS) showed that corona formation reduced the cell uptake compared to bare AuNP. Establishment of definite links between NP physicochemical properties, protein corona profiles, and cell uptake is needed for designing NP for biomedical applications.

Tumor Host Tissue Vasoreactivity

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Solid tumors, like those present in prostate cancer, contain areas of hypoxia resulting in less effective radiation therapy. Studies designed to combat tumor hypoxia have utilized both ectopic (tumor cells implanted in the subcutaneous area of the flank) and orthotopic tumor models. In orthotopic models, exercise has been demonstrated to reduce tumor hypoxia, whereas in ectopic models the effects of exercise are equivocal. Preliminary studies from our laboratory found a significant increase in blood flow to orthotopic prostate tumors versus a reduction in blood flow in ectopic tumors during moderate intensity exercise. Given this data, it was hypothesized that subcutaneous adipose arterioles and skin arterioles (ectopic tumor host tissue) in rats would have greater vasoconstriction versus prostate arterioles (orthotopic host tissue) in response to the alpha-adrenergic agonist norepinephrine (NE). Arterioles from each location were harvested from male Copenhagen rats (n=20) and cannulated with glass micropipettes for in vitro analysis. Vasoconstriction to cumulative doses of NE (10-9 – 104 M) were recorded. There was a significantly higher peak vasoconstriction to NE in subcutaneous adipose arterioles (92 ± 7%) versus both skin (59 ± 8%) and prostate (55 ± 7%) arterioles. There were no significant differences in vasoconstriction between skin and prostate arterioles. In conclusion, during exercise when sympathetic nerve activity is increasing, the greater vasoconstriction in the host-tissue arterioles of ectopic versus orthotopic tumor models may result in diametrically opposite responses in tumor blood flow and hypoxia. These data are critical in designing exercise studies using tumor models.

Parents' Ability to Report Developmental Speech and Language Patterns of Young Children

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The Caregiver/Parent Understanding-the-Child-Questionnaire (CPUCQ) was developed to assess how well young children, ages 2 to 6 years, are understood in everyday situations. The adult is asked to indicate how the child communicates in 31 situations (e.g. "The child asks for more") using mode of speech and intelligibility. For each situation, a blank field for optional parent comments was provided, and a qualitative analysis of those comments was completed. The purpose of this study was to examine if parents are a reliable source of information in describing early speech and language skills. Therefore, parents' comments were related to speech/language milestones of typically developing children, and the differences between the different age groups were noted. Participants from the larger sample of 54 monolingual English-speaking children and their parents were the 11 parents who utilized the parent comment fields. Comments were aggregated into 10 developmental themes (e.g. gesture – pointing). Findings indicated that eight of the ten themes, or the majority of the parent comments, reflected important aspects of speech and language development. Parent comments provided key information related to milestones in these areas while also reflecting the gradual developmental differences among the age groups. Comments in the youngest groups (i.e., 2- and 3-year olds) reflected earlier developing skills while in the older age group (i.e., 5-year-olds), comments were related to their increased skill level. Overall, the qualitative analysis of parent comments demonstrated that they were related to the key aspects of development that are of interest to speech-language pathologists.

Sensing and Measuring Biomarkers of Lung Inflammation Using Smartphone-Based Technology

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Inflammation is a process that our body uses in order to protect itself against foreign bodies, but constant inflammation is harmful. The purpose of this research is to develop a device that is capable of testing a patient for lung inflammation and lung diseases by measuring biomarkers, or enzymes, caused by the immune's response to the inflammation. In order to measure these biomarkers, nanosensors were developed. These nanosensors are proficient in either binding to or reacting with biomarkers of lung inflammation. The nanosensors consist of dopamine covered Fe/Fe3O4 nanoparticles, to which cyanine 5.5 and TCPP (tetrakis-carboxyphenyl-porphyrin) are tethered. TCPP is linked via an oligopeptide, which either binds to or reacts with the biomarkers. Cyanine 5.5 acts as a Förster energy resonance transfer (FRET) quencher of TCPP fluorescence. Exhaled breath condensate samples will be used with the nanosensors either by using a clinical 96 well plate reader or a smartphone-based microfluidic device. The results of the assays in these experiments show a correlation of an infected sample of a subject with asthma with the above average concentration levels of the biomarker produced by inflammation. It is possible that the use of nanosensors will go beyond the diagnosis of lung inflammation to other diseases within the human body, such as early cancer detection.

"El Immigrante"

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While there is much immigration and economics research done in Southwestern Kansas, there is still a need to recognize the individual identities in these communities—as real people. Southwest Kansas is host to multiethnic, immigrant towns—particularly Liberal, Dodge City, and Garden City—that power some of the areas major economies. The meat packing plants, truck driving businesses, and oil industries in and around these towns are host to a myriad of immigrants from all over the globe. However, the exceedingly dominant racial group remains Hispanic. It is important to recognize the role Hispanics play as minority majority and the dynamics in social and economic relations within the region and beyond. I am making specific and narrow social research by interviewing a few Mexican immigrants who have worked in popular industries around Liberal, KS, along with those who are now business owners and photographing them in a way that reflects broader immigrant sentiments—simultaneously putting a face to "the immigrant worker". This series will portray the individual in a context that emphasizes the many facets there are to this growing immigrant social issue. Along with the photographs, the individuals will issue a short personal statement in order to attempt to explore interconnectedness and overlying themes in immigrants of this region. I predict this will provide some nationwide insight on the ever more complex role of immigrants, society, and economics through the lens of a community in which these factors have become particularly indivisible.

Evolution of multicellularity by co-opting cell-cell adhesion genes

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Multicellular evolution is a major transition that has occurred for more than twenty-five times in many eukaryotic taxa. However, the genetic basis of the transition to multicellularity is unknown in any of these taxa due to high divergence between unicellular and multicellular relatives. The Volvocine algae, however, are a group that have recently transitioned to multicellularity about 200 million years ago that have species ranging from unicelllar (e.g. Chlamydomonas reinhardtii), to colonial groups of like cells (e.g. Gonium pectorale), to those with differentiated tissues (e.g. Volvox carteri). Since these organisms recently evolved in multicellularity and have not diverged significantly, their genomes are surprisingly similar. In an effort to identify genes that may be important for multicellularity, we hypothesize that cell wall genes in unicellular Chlamydomonas were co-opted to promote cell-cell adhesion in colonial organisms such as Gonium. To identify these genes, we created comprehensive phylogenies of cell wall genes in Chlamydomonas, Gonium, and Volvox to identify genes whose evolutionary signature suggested co-option. From this analysis, I identified five candidate genes that may be important for cell-cell adhesion. After functionally testing two candidate Gonium genes and transforming them in Chlamydomonas, the phenotypic ratio expressed almost one hundred percent in unicellularity. Our results mean that these two candidate genes are probably not important for multicellularity. I am currently functionally testing other candidate genes for importance in cell-cell adhesion using transformation.

Role of Polyamine Synthesis Pathway in Glutamine Addiction of Vaccinia Virus Infection

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Vaccinia Virus (VACV) is a large, double stranded DNA virus used as a model to study members of poxviridae family. VACV is also used as a vector to develop recombinant vaccines and cancer therapeutic agent. VACV infection causes alterations in host cell metabolism and utilizes glutamine instead of glucose for efficient replication (Fontaine et. al, 2014). Glutamine can act as a precursor of ornithine, a substrate of polyamine synthesis, or stimulate polyamine synthesis. The objective of this study is to examine the mechanism behind the glutamine addiction of VACV infected cells. Our preliminary results show that polyamines can rescue VACV replication from glutamine depletion. We constructed a plasmid encoding human ornithine decarboxylase (hodc1), a rate limiting enzyme of polyamine synthesis. We will transfect this plasmid into host cells and the effect of hodc1 overexpression on virus replication will be measured. Moreover, the differentially expressed genes and proteins during glutamine depletion and rescue by polyamines will be examined. By understanding the metabolic pathway involved in VACV replication, specific inhibitory mechanisms can be discovered.

WILDCAT WIND POWER

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Small wind turbines have the potential to make an impact on the energy market, however they need more research and development. This year the Department of Energy is sponsoring the Third Collegiate Wind Competition, through which teams of university students design, build, test and develop marketing materials for small wind turbines. Kansas State University is one of twelve universities that are competing in New Orleans, Louisiana this year. The competition requirements build on last year's event; the goal is to design, build, and present a unique, wind driven power system based on research to test the turbine and corresponding load in an on-site wind tunnel. The competition is comprised of a business plan, technical design report, deployment strategy, turbine testing and a bonus challenge. The team is currently in the process of testing the electrical components of the turbine, and the construction of a wind tunnel for the team's personal use. As part of the electrical team's task, the components to be designed in house for the turbine are the brake, dc-dc converters, load and Arduino microcontroller code to control certain functions of the components. The current sensor and audurinos are obtained by purchasing them from outside sources.

Enhanced Pool Boiling at Elevated Pressures

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Boiling has many applications in our world, one important application is generating electricity. Boiling is an efficient method of heat transfer. The bubbles generated from boiling take away heat from the surface through the latent heat of vaporization. The performance of boiling is measured by the heat transfer coefficient and critical heat flux. Previous research has shown that at atmospheric pressures micro/nano structured surfaces and coated surfaces will increase the heat transfer coefficient. However, boiling applications in the power industry are done at high pressures. The purpose of this research is to examine the heat transfer enhancement at elevated pressures on modified surfaces. During our research, we used a plain copper substrate for our surface. Experiments were done on the copper substrate in a boiling vessel that can reach pressures up to 300 psi. From our findings, we concluded that the heat transfer coefficient of plain copper increases by 100 percent at a pressure of 45 psi. As we continue our work we will experiment with graphene-coated surfaces and micro/nano structures where we expect to find a higher increase in the heat transfer coefficient. In our research, we hope to find a modified surface that enhances the performance of boiling under high pressures.

Toy Marketing: The Impact of Consumer Constellations on a Girl's Career Choice in STEM

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The purpose of this research is to understand the relationship between the marketing of toys and girls' choice to select a career in a STEM field. Several studies link the effects of advertising influence to children's decision making. However, there are other aspects of marketing that affect children. Packaging, pricing, placement, as well as promotion affect what parents buy and what children want. This study deconstructs the marketing mix to understand the effects of the 4Ps on parents, children and career choices.

Toys are usually the first indoctrination of cultural gender identities for children. Finding a toy that is not gender-specific has become increasingly difficult (Sweet 2012). Girls play with fashion dolls and boys play with action figures. Barbie, for example, has been criticized for its enculturation of girls (Scott 2002). In fact, Mattel, the makers of Barbie, have answered this criticism by developing Barbie as shorter, plumper, and ethnically diverse. However, Barbie is still a doll. According to Solomon (1988), consumers structure products cognitively to correspond to social roles. These structures are called constellations – collections of symbolically related products that are defined by social identities (Solomon 1988). Children understand from toys their place in society. We posit that how toys are marketed to both parents and children promulgate gender stereotypes. As children develop these stereotypes, the perceived social roles preclude girls from choosing a career in any STEM field as these career paths are not seen as feminine.

Toys are also the first and most influential technologies for children (Varney 2000). Technologically, girls play with Easy-Bake Ovens, while boys are more likely given scientific toys. Toy constellations are formed by children as young as eight (Chaplin and Lowery 2010), and have been found to lead to gender stereotyping. In fact, children use consumption constellations in making inferences about different occupations (Davis 2000). We therefore posit that these stereotypes, based on toys, can define future career pathways.

Emotion Estimation Through Brain-Computer Interface

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Emotion estimation breaks down barriers in communication. The topic of this study is emotion estimation as well as the various stimuli systems used to provoke emotion states and the level of their effectiveness. Researchers have made it possible to directly monitor and measure brain activity through the use of brain computer interface. In order to test these systems and their validity, we will conduct a study with 20 student participants using two stimuli systems. Each participant will be trained in both systems. During their exposure to the systems, the participants will wear an electroencephalography (EEG) cap to measure and record their brain signals, and self-reports of emotional states will also be documented for each individual throughout the process. The measurements and self-reports will be compared to show the accuracy of the systems. While our study is not concluded, it aims to find if cross-task classification works, which indicates the detection of real emotions. Ultimately, these findings will help advance communication and brain imaging technologies.

Synthesizing Dendrimers for the Delivery of Prodrugs To Solid Tumors and Metastases

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The synthesis of dendrimers as nanovesicles has been developed following elaborative mathematical and chemical procedures. The tree-like structures of these molecular building blocks are defined through the replication of repeated monomers within the structure, which increase the solubility and functionality of these nanoplatforms. The ability to manipulate the shape, size, surface, and morphology of the dendrimers is a vital aspect for the delivery of drugs in a biological system. The chemically engineered dendrimers are "synonymous" to biotic monomers, because they work in conjunction with DNA, RNA, and proteins in order to increase the precision of delivery to target sites. The flexibility of this collaborative approach allows for targeting solid tumors, as well as for including stereochemical properties in the dendrimer-based nanoplatforms. This will work in a code-like manner in that, depending on the void space of the dendrimers, the attachment of biologically meaningful ligands will be performed. This has the potential of increasing the precision of nanoplatform delivery. We are currently developing and testing multiple generations of dendrimers with varying concentrations of proteolytic enzymes to compare the effects of their concentrations in different environments with respect to targeted delivery and release of dyes as model drugs. Interestingly, starburst dendrimer-based nanoplatforms are being taken up very rapidly by defensive cells, such as monocytes and macrophages, as well as neural and umbilical stem cells. Depending on the nature of the delivery cells, the application of the dendritic nanoplatforms in cancer therapy will permit the targeting and drug delivery of different sites within the biological system.

An Exploration of Contemporary and Cultural Animation

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Animation is defined by the act giving 'a breath of life' to an image that causes the illusion of movement. This project provides an overview of the current literature to better understand the contemporary world of animation through the use of digital tools and techniques. We find through expanding technological advancements and an ever growing society of animators, animation is acting as a catalyst for social change. Through theoretical explanations, and the latest research, we explain the link between the rise of digital animation, contemporary art and cultural change. Because this is an exploration of a not as well-known topic rather than a tested theory, we will not have an expected outcome.

Barriers to Healthy Behaviors Among Military Spouses

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As a group, military spouses struggle to engage in regular physical activity, maintain a healthy diet, stay connected with other people, and relax or manage stress. Understanding the barriers that prevent military spouses from engaging in healthy behaviors will help us develop programs to promote health in the large military population in our community. For this study, we had military spouses complete online surveys and report up to three barriers that impacted regular physical activity, maintaining a healthy diet, connecting with other people, and relaxing/managing stress. We also conducted focus groups and transcribed them to identify reoccurring barriers in military spouses. Barriers reported on the surveys were coded into categories for analysis. We ran frequency analyses to determine the most prevalent barriers. The top barriers for physical activity, diet, connection, and relaxation, respectively, were financial concerns, lack of time, and schedule constraints. Overall, time constraints and family responsibilities were the most frequently re-occurring issues affecting health behaviors for military spouses. We expect that creating groups within their community will drive the military spouses to slowly decrease their barriers limiting their healthy behaviors by increasing support and accountability. Within these groups, we will reshape their understanding of healthy behaviors, help them reframe their ideas of what it means to be healthy, encourage them to incorporate physical activity into their everyday life, and teach them time management strategies for prioritizing their own health and well-being.

Global Sensitivity Analysis of Dam Erosion Models

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WindowsTM Dam Analysis Modules (WinDAM) is a set of modular software components that can be used to analyze overtopped earthen embankments and internal erosion of embankment dams. These software components are being developed in stages. The initial computational modules address routing of floods through the reservoir with dam overtopping and evaluation of the potential for vegetation or riprap to delay or prevent failure of the embankment. Subsequent modules incorporate dam breach analysis. Current work is underway to include analysis of internal erosion, non-homogeneous, zoned embankments, and the analysis of various other forms of embankment protection. The focus of this project is on the overall software architecture and its integration with Sandia National Laboratories' DAKOTA software suite to perform global sensitivity analysis on a wide range of input parameters.

The Effect of Postmortem Aging on Tenderness and Protein Degradation from the Semitendinosus and the Longissimus lumborum

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The objective of this study was to evaluate the effect of postmortem aging on tenderness and myofibrillar protein degradation of Semitendinosus (ST) and Longissimus lumborum (LL) steaks. Forty ST and LL muscles were collected from a commercial abattoir and fabricated into steaks assigned to 7, 28, or 112 days of aging. After aging, steaks were subjected to Warner-Bratzler shear force (WBSF), calpain activity, and desmin and troponin-T degradation analyses. There were no muscle×day interactions for WBSF, autolyzed calpain-1 and intact calpain-2 activities, and troponin-T degradation. There were muscle×day interactions for intact calpain-1, autolyzed calpain-2 activities, and desmin degradation. On day 7, LL steaks had greater intact calpain-1 activity than ST steaks, but steaks were similar on day 28 and 112. Autolyzed calpain-2 activity of LL and ST steaks were similar on day 7 and 28, but LL steaks had more activity on day 112. On days 7 and 28, steaks from both muscles had similar amounts of degraded desmin, but on day 112, ST steaks had more degraded desmin. Throughout aging, WBSF decreased, calpain-1 and autolyzed calpain-2 activities decreased, autolyzed calpain-1 and intact calpain-2 activities were unaffected, intact desmin and troponin-T decreased, and degraded desmin and troponin-T increased. Throughout aging, LL steaks had smaller WBSF than ST steaks, but had similar intact calpain-1 and autolyzed calpain-2 activities, LL steaks had greater autolyzed calpain-1 and intact calpain-2 activities, ST steaks had more degraded desmin, and steaks had similar degraded troponin-T. Overall, LL steaks were more tender than ST steaks, and both became more tender as aging time increased due to the impact of intact calpain-1 and its degradation of desmin.

Actinide breeding simulation in the TRIGA(Training, Research, Isotopes, General Atomics) Mark II Nuclear Reactor

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Actinide breeding is a viable way to produce fissile elements in nuclear reactors. This research project uses Python to predict the concentration of U and Pu isotopes resulting from a breeding chain of 232Th and 238U. By solving the Bateman equations, the concentration of these elements can be solved as a function of time. These equations are a coupled set of differential equations that are solved using Python's ODEINT function to simulate the time dependent concentration of any chosen actinide resulting from the breeding chain. With a constant TRIGA reactor neutron flux of 1013cm-2s-1, and an irradiation time of one month, the resulting concentrations of actinides from the breeding chains of both 232Th and 238U were found as a function of time. Knowledge of the concentration of fissile elements due to breeding shows whether or not breeding from 232Th and 238U is an effective way to create small quantities of higher actinides for use in neutron detection. For the TRIGA, it was found that μg quantities of 233U and 239Pu can be generated from mg quantities of 232Th and 238U, respectively. These quantities may be sufficient for use in neutron detection.

Habit Formation and The Underlying Theories

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Creating or changing habits can be difficult. Wood (2016) asserts that habits are best understood as learned automatic responses with specific features, (a) activated by recurring context cues and (b) insensitive to short-term changes in goals. While there are many theories for habit formation, this research will look at two specific theories that underlie habit formation or change. Looking at Thorndike's (1898) law of effect and Hull's (1943) formalized drive theory, we question if one is more effective in explaining habit formation and change. Through our analyses, it seems that Thorndike's (1898) law of effect can be adopted to encourage and promote consistent behaviors more effectively and therefore to generate or change habits. Toward this end, we will conduct literature reviews on both theories and extensively compare their effectiveness. This has crucial implications for individuals to form or change habits and for organizations to manage healthy individual behaviors.

Compliance in stuttering treatment: A qualitative analysis

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Though many people have fears of speaking publicly for various reasons, people who stutter must face these same fears in day to day life. Treatment to address fluency disorders may involve both teaching techniques to reduce stuttering and offering assistance in handling emotional reactions associated with stuttering. A qualitative analysis was conducted on a previous study in which people who stuttered were administered a technique to reduce stuttering. This technique helped participants relax the muscles associated with speech in order to help them stutter more easily and less frequently. Though the participants reported both a reduction in frequency and tension of stutters, they largely chose to discontinue use of the technique once the training sessions ended. The current study aimed to discover what factors make a person more or less likely to persist in a given treatment. This process began with transcribing the post-treatment follow up interviews of each participant, where the participant reflected on their use of the technique since the ending of treatment sessions. Next, a code was devised to identify factors that may have led to a persistence or cessation of use. The participants' responses were then reviewed and coded to help clarify their experiences with the technique. The results indicate that those who chose not to use the technique were not dissatisfied with its efficacy, but rather were choosing to discontinue using it for reasons outside of the study. This research will help clinicians make more effective treatment decisions for people who stutter.

Efforts towards the total synthesis and final structural elucidation of Lagunamide C

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Cancer continues to be a major public health problem despite all the efforts that have been made in the search for new drugs and treatments. Lagunamide C, a chemically diverse compound, was first isolated by Prof. Tan of Nanyang Technological University in Singapore from the cyanobacteria Lyngbya majsucle and was reported to have potent cytotoxicity ranging from 2.1 to 24.4 nM towards colon, lung, prostate, lymphoma, and ovarian cancerous cell lines. The absolute stereochemical configuration of lagunamide C is unfortunately unknown within the polyketide unit; the authors are unsure about three of its stereogenic carbons. As such, we aim to conquer a total synthetic chemistry route leading to lagunamide C that will allow for the synthesis of all eight different diastereomers to be accessed for structural identification of langunamide C and for seven analogs for additional biological testing. We propose to access the eight different diastereomers of Lagunamide C through a three modular approach towards the polyketide. Current synthetic efforts towards the pentapeptide and the polyketide units will be presented as work towards the optimization of a recycling strategy of a key intermediate unit. Future work will include the synthesis of all 8 different diastereomers. This compound is a unique and complex compound that will ultimately be tested against cancer lines and if successful will be introduced as a possible cure to several types of cancer.

Fluorescent Molecules in Catalytic Reactions

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Many important reactions are catalyzed by solid acids. Conventional characterization techniques cannot always provide information on the location of the acid sites. Fluorescent microscopy offers the potential to determine where acid sites are located. In this method, an optical microscope is used to observe a substance's fluorescence or phosphorescence with respect to time and position on a microscope slide. This research seeks to demonstrate the ability of fluorescent microscopy to study solid acid catalysts. Two silica wafer gradient films have been synthesized, where the acidity of the film varies with position due to changes in the Si/Al ratio. Both films were made with the same concentration of alumina 20% and Silica 80%. The gradient films were synthesized by dip coating a silica wafer in a solution containing a soil containing both silica and alumina. A concentrated alumina mixture was pumped into a silica solution inside a glass vessel while slowly retracting the silica wafer from the top of the vessel. At the same time, the solution in the vessel was withdrawn with another pump. This procedure led to changes Si/Al ratio in the vessel, which in turn modifies the Si/Al ratio on the wafer with position. The procedure was used to produce a film where the Al/Si ratio varied from 0 at one side to 0.2 at the other. To characterize the films, ellipsometry was used. Ellipsometry is an optical technique that measures the electrically insulated properties of an object; these include composition, roughness, thickness, and conductivity. The results from the ellipsometer show a parabolic relationship between refractive index and position, which confirms that the composition of the film varies with position. Fluorescence microscopy experiments will be run to probe the variation of acidity in the gradient film with position. These experiments will use a pH-dependent fluorescent molecule known as C-SNARF-1. In addition, a new fluorescent probe molecule, named 8-acetly-1,4-diethyl-1,2,3,4-tetrahydro-7H-pyranol[2,3-g]quinoxaline-7-one that fluoresces when it reacts on an acid-site is being synthesized through a sequence of organic reactions. These experiments help establish the application of fluorescence microscopy to study solid acid catalysts, and provide new information on the location of acid sites on active catalytic materials.

Financial Stress, Self-Efficacy, and Financial Help-Seeking Behaviors of College Students

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Between academic years 2000-2010, the cost of an education at a public university increased by 42% (NCES, 2012). The graduation rate for multicultural students in four year public institutions is 50.1%. This study investigates the influence of financial stress, unmet financial need, the number of hours worked per week, race/ethnicity and first generation status on the academic efficacy and academic performance of students. Research has shown (Vincent Tinto, July 2004) unmet financial need to be one of the four primary reasons that students leave college before they graduate. A convenience sample of students will complete an online questionnaire. Data will be analyzed to identify the importance of financial need and academic efficacy, performance and persistence. The information gained in this study will assist college institutions in understanding how increasing financial aid opportunities for multicultural students can affect regulations for secondary education.

OURCI Presenters

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Functionalized Boron Nanoparticles: Characterization of Thiol-ene Click Chemistry

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Carboranes are a family of cluster compounds comprised of boron, carbon, and hydrogen that are being investigated in a number of applications, including self-assembling monolayers (SAMs), cancer treatment, and non-catalytic synthetic agents. Various functionalities have been attached to carboranes to facilitate their utilization. Thiol-ene "click" chemistry between thiol-functionalized m-carborane and a variety of maleimide derivatives provides a facile path to a wide variety of functionalized boron nanoparticles. The reaction rate shows a strong dependence on the solvent as well as on the position of the thiol group on the carborane. To test the reaction rate dependences, absorbance measurements were taken over time in a temperature controlled spectrophotometer for each selected solvent. Preliminary testing revealed reactivity differences greater than an order of magnitude between m-carborane-1-thiol and m-carborane-9-thiol. In order to better understand observed differences in reactivity, the chemical kinetics are modeled to clarify the reaction mechanisms and to quantify the rate constants and activation energies. Future research entails computational and electron density modelling to further investigate the cause of the reaction kinetic differences.

Evaluation of Thermal Injury to Gastroesophageal Targets by Catheter-based Microwave Antennas

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Thermal ablation has emerged as an effective modality for targeted destruction of tumors and localized benign disease. Within the gastroesophageal space, ablation targets include mucosal tissue for treatment of Barrett's esophagus, distended blood vessels, and esophageal tumors. The gastroesophageal space provides a challenge for ablation therapies because of the sharp transition between targeted tissue (e.g. vessels within the esophageal wall) and surrounding healthy tissue and other critical structures (e.g. mucosal tissue). Our research involves the evaluation and response of thermal ablation with catheter-based microwave antennas on tissue samples resembling Barrett's esophagus, and esophageal adenocarcinoma. Barrett's esophagus is a condition where the esophageal wall changes to resemble the intestinal wall. This can lead to the development of esophageal cancer in some patients. We hypothesize that microwave radiation patterns can be tuned to cause selective thermal damage to gastroesophageal targets, while sparing the outer mucosa layer. Experimental ablations have been performed to examine the thermal damage pattern in ex vivo tissue models, mimicking a target structure (simulated with porcine muscle) enclosed by the mucosa layer of the esophageal wall. We considered a directional microwave antenna with a modified tip to radiate energy in a preferred direction. The mucosa layer was stripped from horse blood vessels, wrapped around pork cuts, inserted into the catheter, and ablated for varying time periods. The extent of thermal damage to the outer mucosa layer as a function of time was examined histologically. Further response to thermal injury will be evaluated by haemotoxylin and eosin (H&E) staining, and viability stains following in vivo tissue experiments (in progress).

The Impact of U.S. Beef Exports on U.S. Domestic Beef Price

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This project will develop a multiple structural model based on international trade theory and use the model for forecasting the impact that U.S. beef exports have on U.S. domestic beef prices. The estimated impact can be used to inform domestic companies and beef producers of the predicted magnitude of price changes that are caused by the variability in U.S. beef exports. Export bans because of government relations, changes in meat consumption patterns, cattle disease, and other factors induce significant decreases in exports quantity. This negatively affects domestic beef producers. The accuracy of the price forecasting is an important factor of managing risk on price setting and adjustments. Therefore, quantitative analysis is needed. Knowing the impact of U.S. beef exports helps firms plan strategically for long term development, to increase scale and profit. Using strategy to manage companies based on knowing this impact also improves global perspectives, resource diversity, international trade awareness, and universal economic elements of firms. Managing export risk also helps keep beef prices stable for domestic consumers.

It is expected that U.S. beef exports have a significant impact on the domestic boneless beef and veal price. The model, I estimate, will be able to predict domestic beef prices with an acceptable degree of accuracy. My results will help beef producers to understand the dynamics between international trade and domestic markets. This study is expected to inform domestic companies and beef producers on the predicted magnitude of price changes that are caused by the variability in U.S. beef exports, in order to develop strategies for managing price risk from beef exports impact. Using strategy to manage companies' portfolios based on knowing this impact also improves global perspectives, resource diversity, international trade awareness, and universal economic elements of firms. Managing export risk also helps keep beef prices steady for domestic consumers.

The effects and changes of localization and speciation of Arsenic in cooked rice grains

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Threats of Arsenic (As) in drinking waters has generally been a worldwide problem, especially when it is accentuated within most fluvial-deltaic aquifers. Arsenic through food uptake, mostly via consumption of rice, is another potential pathway that presents a concern for the millions of inhabitants who live in these river valleys and irrigate the soil with contaminated water. This study focuses on As-contaminated rice grown in such soils, and the effect of boiling this rice in As-contaminated water in preparation for dietary intake. Many studies have been done on As-contamination in rice, but little has been found on the boiled product that most people ingest. Understanding As-speciation in rice is important in assessing its threat as a carcinogen to humans. Using spectroscopy methods - micro X-Ray Fluorescence and micro X-Ray Absorption Near Edge Structure spectra at Stanford Synchrotron Radiation Lightsource (SSRL) - location and speciation changes of As in rice grains before and after cooking were able to be mapped. For rice preparation, husked rice grains were boiled in 40 mL of >500 µg/L As-contaminated water for approximately 40 minutes. The husks were then manually removed from the rice grain, and analysis of both the husk and grain for both cooked and uncooked samples was undergone. The results showed a transition from arsenite (As-III) heavily localized in areas of uncooked rice to arsenate (As-V) less localized in particular areas of cooked rice, but rather spread throughout the grain—inferring more inhomogeneous distribution rather localization —with some localization in husk. The impact that this study portrays is consuming rice cooked by As -contaminated waters may not decrease the levels of As being consumed, but diversifies the study to other cooking techniques that may cause As to be less concentrated in rice grains.

Assay Development for Determining Enzymatic Activity of the Autolytic Enzyme Produced by the Microalgae C. reinhardtii

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The freshwater microalgae, Chlamydomonas reinardii, has the potential to accumulate bioproducts such as oil, protein, and pharmaceutical compounds. Developing an efficient and cost-effective extraction method can potentially improve the feasibility of using microalgae as a feedstock for food, pharmaceuticals and fuel industries. However, several challenges are associated with bioproduct extraction from C. reinardtii including the energy-intensive chemical/mechanical process of cell wall disruption. Enzymatic cell wall disruption is an energy-efficient alternative extraction method that facilitates release of intracellular bioproducts by specifically targeting the cell wall microstructure. C. reinhardtii has a glycoprotein-rich cell wall that can be disrupted using an autolytic enzyme, providing an inexpensive enzyme source for cell lysis. The application of autolysin as an enzymatic pretreatment prior to protein and lipid extraction from C. reinhardtii has not been explored. Thus, no sufficient efforts have been made to optimize autolysin production that would allow for a scalable and robust enzymatic extraction method. Developing a method to quantify autolysin activity is critical for screening of autolysin production methods. In this research, an autolysin activity assay was developed based on the degree of cell permeability of C. reinhardtii cells. Chlorophyll release was quantified and correlated with cell permeability by measuring changes in absorbance (at 435 nm) over time. Cell density (enzyme substrate concentration) was optimized to find a suitable rate of reaction, and an activity curve was developed. With this assay, the specific activity of autolysin was determined and used to identify optimal autolysin production conditions.

University Award for Distinguished Undergraduate Student in Research

Electrodeposition of Uranium for Micro-Pocket Fission Detectors (MPFDs)

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Prototype micro-pocket fission detectors (MPFDs) with neutron-sensitive coatings have previously been used to monitor in-core neutron flux at the Kansas State University TRIGA Mark-II nuclear reactor. The small size of these detectors allows for direct insertion in a reactor without perturbing neutron flux. MPFDs can also be arranged in arrays and used to generate real-time flux maps of a nuclear reactor. Techniques used to deposit the neutron-sensitive coatings were found inadequate for advancing micro-pocket fission chamber technologies. Coatings were difficult to reproduce, characterize, and apply to unique geometries. A system accommodating electrodeposition techniques for 2 mm diameter MPFD electrodes was investigated. Uranium layers were deposited using cyclic voltammetry. Source material was verified on electrodes by means of optical microscopy, scanning electron microscopy (SEM), and X-ray fluorescence (XRF) analysis. Up to 27.5 wt% uranium has been measured. Additionally, higher concentrations of deposited uranium appeared near the perimeter of the electrode. Efforts are presently underway to improve coating uniformity and numerically associate voltammetry parameters to mass deposition. The ability to reproduce and characterize neutron-reactive coatings onto unique MPFD electrodes is conducive to the feasibility of mass production of these devices, which is necessary to generate groups of MPFDs for in-core instrumentation.